TRANSACTIONS
OF THE
PHILADELPHIA
ACADEMY
OF
SURGERY

VOL. XV.

1913

TRANSACTIONS

OF THE

PHILADELPHIA

ACADEMY OF SURGERY

VOLUME XV

PHILADELPHIA
PRINTED FOR THE ACADEMY
1913

NOTICE

The present volume of *Transactions* contains the papers read before the Academy from January, 1912, to December, 1912, inclusive.

The Business Committee thinks it proper to state that the Academy holds itself in no way responsible for the statements, reasonings, or opinions set forth in the various papers published in its *Transactions*.

LIPPINCOTT PRESS, PHILADELPHIA

LIST OF OFFICERS, 1912

President

GWILYM G. DAVIS, M.D.

Vice-Presidents

JOHN H. GIBBON, M.D.
CHARLES H. FRAZIER, M. D.

Secretary

CHARLES F. MITCHELL, M.D.

Treasurer

EDWARD B. HODGE, M.D.

Recorder

JOHN H. JOPSON, M.D.

Council

THOMAS R. NEILSON, M.D.
J. CHALMERS DA COSTA, M.D.

Business Committee

GEORGE G. ROSS, M.D.
FRANCIS T. STEWART, M.D.

Trustees of the S. D. Gross Prize Fund and Library

WILLIAM J. TAYLOR, M.D.
RICHARD H. HARTE, M.D.

PHILADELPHIA ACADEMY OF SURGERY

FOUNDED APRIL 21, 1879
INCORPORATED DEC. 27, 1879

OFFICERS

1879.

Temporary Chairman.....ADDINELL HEWSON
Temporary Secretary.....J. EWING MEARS
Temporary Treasurer.....WILLIAM HUNT
Temporary Recorder.....JOHN B. ROBERTS

PRESIDENT.

ELECTED		ELECTED	
1880	SAMUEL D. GROSS	1902	RICHARD H. HARTE
1884	D. HAYES AGNEW	1904	HENRY R. WHARTON
1891	WILLIAM HUNT	1906	JOHN B. ROBERTS
1895	THOMAS G. MORTON	1908	WILLIAM J. TAYLOR
1898	J. EWING MEARS	1910	ROBERT G. LE CONTE
1900	DEFORREST WILLARD	1912	GWILYM G. DAVIS

VICE-PRESIDENTS.

ELECTED		ELECTED	
1880	D. HAYES AGNEW	1900	RICHARD H. HARTE
1880	R. J. LEVIS	1900	HENRY R. WHARTON
1884	SAMUEL W. GROSS	1902	JOHN B. DEAVER
1889	JOHN H. PACKARD	1904	JOHN B. ROBERTS
1891	WILLIAM W. KEEN	1905	WILLIAM J. TAYLOR
1891	J. EWING MEARS	1906	ROBERT G. LECONTE
1898	JOHN ASHHURST, JR.	1908	G. G. DAVIS
		1909	JOHN H. GIBBON

SECRETARY.

ELECTED		ELECTED	
1880	J. EWING MEARS	1896	WILLIAM J. TAYLOR
1885	J. HENRY C. SIMES	1905	JOHN H. GIBBON
1893	THOMAS R. NEILSON	1909	CHARLES F. MITCHELL

CORRESPONDING SECRETARY.

ELECTED
1880 THOMAS G. MORTON
Office abolished after 1889 by amendment to By-Laws.

TREASURER.

ELECTED
1880 WILLIAM HUNT
1891 WILLIAM G. PORTER
ELECTED
1904 JAMES P. HUTCHINSON
1911 EDWARD B. HODGE

RECORDER.

ELECTED
1880 JOHN B. ROBERTS
1881 DEFORREST WILLARD
1881 O. H. ALLIS
1884 C. B. G. DENANCREDE
ELECTED
1884 J. EWING MEARS
1891 LEWIS W. STEINBACH
1902 JOHN H. GIBBON
1905 JOHN H. JOPSON

LIBRARIAN.

ELECTED
1880 O. H. ALLIS
Office abolished after 1889 by amendment to By-Laws,

PATHOLOGICAL HISTOLOGIST.

ELECTED
1880 SAMUEL W. GROSS
Office abolished after 1889 by amendment to By-Laws.

COUNCIL.

ELECTED
1880 JOHN ASHHURST, JR.
1880 JOHN H. BRINTON
1894 WILLIAM BARTON HOPKINS
1895 HENRY R. WHARTON
ELECTED
1898 THOMAS R. NEILSON
1900 W. JOSEPH HEARN
1902 ROBERT G. LECONTE
1906 THOMAS R. NEILSON
1910 J. CHALMERS DA COSTA
With President, Secretary, Treasurer and 1st Vice-President.

PUBLICATION COMMITTEE.

ELECTED
1880 JOHN H. PACKARD
ELECTED
1880 WILLIAM W. KEEN
With Recorder.
Office abolished after 1894 by amendment to By-Laws.

BUSINESS COMMITTEE.

ELECTED
1895 WILLIAM J. TAYLOR
1895 DEFORREST WILLARD
1896 RICHARD H. HARTE
1897 ROBERT G. LECONTE
ELECTED
1900 G. G. DAVIS
1902 JOHN H. JOPSON
1905 GEORGE G. ROSS
1908 FRANCIS T. STEWART
With Recorder.

COMMITTEE ON SAMUEL D. GROSS PRIZE FUND AND LIBRARY.

1884–1891
D. HAYES AGNEW
SAMUEL W. GROSS
J. EWING MEARS
SAMUEL ASHHURST
WILLIAM HUNT

1892–1893
J. EWING MEARS
SAMUEL ASHHURST
WILLIAM HUNT
JOHN ASHHURST, JR.
WILLIAM W. KEEN

TRUSTEES OF THE SAMUEL D. GROSS PRIZE FUND AND LIBRARY.

1894
J. EWING MEARS
JOHN ASHHURST, JR.
WILLIAM W. KEEN
With SAMUEL ASHHURST and WILLIAM HUNT to serve with them on distribution of the prize.

1895–1899
J. EWING MEARS
JOHN ASHHURST, JR.
WILLIAM W. KEEN

1900–1901
WILLIAM W. KEEN
J. EWING MEARS
J. CHALMERS DACOSTA

1902–1904
WILLIAM J. TAYLOR
WILLIAM L. RODMAN
JOHN B. ROBERTS

1905
WILLIAM J. TAYLOR
DEFORREST WILLARD
RICHARD H. HARTE

ACTIVE FELLOWS OF THE PHILADELPHIA ACADEMY OF SURGERY

1910.* Alexander, E. G., M.D., 1627 Oxford Street. Surgeon to the Out-Patient Department of the Episcopal Hospital; Surgeon to the Out-Patient Department of the Mary J. Drexel Home for Children; Assistant Surgeon to the Kensington Hospital for Women; Demonstrator of Fracture Dressings at the Jefferson Medical College; Demonstrator of Fracture Dressings at the Woman's Medical College.

1905. Allen, Francis Olcott, Jr., M.D., 2216 Walnut Street. Dispensary Surgeon to the Presbyterian Hospital; Dispensary Surgeon to the Methodist Hospital.

† Allis, Oscar H., M.D., 1604 Spruce Street. Surgeon to the Presbyterian Hospital; Member American Surgical Association.

1906. Ashhurst, Astley P. C., M.D., 811 Spruce Street. Surgeon to the Out-Patient Department of the Episcopal Hospital; Assistant Surgeon to the Orthopædic Hospital; Surgeon to the Dispensary of the Children's Hospital; Chief of the Gynæcological Dispensary of the Pennsylvania Hospital; Prosector to the Associate Professor of Applied Anatomy in the University of Pennsylvania.

1898. Boger, John A., A.M., M.D., 2213 N. Broad Street. Surgeon to St Mary's and the Samaritan Hospitals; Surgeon to the Dispensary of the Episcopal Hospital.

---

* Figures denote year elected to membership.
† Denotes Original Fellows.

1905. Brooks, Macy, M.D., 1314 Spruce Street. Assistant Genito-Urinary Surgeon, Philadelphia Hospital; Chief of Out-Patient Surgical Department of the University of Pennsylvania and Howard Hospitals.

1907. Carmany, Harry S., 366 Green Lane, Roxborough. Surgeon to St. Timothy's Hospital; Out-Patient Surgeon to Episcopal Hospital.

1909. Carnett, John B., 318 S. Fifteenth Street. Associate in Surgery, University of Pennsylvania, Medical Department; Assistant Surgeon to the University and Philadelphia General Hospitals; Consulting Surgeon to the Phœnixville Hospital.

1896. Da Costa, John Chalmers, M.D., 2045 Walnut Street. Professor of the Principles of Surgery and Clinical Surgery in Jefferson Medical College; Surgeon to the Philadelphia Hospital.

1896. Davis, Gwilym G., M.D., M.R.C.S. (Eng.), 1814 Spruce Street. Assistant Professor of Applied Anatomy, University of Pennsylvania; Surgeon to the Episcopal, St. Joseph's, and the Orthopædic Hospitals.

1896. Deaver, Henry C., M.D., 1534 N. Fifteenth Street. Surgeon to the Episcopal, St. Agnes, Stetson, and Children's Hospital of the Mary J. Drexel Home; Professor in Surgery in Woman's Medical College.

1890. Deaver, John B., M.D., 1634 Walnut Street. Chief of the Surgical Department, German Hospital.

1908. Despard, Duncan Lee, M.D., 1806 Pine Street. Instructor in Surgery, Jefferson Medical College; Chief Assistant in the Surgical Clinic at Jefferson Medical College.

1884. Dulles, Charles W., M.D., 4101 Walnut Street. Lecturer on the History of Medicine, University of Pennsylvania; Consulting Surgeon to the Rush Hospital.

1909. Elmer, Walter G., M.D., 1801 Pine Street. Instructor in Orthopædic Surgery in the University of Pennsylvania and Assistant Orthopædic Surgeon to the University Hospital; Orthopædic Surgeon to the Jewish Hospital; Surgeon to the Presbyterian Hospital Dispensary; Surgeon to the Pennsylvania Training School for Children at Elwyn.

1898. Frazier, Charles Harrison, M.D., 1724 Spruce Street. Professor of Clinical Surgery, University of Pennsylvania; Surgeon to the University Hospital, and Episcopal Hospital.

1899. Gibbon, John H., M.D., 1608 Spruce Street. Professor of the Principles of Surgery and of Clinical Surgery, Jefferson Medical College; Surgeon to the Pennsylvania and Bryn Mawr Hospitals; Consulting Surgeon to the Woman's Hospital.

1902. Girvin, John H., M.D., 2120 Walnut Street. Gynæcologist to the Presbyterian Hospital; Instructor in Obstetrics, University of Pennsylvania.

1892. Harte, Richard H., M.D., 1503 Spruce Street. Associate Professor of Surgery, University of Pennsylvania; Surgeon to the Pennsylvania Hospital, and to the Orthopædic Hospital and Infirmary for Nervous Diseases; Consulting Surgeon to St. Mary's, St. Timothy's, and Bryn Mawr Hospitals.

1882. Hearn, W. Joseph, M.D., 1120 Walnut Street. Emeritus Professor of Clinical Surgery, Jefferson Medical College; Surgeon to the Philadelphia Hospital; Consulting Surgeon to the Phœnixville Hospital, and to the General Hospital of Salisbury, Md.

1890. HEWSON, ADDINELL, M.D., 2120 Spruce Street. Surgeon to St. Timothy's Hospital; Professor of Anatomy, Philadelphia Polyclinic and College for Graduates in Medicine.

1905. HODGE, EDWARD B., M.D., 346 S. Sixteenth Street. Surgeon to the Children's Hospital; Surgeon to the Out-Patient Department of the Pennsylvania Hospital; Dispensary Surgeon to the Presbyterian Hospital; Assistant Surgeon to the Orthopædic Hospital.

1890. HORWITZ, ORVILLE, B.S., M.D., 1721 Walnut Street. Professor of Genito-Urinary Surgery, Jefferson Medical College; Surgeon to the St. Agnes Hospital and the State Hospital for the Insane; Consulting Surgeon to the Jewish Hospital.

1898. HUTCHINSON, JAMES P., M.D., 133 S. Twenty-second Street. Surgeon to the Pennsylvania, St. Timothy's, Methodist Episcopal, Children's, and Bryn Mawr Hospitals.

1900. JOPSON, JOHN H., M.D., 1824 Pine Street. Surgeon to the Presbyterian, Children's, and Bryn Mawr Hospitals, and to the Philadelphia Home for Incurables.

† KEEN, WILLIAM W., M.D., LL.D., F.R.C.S. (Hon.), 1729 Chestnut Street. Emeritus Professor of the Principles of Surgery and of Clinical Surgery in the Jefferson Medical College; Membre correspondant étranger de la Société de Chirurgie de Paris; Membre honoraire de la Société Belge de Chirurgie, Ehrenmitglied der Deutsche Gesellschaft für Chirurgie; Honorary Member of the Clinical Society of London.

1910. KELLY, JAMES A., M.D., 1621 N. Seventeenth Street. Surgeon to St. Mary's Hospital; Associate in Surgery and Pathologist to the Philadelphia Polyclinic Hospital and College for Graduates in Medicine.

1895. LE CONTE, ROBERT G., M.D., 1530 Locust Street. Surgeon to the Pennsylvania and Bryn Mawr Hospitals; Consulting Surgeon to the Germantown and Gynecean Hospitals.

1910. LEE, WALTER E., M.D., 905 Pine Street. Gynecologist to the Out-Patient Department of the Pennsylvania Hospital; Surgeon to the Dispensary of the Germantown Hospital.

1899. LOUX, HIRAM R., M.D., 1614 N. Broad Street. Associate Professor of Genito-Urinary Surgery, Jefferson Medical College; Surgeon to the Philadelphia Hospital.

1885. MCCLELLAN, GEORGE, M.D., 1116 Spruce Street. Professor of Anatomy, Jefferson Medical College; Consulting Surgeon to Howard Hospital; Professor of Anatomy, Pennsylvania Academy of the Fine Arts.

1900. MARTIN, EDWARD, M.D., 1506 Locust Street. Professor of Clinical Surgery, University of Pennsylvania; Professor of Clinical Surgery, Woman's Medical College; Surgeon to the Philadelphia, University of Pennsylvania, and Howard Hospitals; Consulting Surgeon to the Bryn Mawr, Phœnixville, Wernersville, and Norristown Hospitals.

1907. MILLER, MORRIS BOOTH, M.D., 2117 Pine Street. Professor of Surgery, Philadelphia Polyclinic and College for Graduates in Medicine; Assistant Surgeon, Philadelphia General Hospital; Surgeon to the Douglas Hospital.

1904. MITCHELL, CHARLES F., M.D., 342 S. Fifteenth Street. Surgeon to the Germantown Hospital; Assistant Surgeon to the Orthopædic Hospital and Infirmary for Nervous Diseases; Consulting Surgeon to the Eastern State Penitentiary; Surgeon to the Out-Patient Department of the Pennsylvania Hospital.

1906. MÜLLER, GEORGE P., M.D., 334 S. Fifteenth Street. Associate in Surgery in the University of Pennsylvania; Surgeon to St. Christopher's Hospital; Assistant Surgeon to the University Hospital, Philadelphia Hospital, and the Home for Crippled Children; Consulting Surgeon to the Chester County Hospital.

1902. MUTSCHLER, LOUIS H., M.D., 2030 Tioga Street. Surgeon to the Dispensary of the Episcopal Hospital; Surgeon to the Dispensary of the Samaritan Hospital; Assistant Surgeon to the Orthopædic Hospital.

1905. NASSAU, CHARLES F., M.D., 1831 Chestnut Street. Surgeon to St. Joseph's Hospital; Consulting Surgeon to the Frankford Hospital; Prosector, Jefferson Medical College (Chair of Regional Anatomy).

1890. NEILSON, THOMAS R., M.D., 122 S. Seventeenth Street. Surgeon to the Episcopal Hospital and to St. Christopher's Hospital for Children; Clinical Professor of Genito-Urinary Diseases in the University of Pennsylvania.

1906. ‡NORRIS, HENRY, M.D., Rutherfordton, North Carolina.

1890. PENROSE, CHARLES B., M.D., Ph.D. (Harvard), 1720 Spruce Street.

1912. PFEIFFER, DAMON B., M.D., 1953 Locust St.

1890. †ROBERTS, JOHN B., M.D., 313 S. Seventeenth Street. Professor of Surgery in the Philadelphia Polyclinic; Surgeon to the Methodist Hospital.

1898. ROBINSON, J. WEIR, M.D., 326 S. Sixteenth Street. Assistant Surgeon to the Presbyterian Hospital.

‡ Non-Resident Fellow.

1900. RODMAN, WILLIAM L., M.D., LL.D., 1904 Chestnut Street. Professor of the Principles of Surgery and Clinical Surgery, Medico-Chirurgical College of Philadelphia; Surgeon to the Medico-Chirurgical Hospital, Presbyterian, and the Philadelphia General Hospitals.

1900. ROSS, GEORGE G., M.D., 1721 Spruce Street. Surgeon Germantown Hospital; Assistant Surgeon, German Hospital; Surgeon to the Out-Patient Department, German Hospital; Assistant Surgeon, University Hospital; Instructor in Surgery, University of Pennsylvania; Surgeon to the Stetson Hospital.

1894. SHOEMAKER, GEORGE ERETY, A.M., M.D., 1831 Chestnut Street. Gynæcologist to the Presbyterian Hospital.

1903. SITER, E. HOLLINGSWORTH, M.D., 2038 Locust Street. Surgeon to the Out-Patient Department, St. Agnes' Hospital; Surgeon to the Out-Patient Department of the Children's Hospital; Chief Surgeon, Genito-Urinary Diseases of the University Hospital; Instructor in Genito-Urinary Diseases, University of Pennsylvania, Surgeon of the British Consulate.

1909. SPEESE, JOHN, M.D., 248 S. Twenty-first Street. Instructor in Surgery, University of Pennsylvania; Surgeon to the Out-Patient Department of the University Hospital and the Children's Hospital.

1898. SPELLISSY, JOSEPH M., A.M., M.D., 110 S. Eighteenth Street. Surgeon to the Methodist and to St. Joseph's Hospitals, the Elwyn Training School, and to the Out-Patient Department of the Pennsylvania Hospital; Assistant Surgeon to the Orthopædic Department of the University Hospital.

1890. STEINBACH, LEWIS W., M.D., 1309 N. Broad Street. Professor of Surgery, Philadelphia Polyclinic; Surgeon to the Philadelphia and to the Jewish Hospitals.

1911. STELLWAGON, THOMAS C., JR., 1119 Spruce Street. Chief Clinical Assistant in the Out-Patient Surgical Department of the Jefferson Medical College Hospital.

1903. STEWART, FRANCIS T., M.D., 311 S. Twelfth Street. Surgeon to the Germantown Hospital; Professor of Clinical Surgery in Jefferson Medical College; Surgeon to the Out-Patient Department of the Pennsylvania Hospital.

1908. SWEET, J. EDWIN, A.M., M.D., 301 St. Mark's Square. Assistant Professor of Experimental Surgery, University of Pennsylvania.

1890. TAYLOR, WILLIAM J., M.D., 1825 Pine Street. Surgeon to St. Agnes' and the Orthopædic Hospitals; Consulting Surgeon to the West Philadelphia Hospital for Women.

1911. THOMAS, BENJAMIN A., 116 S. Nineteenth Street. Professor of Genito-Urinary Surgery in the Philadelphia Polyclinic and College for Graduation in Medicine; Instructor in Surgery in the University of Pennsylvania; Surgeon-in-Chief to the Out-Patient Department of the University Hospital.

1908. THOMAS, THOMAS TURNER, M.D., 2005 Chestnut Street. Instructor in Surgery in the University of Pennsylvania; Assistant Surgeon to the University Hospital; Assistant Surgeon to the Philadelphia Hospital.

1907. UHLE, ALEXANDER A., M.D., 1831 Chestnut Street. Assistant Instructor, Genito-Urinary Department, University of Pennsylvania; Assistant Genito-Urinary Surgeon, Philadelphia Hospital; Surgeon to Urologic Dispensary of the German Hospital.

1907. WALKER, WARREN, M.D., 1632 Spruce Street. Surgeon to the Out-Patient Department of the Episcopal and Children's Hospitals.

1892. WHARTON, HENRY R., M.D., 1725 Spruce Street. Clinical Professor of Surgery, Woman's Medical College; Surgeon to the Presbyterian and to the Children's Hospitals; Consulting Surgeon to the Bryn Mawr Hospital, St. Christopher's Hospital, and to the Pennsylvania Institution for the Deaf and Dumb.

1883. WHITE, J. WILLIAM, M.D., 1810 S. Rittenhouse Square. John Rhea Barton, Professor of Surgery, University of Pennsylvania; Surgeon to the Rush Hospital.

1902. WHITING, A. D., M.D., 1523 Spruce Street. Surgeon to the Germantown Hospital; Assistant Surgeon to the German Hospital; Surgeon to the Southern Home for Destitute Children; Surgeon to the Out-Patient Department, German Hospital; Assistant Surgeon, University Hospital; Instructor in Surgery, University of Pennsylvania.

1890. WILSON, H. AUGUSTUS, A.M., M.D., 1611 Spruce Street. Professor of Orthopædic Surgery, Jefferson Medical College; Emeritus Professor of Orthopædic Surgery, Philadelphia Polyclinic; Orthopædic Surgeon to the Philadelphia Hospital; Consulting Orthopædic Surgeon to the Lying-in Charity Hospital and to the Kensington Hospital for Women.

1898. Wood, Alfred C., M.D., 128 S. Seventeenth Street. Assistant Professor of Surgery in the University of Pennsylvania; Surgeon to the University, Philadelphia and St. Timothy's Hospitals; Consulting Surgeon to Charity Hospital and the State Hospital for the Insane, Norristown.

1910. Woods, Richard F., M.D., 1501 Spruce Street. Gynæcologist, Presbyterian Hospital; Associate Gynæcologist, Gynecean Hospital.

1902. Young, James K., M.D., 222 S. Sixteenth Street. Professor of Orthopædic Surgery, Philadelphia Polyclinic; Clinical Professor of Orthopædic Surgery, Woman's Medical College of Pennsylvania; Associate in Orthopædic Surgery, University of Pennsylvania; Assistant Orthopædic Surgeon, Hospital of the University of Pennsylvania.

LIST OF FELLOWS WHO HAVE DELIVERED THE ANNUAL ADDRESS

1881. S. D. Gross.
1882. D. Hayes Agnew.
1883. William Hunt.
1884. John H. Brinton.
1885. John H. Packard.
1886. R. J. Levis.
1887. J. Ewing Mears.
1888. C. B. G. de Nancrede.
1889. John B. Roberts.
1890. De Forrest Willard.
1891. William G. Porter.
1892. T. G. Morton.
1893. C. W. Dulles.
1894. W. B. Hopkins.
1895. John B. Deaver.
1896. James M. Barton.
1897. Thomas R. Neilson.
1898. O. H. Allis.
1899. William J. Taylor.
1900. None.
1901. H. R. Wharton.
1902. J. M. Spellissy.
1903. R. G. LeConte.
1904. G. G. Davis.
1905. J. Chalmers DaCosta.
1906. Richard H. Harte.
1907. Edward Martin.
1908. Charles H. Frazier.
1909. John H. Gibbon.
1910. Astley P. C. Ashhurst.
1911. John H. Jopson.
1912. George G. Ross.

WINNERS OF THE SAMUEL D. GROSS PRIZE

1895 "Inquiry into the Difficulties Encountered in the Reduction of Dislocations of the Hip."—Dr. Oscar H. Allis, Philadelphia, Pa.

1902 "The Treatment of Certain Malignant Growths by Excision of the External Carotids."—Dr. Robert H. W. Dawbarn, New York, N. Y.

1905 "The Biology of the Micro-organisms of Actinomycosis." —Dr. James Homer Wright, Boston, Mass.

1910 "An Anatomical and Surgical Study of Fractures of the Lower End of the Humerus."—Dr. Astley Paston Cooper Ashhurst, Philadelphia, Pa.

HONORARY FELLOWS

ELECTED.		
1881	*Sir James Paget	London, England.
1881	*Theodor Billroth	Vienna, Austria.
1881	*Bernhard von Langenbeck	Berlin, Germany.
1881	*Willard Parker	New York, N. Y.
1881	*Lewis A. Sayre	New York, N. Y.
1881	*Moses Gunn	Chicago, Ill.
1881	*John T. Hodgen	St. Louis, Mo.
1881	*W. W. Dawson	Cincinnati, Ohio.
1881	*T. G. Richardson	New Orleans, La.
1881	J. Collins Warren	Boston, Mass.
1881	*W. T. Briggs	Nashville, Tenn.
1881	*Christopher Johnston	Baltimore, Md.
1881	*D. W. Yandell	Louisville, Ky.
1898	Maurice H. Richardson	Boston, Mass.
1898	George M. Sternberg	Washington, D. C.
1898	Charles B. McBurney	New York, N. Y.
1898	*Nicholas Senn	Chicago, Ill.
1898	*Theodore F. Prewitt	St. Louis, Mo.
1898	L. McLane Tiffany	Baltimore, Md.
1898	Nathaniel P. Dandridge	Cincinnati, Ohio.
1898	Roswell Park	Buffalo, N. Y.
1898	Robert F. Weir	New York, N. Y.
1898	Frederick S. Dennis	New York, N. Y.

* Deceased.

1900	W. H. A. Jacobson	London, England.
1900	Theodor Kocher	Berne, Switzerland.
1900	Vincenz Czerny	Heidelberg, Germany.
1906	William J. Mayo	Rochester, Minn.
1906	Dudley P. Allen	Cleveland, Ohio.
1906	Robert Abbe	New York, N. Y.
1906	C. B. G. deNancrede	Ann Arbor, Mich.
1907	*John C. Munro	Boston, Mass.
1908	J. Ewing Mears	Philadelphia, Pa.
1909	Stephen Pilcher	Brooklyn, N. Y.

CONTENTS

*Read Feb. 5th, 1912. By error this paper was bound up in Vol. XIV of the Transactions of the Philadelphia Academy of Surgery (1911–1912, pp. 32–33).

TRANSACTIONS
OF THE
PHILADELPHIA ACADEMY OF SURGERY

STATED MEETING, HELD JANUARY 8, 1912

The Vice-President, DR. GWILYM G. DAVIS, in the Chair.

THE ART OF SURGERY*

BY GEORGE G. ROSS, M.D.,
OF PHILADELPHIA

Fellows of the Philadelphia Academy of Surgery:

It is with mixed feelings that I take up the task of delivering the annual address to the Academy. It is a duly appreciated honor to have been asked to do so, but also one that carries with it a great responsibility. The high character of the work of this association, and the exalted position in the surgical world of its Fellows raises a standard difficult to live up to.

Surgery to-day is the outgrowth of centuries of accumulated experience and the thought of thousands of men. "No great thing cometh suddenly into being," and we may trace the beginning of the Art of Surgery into the dim past when history first begins to record the deeds of mankind.

Happily, to-day, Surgery stands upon firm ground—the art supported and enlightened by the science of surgery, yet let us not forget that essentially surgery is an art.

Science of whatever kind seeks to enlighten us as to the causes of things and to explain known phenomena in accordance with certain well known fundamental laws of nature. How vast is its scope; how great are its limitations. "Science," says Holmes, "is the topography of ignorance. From a few elevated points, we triangulate vast spaces, inclosing infinite unknown details. We cast the lead, we draw up a little sand from abysses we may never reach with our dredges. The best part of our knowledge is that which teaches us where knowledge leaves off and ignorance begins."

*The Annual Oration in Surgery.

And, if the professed scientist is he who from a height surveys and examines facts and attempts to correlate and explain them, are there not ever so many more who from a lower level, perhaps, discover and hand down to posterity known facts in a much more restricted field of observation.

Just as in all crafts the practical utilization of experience long preceded the explanation of phenomena, so has the art of surgery preceded the science, and even yet remains the essential factor in its usefulness.

Of singular appropriateness in distinguishing between the art and science of surgery, I may quote the late Dr. Alfred Stille's remarks upon the Essentials of the Art of Medicine. "I venture once more to repeat my life-long declaration of faith that every art must exist before its associated science, and that how much soever each may illustrate the other, both are essentially independent. Neither botany, nor chemistry, nor pharmacy, nor pharmaco-dynamics, nor physiology, nor bacteriology, is an essential part of therapeutics. Its true and only foundation is clinical medicine, the medicine which recognizes and treats diseases. Medicine, in this sense, is an art and not a science; its laws are rules established, not only by theory but by observation and experience. They are as various as the medicines employed or as the patients who take them; they must be modified by the nature, the form, the tendencies of the particular disease, by the external and internal conditions and relations of the patients. The certainty of a science depends upon the fixity or constancy of its elements; the uncertainty of the healing art is due to inconstancy, the fluctuating values of the elements involved in the disease, in the remedies, in the patient, and in the physician himself, elements which no science has ever measured or reduced to law, and which none probably ever will; but what science has failed to do for disease in general, and for classes of diseases, practical sagacity has accomplished for individual patients."

"There is a science, and there is an art of medicine, but the boundary line between them is not always clearly defined; for although we may arbitrarily separate the one from the other, it is evident that while both are independent in their nature, each tends to throw light upon the other—the science upon the art, by enabling us to group together empirical facts in an order

and arrangement which makes both the science and the art more intelligible; and the art upon the science, by providing it with a wider basis of facts for induction, and by tending through clinical experience to rectify the errors inseparable from the application of normal laws to abnormal conditions. The familiar anecdote, whether it be literally true or not, which relates that the law of gravitation was revealed to Newton by the fall of an apple; or that other equally striking story that oscillation of a chandelier suggested to Galileo the orbit of the planets, show that in the portion of the domain of knowledge where the laws are unchangeable, a sagacious mind may leap from a single fact to a boundless generalization."

The same thought is pursued upon a somewhat different line by Holmes in his essay on scholastic and bedside teaching. "We must not expect too much from 'Science' as distinguished from common experience. There are ten thousand experimenters without special apparatus for every one in the laboratory. Accident is the great chemist and toxicologist. Battle is the great vivisector. Hunger has instituted researches on food such as no Liebig, no Academic Commission has ever recorded."

Medicine, sometimes impertinently, often ignorantly, often carelessly called "allopathy," appropriates everything from every source that can be of the slightest use to anybody who is ailing in any way, or like to be ailing from any cause. It learned from a monk how to use antimony, from a Jesuit how to cure agues, from a friar how to cut for stone, from a soldier how to treat gout, from a sailor how to keep off scurvy, from a post-master how to sound the Eustachian tube, from a dairy maid how to prevent small-pox, and from an old market woman how to catch the itch-insect. It borrowed acupuncture and the moxa from the Japanese heathen, and was taught the use of lobelia by the American savage. It stands ready to-day to accept any thing from any theorist, from any empiric who can make out a good case for his discovery or his remedy. "Science" is one of its benefactors, but only one, out of many. Ask the wisest practising physician you know, what branches of science help him habitually, and what amount of knowledge relating to each branch he requires for his professional duties. He will tell you that scientific training has a value independent of all the special knowledge acquired. He will tell you that many facts are ex-

plained by studying them in the wider range of related facts to which they belong. He will gratefully recognize that the anatomist has furnished him with indispensable data, that the physiologist has sometimes put him on the track of new modes of treatment, that the chemist has isolated the active principle of his medicine, has taught him how to combine them, has from time to time offered him new remedial agencies, and so of others of his allies. But he will also tell you, if I am not mistaken, that his own branch of knowledge is so extensive and so perplexing that he must accept most of his facts ready made at their hands. He will own to you that in the struggle for life which goes on day and night in our thoughts as in the outside world of nature, much that he learned under the name of science has died out, and that simple homely experience has largely taken the place of that scholastic knowledge to which he and perhaps some of his instructors once attached a paramount importance."

Let it not be supposed that anyone should think of considering to-day the art of surgery as separate and apart from the science of surgery.

The Art of Surgery in its fullest and best sense avails itself not only of the facts which experience has demonstrated, but also of every aid which science, experimental and otherwise puts at his disposal. But he who would practise the art of surgery must rely first of all upon the accumulated experience of all who have preceded him.

And where a scientific theory or hypothesis runs counter to our knowledge of fact it must be cast aside. Sydenham, the great pioneer in medicine, says: "In writing therefore a history of diseases, every philosophical hypothesis which hath prepossessed the writer in its favor ought to be totally set aside." In a similar vein, Claude Barnard, the greatest of physiologists, states that "when you meet with a fact opposed to a prevailing theory, you should adhere to the fact and abandon the theory, even when the latter is supported by great authorities and generally adopted."

This great adherence to fact and abhorrence of pure theory has been a guiding principle with those who have most successfully practised the art of surgery.

No one would attempt to oppose the art and science of surgery to array the craftsman and the scientist on opposite sides.

The true surgeon practises his art with full knowledge of and reliance upon those aids which science alone furnishes. And to do this in the fullest sense of the word requires a man of many and diverse qualities.

Sedillot, himself one of the greatest of a brilliant group of French surgeons, early in the last century, says, he (the surgeon) must be strong, active and adroit, fertile in resource, persuasive, of an unshakable firmness, practised in solving the most difficult problems of symptomatology, for his diagnosis may be a question of life and death.

With Velpeau, he must give ear to the experiences of every one without regard to country, school or person.

The surgeon must develop his powers of observation to the fullest extent; no detail, however small, can be too insignificant for his attention. Superficiality is fatal to the practise of surgery. Things, apparently trivial, may change the prognosis of a case entirely.

And not only must the power of observation be trained, but with it there must be a keen sense to discern the actual facts, a fine discrimination between the real and the apparent. Experience must set its seal deeply upon him who aspires to the heights of the surgical art. Each case must carry its lesson, however slight. The work and experience of others should be weighed in the balance.

And, granted that the surgeon has those qualifications which are so necessary to him, what is it that will enable him to further advance the science and art of Surgery?

Primarily, it is the ability to profit by the experience of others, and the constant endeavor to add something new, seem it ever so trifling to the fund of acquired knowledge. Paré, in 1575, said of his surgery, "that posterity will not be able to surpass us (be it said without malice or offense) save by some additions such as are easily made to things already discovered."

How false this view of a truly great man was; what enormous strides have been made in the art of surgery and its allied branches within the lives of those present.

Fitz placed the pathology of appendicitis upon a firm basis. Fowler, Treves, Murphy, Deaver, Richardson, Oschner and a host of others have put his teachings to practical use.

Surgery of the Stomach, Biliary System and the Pancreas

has come into its own. The work of Matas on aneurysms and of Carrel and others on blood vessel anastomosis and transplantation have been the first great advances since Antyllus described his method of treating aneurysms and Paré first used the ligature to control hemorrhage after amputation.

Ferrier's epoch-making studies on cerebral localization have borne fruit in the work of Horsley, Keen, Cushing, Krause and others.

We are just at the beginning of an era of intrathoracic surgery, made possible by Sauerbruch and Brauer's use of negative and positive pressure apparatus. The whole field of thyroid surgery has been opened. Surgery of the prostate and kidneys and bladder has been made practicable.

We have achieved a constantly greater success in the treatment of peritonitis, for Fowler and Murphy, by utilizing physiological knowledge, have given us practical contributions to surgical art.

But in all these great advances the practical craftsman of the surgical art has been the one who has turned things discovered into actual benefits.

When Pasteur announced his all-important discovery that micro-organisms were the cause of fermentation, Lister, the practical surgeon, at once saw its value in its application to the treatment of wounds. His methods are our methods to-day, modified and simplified by constant use, at the bedside and in the operating rooms of the world. Their value has been tested in the retorts of practical experience and the favorable verdict has rested, as it always must, upon the approval of the practising surgeons and physicians.

As an instance, let us also consider the development of the symptomatology of gastric disease. Laboratory methods here misled the medical profession for many years, until the surgeon with his study of living pathology showed the true connection between lesion and symptom.

And how may we further progress? First and foremost by the study of what has been aptly called "living pathology"; the study at the operating table of pathology and diseased physiology *in vivo*. What correct idea does the post mortem examination of a patient who has died of an appendicael peritonitis give of an acute incipient appendicitis? Or what does the pic-

ture of a patient succumbing to intestinal gangrene as a result of strangulation teach us as to the methods of cure of the condition in its early stages?

The surgeon of to-day must study morbid anatomy not only at the autopsy table and in the museum but at the operating table, and how great is his advantage over the internist who does not see the wonders revealed by surgery.

What an ideal combination for the furtherance of learning, it would be to have present at every operation of moment, besides the surgeon, the internist and the pathologist, working in harmony, and each one exerting his special powers in the solution of the problem at hand. When, as is rarely the case, a marvelous man of medical science combines these three functions well, how wonderful are the results!

"When Fitz, soon after his classical monograph on Acute Hemorrhagic Pancreatitis, made the correct diagnosis in the case of a prominent citizen of Boston, the medical and surgical community applauded the brilliancy of that intellectual feat. That diagnosis was the result of pathologic observations in connection with a study of the clinical history; it was the fruit of years of observation in which there had been a direct and early demonstration of the pathology of the disease." (Richardson.)

And so, the true surgeon can not be too narrow a specialist. Specialism in modern surgery is necessary; but, even more necessary is the well-grounded thorough man, who combines with his highly specialized vision, openness to facts that lie beyond his immediate horizon and an ability to interpret them.

Let us use the laboratory and its findings to their full extent. Let us appreciate the benefits of scientific investigation in the solution of diagnostic difficulties. But, with Richardson, I believe that the tendency to-day is to return to the old-fashioned methods of diagnosis; the history, the touch and the tongue; the pulse; the indescribable picture as a whole, upon which many an experienced practitioner bases at times wonderful intuitive diagnosis.

The general practitioner is the greatest of all specialists. He specializes in individuals and in individual cases and not in diseases of a certain organ or organs. With him, as Osler says, must remain the final verdict as to the value of any surgical or medical procedure.

What I wish to do in this paper is to make a plea for the application to the problems of surgery, of those broader principles and insights which constitute the strength of the general practitioner. If, in the field of special surgery we can bring into use the abilities of men who see in the lesion of a particular organ, its near and remote effects upon the organism as a whole, we shall be on the verge of a great and new era of practical surgery. Results in surgery depend not so much upon the immediate outcome of a surgical procedure upon any diseased viscus or structure, as upon the more remote effects upon the body as a whole. And here lies one of the dangers of modern surgery. In the large surgical clinics of to-day there is a tendency to perform operations in great numbers and to accumulate great masses of statistical material, more or less correct as to technical details, but wholly lacking in value in a consideration of end results.

Every surgeon to make advances in his work should know how many patients have been, and how many have not been permanently benefited by his treatment.

We must do more than treat the disease; we must treat the patient. To treat the patient, we must know more than the symptoms from which he is suffering. We must know his characteristics, his hereditary tendencies, his environments, his idiosyncrasies, and his vital resistance. To do this takes time; to gain time, we must do one or more of several things. We must increase our capacity for work; or we must decrease the number of patients to correspond to our capacity for work; or we must by efficient organization, divide up the work so that these essential details are not overlooked or ignored.

You, as leaders of our profession, must ever be in close association with the family doctor. You must teach him; be at his elbow in times of stress; must impress upon him the fact of his heavy responsibility to his patient and the importance of his opinion and advice. You must teach the laity the added value of this service, which calls for corresponding remuneration.

You must stop the waving of the shining banner of Science as an excuse for mere numbers, and return to the more rational and safer ground of Doctor and Patient!

TUMORS OF THE MALE BREAST.

BY JOHN SPEESE, M.D.,
OF PHILADELPHIA,
Instructor in Surgery in the University of Pennsylvania.

(From the Laboratory of Surgical Pathology, University of Pennsylvania.)

THE infrequency of tumors of the male breast is explained by its rudimentary state, the physiologic inactivity of its glandular elements, and particularly by the fact that the conditions incident to pregnancy, which predispose to mammary disease in the female, are entirely absent.

The degree of frequency is well demonstrated in Williams's analysis of 13,894 primary neoplasms, which show that 2422 originated in the breast; of these, 25 occurred in males and 2397 in females. Therefore, 17.5 per cent. of all neoplasms occur in the breast, and when subdivided, we find that the female breast is relatively affected in 26 per cent., and the relative frequency in the male breast is 5 per cent. The influence of sex in the development of neoplasms is thus demonstrated. Williams estimates, in general, that females are twice as liable as males, the percentage proportion being 67 females to 33 males. In the breast, however, nearly 99 per cent. of all its neoplasms occur in females, and only about 1 per cent. in males. This illustrates the law that functionless, obsolete structure has but little tendency to take on the neoplastic process, which is most prone to arise in the sites of greatest post-embryonic developmental activity.

CARCINOMA.

In spite of the fact that carcinoma of the male breast, when compared with the same disease in the female, is relatively infrequent, there are a sufficient number of cases re-

ported in the literature to give to this affection a degree of considerable importance. This importance is further emphasized by a comparison of the disease in the two sexes, a study which tends to bring out many distinct differences.

Of the 25 tumors of the male breast collected by Williams, 16 were carcinomata, 3 sarcomata, and 6 various forms of benign growths. In 1885, Schuchardt collected 406 cases, 348 of which were malignant; Manger, in 1902, referred to 71 cases—some of these were probably included in Schuchardt's statistics. In 1901, Warfield collected 37 cases of cancer reported since the publication of Schuchardt's paper, and in 1906 Finsterer added 11 new cases. In addition to these, about 30 other cases have been recorded, making an approximate total of 500 instances of cancer of the male breast.

Carcinoma of the breast occurs considerably later in life in men than it does in women. In the latter, the statistics of various authors vary from 45 to 49 years, and in males the average age is about 55 years (50 years, Williams; 61.5 years, Keyser). The greatest number occurred in the seventh decade of life in both Warfield's and Manger's series, although a relatively large number also appeared in the fifth and sixth decades.

The disease may occur at an early age, as is seen in the case reports of Blodgett, Williams, Moore and Coley, in which the ages were respectively twelve, twenty and twenty-two years. The oldest case on record occurred in a man aged ninety-one (Lunn).

A definite history of injury to the breast is obtained in a sufficiently large number of cases to attach some importance to traumatism as a predisposing factor in the development of cancer. It was mentioned in 8 of 37 cases (Warfield), and Schuchardt found that contusions, small wounds, fissures and mechanical factors, were present in 25 of 406 cases. In those instances in which traumatism was followed by either blood extravasation or scar formation (Schuchardt, Dietrich, Moore), there can be little doubt that the carcinoma developed at the site of lowered vitality. In one of Dietrich's cases, after the absorption of a hæmatoma, a nodule remained, and from this a malignant growth began two years later. In a second case a blow was followed by an inflammatory tumor discharging pus, and at this spot a hard nodule developed and later became carcinomatous.

The effect of constant pressure is noted in the appearance of cancer in workmen, who, in their occupations, are accustomed to exert force in the breast region. These cases are so numerous that the etiologic importance of this factor cannot be overlooked. The chronic irritation of articles of clothing is also mentioned, and it is certain that constant rubbing in this manner seems to hasten the growth of the tumor, and certainly predisposes to ulceration in those cases in which the carcinoma has already developed.

The action of the process spoken of as adolescent mastitis in the production of benign tumors will be alluded to. That the same affection may cause a predisposition to cancer seems likely, to judge from the first case reported by the author, in which the malignant growth was preceded by several attacks of inflammation.

The effect of hereditary predisposition in the development of tumors has been mentioned by several authors, a family tendency existing in benign as well as in malignant tumors of the breast. Gangitano has recently reported two cases of benign tumors in which the families of both showed a predisposition to breast disease. According to Williams, there was a history of cancer in seven of 29 cases (24 per cent.). Of the seven cases, the breast was the seat of the cancer in three, and in three cases there was history of carcinoma in more than a single relative.

Traumatism, or some form of chronic irritation, tends to produce rapid enlargement of latent carcinomata, and the same factors are often instrumental in producing ulceration. The formation of an ulcer is more likely when the malignant process has extended to the overlying skin which becomes atrophic in appearance. The frequency of ulceration is noted

by many writers, occurring in 61 of 219 cases (Schuchardt), 9 of 26 (Williams), 13 of 37 (Warfield), 18 of 71 (Manger). About 30 per cent. of the cases, therefore, undergo ulceration, a percentage which is much higher than in the breast carcinomata of women.

The slow growth of the tumor probably accounts for the fact that from the time when first noticed until the patient came under observation, a period of 29.5 months elapsed on the average (Williams), 18 to 25 months (Finsterer). In females, this period is much less, and varies from 10 to 12 months. While the growth of the tumor is protracted in most cases and covers a period of many years in slowly growing scirrhous tumors, the length of time observed has been as short as two weeks (Moore), two months (Finsterer) and three months in the first case reported by the author.

Enlargement of the axillary lymph-nodes is observed in a majority of the cases (60 to 65 per cent.). In a few instances, no axillary enlargement was noted, and in cases whose duration was not longer than six months, the nodes were usually normal. After this period of time, as in the female, the lymphatics become affected regularly.

Some authors have found that the right breast is affected more frequently than the opposite one, whereas, other statistics place the degree of frequency slightly higher in the left. The average of a large series of cases, however, shows that the difference is so little that it is not of practical importance. The disease was bilateral in four of 88 cases (Williams), but did not begin as a primary bilateral affection in any case. Hansy reports a case in which the second tumor in the opposite breast developed so soon after the appearance of the first, that it can be regarded as an example of bilateral primary malignancy.

The clinical picture of the disease does not differ in many other particulars from that of the female. The growth, usually situated near and below the nipple, is small, hard and freely movable in the early stages. Slow growth has been mentioned, and depending upon that, we find that adhesions

to the surrounding parts with fixation of the tumor are late manifestations. The growth, in spite of its long duration, remains small, usually being the size of a small nut, and occasionally becomes as large as an apple. Pain is rarely a prominent symptom unless extensive infiltration or ulceration has taken place. In many cases, the tumor, although of a fairly large size, produced no symptoms. The nipple becomes retracted in about half of the cases because the cancer is situated close to the ducts. In a few instances, the tumor has extended to and destroyed the nipple (Warfield). Discharge from the nipple is rather uncommon, but may be bloody, milky or puriform in character.

The majority of the above symptoms, therefore, represent late manifestations of the cancer, the disease having infiltrated the surrounding parts. At this stage, the diagnosis is not difficult, but it may be so in the early stages when the tumor is small and freely movable. That the primary tumor may be overlooked and serious consequences arise from its presence, is learned from McConnell's case. The man, aged fifty-four, developed symptoms which suggested a pulmonary lesion, and a diagnosis of sarcoma of the lung was made. The breast was enlarged, but the examination did not disclose any definite tumor, so that a neoplastic process was not suspected. The autopsy disclosed metastases in many of the viscera, including the pleura and lungs, the primary tumor originating in the breast.

The malignant degeneration of benign tumors will be alluded to. Sudden growth of a pre-existing tumor, with fixation of the mass, and especially if present in middle-aged men, should always warrant the diagnosis of malignancy and call for its appropriate treatment.

The histologic examination of the cases shows that the carcinoma arises most commonly from the ducts of the gland and less frequently from the acini, as is to be expected from their lack of development.

Williams's hundred cases were divided as follows: acinous 91 (scirrhus 88, encephaloid 3), tubular 6 (cylinder cell duct

cancer), cutaneous squamous cell cancer, 3. While the scirrhous variety is most commonly observed, the relative proportion is not so high in Warfield's series, 11 of 26 cases being scirrhous cancers.

A peculiarity of the histologic examination is noted in the number of melanotic and squamous carcinomas contained in Williams's collections. Of the scirrhous growths, two were melanomas; and one of the three squamous carcinomata was a melanotic tumor. This frequency is explained by the fact that skin growths, in general, are much more liable to affect the male sex. The melanotic tumors also arise much more frequently in connection with structures of integumentary origin. The male breast being of this type and having lost most of its special characters, is in a process of reversion to the primordial cutaneous condition, and herein may be an explanation of its comparative proneness to melanosis.

The recurrent disease is found usually in or near the scar of the operation, or it may arise in the axilla or opposite breast. It is worthy of note that the carcinoma was present, on an average, 20.4 months before operation was undertaken in five recurrent cases reported by Finsterer. The duration of life from onset of the tumor in these cases averaged 51.4 months, in spite of the secondary growths. On the other hand, in exceptional cases, the disease assumes a rapid growth, and its highly malignant character is manifested by recurrence a few months after operation. Manger states that 70 per cent. of the cases died of recurrence or metastasis, and that recurrence arose in 19 of 72 patients in a few months to 5 years. There were 9 recurrences within 6 months of the operation, 3 within 1 year, 2 within 2 years, 3 within 4 years, 1 within 5 years, 1 within 6 years. The tendency toward late recurrence 5, 10 or more years after operation, which is rather common in women, does not exist in men, the majority of the cases reported recurring within a comparatively short time, and a few living 5, 6 or 8 years before local recurrence arose.

Secondary growths involving the internal organs are most

commonly found in the liver and lungs. In 5 of 88 cases (Williams) deposits were noted in the bones; both clavicles and tibiæ, the vertebræ, the sphenoid and base of the skull were involved in one case each.

The operative mortality in Williams's statistics was 36 per cent., two deaths occurring in 56 amputations of the breast. Death in these cases was due to sepsis; this complication is practically unknown at the present day. The operative mortality at present is *nil*, the 34 cases collected by Warfield in recent times, and 30 I have reviewed, all recovered.

It is impossible to judge accurately concerning the percentage of cures because this fact is mentioned in a comparatively small number of cases. Finsterer was able to find but six cases in the literature in which it was stated definitely that recurrence had not arisen. Two of the cases in his series lived 21 and 11 years; Blodgett's case 5 years, and the second case reported by the author has lived 3 years without further trouble.

The following cases of carcinoma of the male breast are reported for the first time:

Case I (Service of Dr. E. B. Hodge, Presbyterian Hospital).—Patient aged fifty-five, noted three months ago a small nodule below the breast. He states that when a boy the breast became red, painful, and swollen, and several times during adult life, similar attacks of inflammation occurred. At these times there was a slight discharge of clear fluid from the nipple. There was no history of trauma to account for the attacks. On examination, a hard nodule, the size of a hickory-nut, was found below the nipple, which was slightly retracted. The mass was adherent to the underlying tissues and was painless. The skin was atrophic in appearance and at a point over the tumor was brawny and infiltrated. One enlarged lymph-node was palpable. The tumor, when removed, was dense and stony hard, and showed microscopically a typical scirrhous carcinoma. The single enlarged lymph-node was not involved. There has been no recurrence nine months after operation.

Case II (Service of Dr. C. H. Frazier, University Hospital).—R. C., male, aged forty-eight, was admitted with the history

of a recurrent tumor of the left breast. The growth appeared two years ago without cause and without pain, and seven months after it was first noted, the lump and nipple were excised. He remained well until a few months ago when a second nodule appeared and was excised. The histologic examination showed carcinoma in both instances, and the patient was finally persuaded to accept radical operation. The axilla contained several enlarged nodes which were removed, and, beneath the scar of the first operation, several nodules were found. These and the axillary lymph-nodes showed infiltration of a scirrhous type. No recurrence at the present time, three years after last operation.

SARCOMA.

Sarcoma of the female breast occurs in 1 to 2 per cent. of the cases, and as an affection of the male gland must be regarded as a very rare condition. In Schuchardt's statistics, only six cases are mentioned in which the diagnosis was confirmed by microscopic examination, and the three instances occurring in Williams's collection of 2422 tumors of the breast have been alluded to. In 1906, Finsterer found 12 sarcomas of the male breast in the literature, three of these he reported for the first time. Connell a year later reported a case occurring in a male aged twenty-five and thoroughly reviewed the subject, collecting, in all, 34 cases.

The clinical features of this form of malignancy resemble carcinoma in some particulars, and, in others, differ sufficiently to justify a diagnosis between the two. Finsterer has found the average age to be considerably lower than that of carcinoma—sarcoma 45.6 years, carcinoma 55 years. The following table represents the age incidence (Connell):

20 to 25 years	4 cases
30 to 35 years	3 cases
35 to 40 years	2 cases
40 to 45 years	3 cases
45 to 50 years	1 case
50 to 55 years	5 cases
55 to 60 years	1 case
73 years	1 case

The tumor begins as a small, freely movable nodule, which grows rapidly as a rule, reaching the maximum size within a year. Sarcomata in some cases may become as large as an orange or a child's head. The skin is involved in a comparatively small number of cases, therefore the formation of ulceration is seen much less frequently than in carcinoma. Fixation of the tumor to the underlying tissues is a rather late manifestation. Involvement of the axillary lymph-nodes, on the other hand, occurs frequently. In 20 cases Connell found axillary involvement mentioned 9 times; skin involvement 4 times; fixation to fascia 3, and no adherence 7.

While the tumors grow rapidly in the majority of cases, occasionally a period of several years elapses before they reach any considerable size, the average duration of the disease being much less than carcinoma. Family predisposition and traumatism play a less important rôle than they do in cancer, for Connell has found but two instances of the former and one of the latter.

Histologic examination has disclosed all varieties of sarcoma; the spindle-cell type, which predominates, is the least malignant. The varieties are subdivided as follows: spindle-cell 12, round cell 7, chloroma 1, cystic 3, and melanotic 3.

Some of the cases which have been reported should not be classified as breast tumors because they have originated in the skin, as pigmented moles or nævi. Sarcoma is reported to have developed from a nodule in the breast of 22 years' duration, and from other benign tumors most likely adenofibromata in nature.

The final result of the operative measures has been mentioned in comparatively few cases. Finsterer could record but one case of cure; in this there was no recurrence after 11 years. Connell mentions 11 recoveries. One case free for 2 years after the fourth operation; one recovery with development of keloid; recovery with development of erysipelas on second day, no recurrence after 11 years; one recovery with inoperable recurrence, after one year Coley's treatment, recovery. Deaths three; death after second operation within five months, one case.

BENIGN TUMORS.

Of the 25 tumors in the male breast, recorded by Williams, 16 were cancerous, 3 were sarcomatous and 6 were benign. Schuchardt's first collection included 274 malignant growths and 21 benign ones. Numerous reports of benign growths of the male breast point to the fact that the pathology of these conditions does not differ essentially from that of the female, and that the various tumor formations so common in the latter may find their counterpart in the male gland.

The least common benign tumors occurring in either the male or female breast are those composed of a single type of tissue. These cases are so rare that they are of most interest from a pathologic stand-point. The cases which have been reported by various authors include fibroma, myxoma, chondroma, angioma, adenoma, and myoma. Several instances of true lipomata presenting noteworthy features are on record. The tumors, for the most part, occur in middle-aged men, are soft, and occasionally reach a size to cause real discomfort. They are painless, of slow growth, and require several years to attain any considerable proportion. The lipoma observed by Queirel became as large as a child's head in 15 months, while in Masse's case the growth was congenital, and grew more rapidly, becoming the size of an orange in nine months. While the tumor in the last case occupied the mammary region, there is some doubt as to whether it and several other lipomata of congenital origin originated in the breast.

The most common tumor described is the fibro-adenoma, which Woodyatt divides into two groups:

(1) Sharply circumscribed form, dense tumors which arise without traumatism in the breasts of young men and run a painful clinical course. Microscopically, there is little or no evidence of inflammation, but all the characteristics of the fibro-epithelial tumors which occur in the breasts of young females, to which they are analogous.

(2) Diffuse or ill-defined growths which may occur at any age as the result of traumatism. Microscopically, these enlargements have the same structure as those of the first group. Signs of inflammation are more in evidence, however, so that their differentiation from chronic inflammation may not be easy. They are called fibro-adenoma because of their progressive growth and microscopic structure. This formation corresponds to the "traumatic indurations" of some writers.

Fibro-adenomata of the male breast vary greatly in size. The tumors seen in boys in conjunction with inflammatory symptoms (adolescent mastitis) are usually small. Their growth is generally slow and progressive, several years elapsing until they reach the size of a walnut, an egg, or even an orange. In Whelan's case, the tumor began at the age of eighteen, and when removed, eight years later, weighed one-half pound. Rapid growth of the tumor may occur, as is seen in the instance recorded by Griffin which is of interest also because the growth was bilateral:

> The patient, aged forty-five, was struck seven weeks previously over the left breast, after which a tumor slowly grew until it reached the size of a hen's egg. Four weeks later a tumor in the opposite breast was removed; this growth was noticed one week after the first operation. Both tumors were fibro-adenomata on microscopic examination.

The interval between the appearance of the second tumor in the opposite breast is not always so short, as is indicated in Gangitano's case:

> A fifty-seven-year old man had a small tumor removed from the right breast sixteen years ago. During the past four years the left breast gradually increased in size, becoming denser than normal, painful on pressure but freely movable, and several enlarged axillary lymph-nodes developed. The breast was amputated, and microscopic examination showed a fibro-adenoma.
>
> A second instance reported by the same author occurred in a male aged sixty-six, in whom bilateral tumors developed over a period of seven or eight years, and reached the size of an apple in the right and a hazel-nut in the left breast. The latter was removed and found to be an adeno-fibroma.

Many cases give the history of antecedent injury to the breast. This effect is mentioned by Denenholtz in a case of bilateral growth in a boy of fifteen years. It is doubtful if

traumatism plays an important predisposing rôle, as the injury is much more likely to call attention to a tumor already present in the breast, a fact commonly observed in growths in the female gland.

During the past few years considerable attention has been directed to the fact that all benign tumors of the breast are potentially malignant. In the female the possibility of carcinomatous degeneration is almost in direct proportion to the amount of epithelial hyperplasia in the primary tumor. We find, therefore, that the fibrous type of the fibro-epithelial tumors becomes malignant in a relatively small per cent.; and that the tumor formations with active proliferation in the ducts and acini undergo malignant change in as high as 24 per cent. of the cases. In other words, the adenofibromata rarely degenerate, whereas the cystadenomata and the cases of abnormal involution frequently become malignant.

It is to be expected, therefore, that tumors of the male breast should undergo similar degenerative changes, although the relative proportion should be less as the factors conducive to epithelial hyperplasia are not so active in the male. Carcinomatous formation in a pre-existing fibro-adenoma has been reported by Owens and Eisendrath.

The patient, aged fifty-six, noticed a slight depression of the nipple and a nodule, the size of a pea, in the right breast. The condition remained unchanged for 36 years, when a small scab formed on the nipple which would bleed slightly when the scab was removed. The nodule began to enlarge one year ago, and formed a hard tumor one inch in diameter, sharply circumscribed from the surrounding skin. The overlying skin was atrophic, bluish in color, and immovable. The microscopic examination. after extirpation of the tumor, showed a scirrhous carcinoma, which undoubtedly arose in the benign tumor described.

What relationship exists between adolescent mastitis and adenofibroma is not clear, although Woodyatt suggests that the former is a separate affection, as a sequel to which the adenofibroma may develop, for many of the cases of sharply circumscribed adenofibroma in youth have developed in the course of what appeared to be "adolescent mastitis." The

following case which I observed for a period of three months seems to bear out this theory:

The patient, aged twelve, complained of pain and burning in the right breast, which, when examined, was slightly larger than the opposite one. The skin was red, but other evidences of inflammation were absent. The pain and swelling subsided under local treatment and the boy was discharged. He returned two months later, complaining of a lump in the breast, which, he said, was noticed several weeks after treatment was discontinued. The tumor was the size of a pea, hard, freely movable, tender on pressure, and situated below and to the outer side of the nipple. The growth was excised under local anæsthesia. The microscopic examination disclosed a fibro-epithelial tumor, in which the periductal fibrous tissue predominated. The ducts and acini were relatively few in number, and were lined with several layers of cuboidal epithelium. In a few acini more active hyperplasia caused the formation of solid plugs of cells, which were, however, non-invasive in character. Diagnosis: fibro-adenoma.

The above case illustrates the type of tumor occurring in Group I, and the following instance may be taken as an example of Group II:

Male (service of Dr. John B. Deaver, German Hospital), aged sixty-eight, noted a lump three months ago in the left breast. Little attention was paid to it until two months later, when it became slightly painful and enlarged progressively. The mass was situated under the nipple, and felt as large as a goose egg, but was not tender. No enlargement of axillary lymph-nodes was noted. The growth was excised. It was made up of fairly dense white tissue, which was not encapsulated as is the ordinary fibro-adenoma. Microscopically, a fibro-epithelial process was seen. The periductal tissue showed proliferation, was fairly cellular and contained many round cells. The acini were more numerous than normal, the lining cells were cylindrical and occurred in several layers. The degree of epithelial proliferation was excessive, but the cells did not extend into the periductal tissue. Slight dilatation of the ducts was seen, and in some of

the cystic cavities, small papillæ were present. Diagnosis: adeno-fibroma.

The cystadenomata of the breast are not so common as the fibro-adenomata, although a number of cases have been recorded in the more recent literature. The line of demarcation between the cyst- and fibro-adenomata is not sharp in all cases, indeed it is contended by some that there are transition stages of one to the other. From the pathologic standpoint, however, it is of importance to make this distinction because the cystadenomata are more likely to carcinomatous degeneration, and from the clinical point of view they differ from the fibro-adenomata when cyst formation is prominent. The tumors are usually small and well circumscribed, but may become as large as an orange when cyst formation is extensive. The case recorded by Worbs caused considerable inconvenience on account of its large size, and for this symptom alone surgical intervention may be sought. The tumors are seen usually in men of advanced years, most of the cases occurring between the forty-fifth and sixtieth years of life, whereas the fibro-adenomata are frequent in youth. In Spencer's case the tumor was present since birth, enlarged rapidly when the boy was four years of age, and reached the size of an egg within three weeks. The breast when removed contained multiple cysts, the contents of which were bloody.

The cysts give to the tumors a definite fluctuation in some cases, and the fluid may be bloody, clear, or dark brown. Milky fluid was observed in a cyst occurring in a child eighteen months of age (Carpenter). The tumor was treated by aspiration, so that its true nature was not ascertained. In many instances papillary excrescences are present in the cysts, and these cases should be classified as papillary cystadenomata.

The following case represents an example of cystadenoma, the differentiation from fibro-adenoma being impossible clinically, as cyst formation was inconspicuous.

The patient, aged twenty-seven, noticed eight years ago a very small painless lump under the left nipple. It remained stationary until last year, when rapid enlargement took place. The patient attributes the growth to traumatism caused by boxing. The tumor, at the time of operation, which was performed by Dr. H. T. Harvey, was the size of a hen's egg, firm, movable, with skin and nipple appearing normal, and on palpation was tender. The mass, when removed, was firm in consistency, white in color and contained small cysts scattered through the tissue. The cyst walls were smooth. Microscopic examination showed a dense fibrous stroma in which a few ducts and a large number of regular acini appeared. The epithelial cells were increased in number, forming a lining composed of several layers of cuboidal cells which were greatly compressed in the dilated acini. The cyst formation was seen in both the ducts and acini, and in many of the latter, minute papillæ projected into the lumen of the dilated spaces. Diagnosis: cystadenoma.

Cystadenomata may also undergo malignant degeneration as demonstrated by Peachell's report:

The man, fifty-eight years of age, had an abnormal development of both breasts, and in the left one, a tumor which began two years ago. The growth was small, irregular, soft, non-adherent to the skin or underlying tissues, and discharged a bloody fluid from the nipple. It was diagnosed a duct papilloma. A year later the growth presented a greatly altered picture: it was hard in consistency, adherent to the skin and pectoral fascia. The bloody discharge continued from the nipple, which became retracted. The breast was removed and the tumor found to be a scirrhus. The patient died of an intercurrent disease nine months later without recurrence or metastasis of the cancer.

CONCLUSIONS.

1. Carcinoma is the most frequent tumor of the male breast.

2. The disease is seen later in life, grows slower, ulceration is more common, and traumatism plays a more important rôle than in women.

3. The operative mortality is *nil;* but the percentage of cures is probably much lower than in the female.

4. Benign tumors are subject to the same malignant degenerations, as are similar tumors in the female.

5. Adenofibroma is the most frequent type of benign tumor encountered, although all varieties have been met with.

6. Adenofibroma in young men may be produced by the affection termed "adolescent mastitis."

The author desires to express his thanks to Dr. John B. Deaver, Dr. Charles H. Frazier, Dr. E. B. Hodge, and Dr. H. T. Harvey, for permission to report the cases mentioned.

BIBLIOGRAPHY.

Williams: Lancet, 1889, Sept. 10, p. 261.
Schuchardt: Arch. f. klin. Chir., 1885, vol. xxxi, p. 1, vol. xxxii, p. 277.
Warfield: Bull. Johns Hopkins Hosp., 1901, vol. xii, p. 305.
Finsterer: Deut. Zeit. f. Chir., 1906, vol. lxxxiv, p. 201.
Keyser: Lancet, 1904, May 28, p. 1403.
Manger: Inaug. Dis., Jena, 1901.
Blodgett: Boston Med. and Surg. Jour., 1897, vol. cxxxvi, p. 611.
Moore: Austral. Med. Jour., 1895, Nov. 20, p. 464.
Coley: Annals of Surgery, 1900, vol. xxxi, p. 741.
Lunn: Trans. Path. Soc. London, 1897, vol. xlviii, p. 247.
Dietrich: Deut. Zeit. f. Chir., 1892, vol. xxxiii, p. 471.
Gangitano: Deut. Zeit. f. Chir., 1909, vol. ciii, p. 1.
Hansy: Wiener med. Woch., 1899, vol. xlix, p. 302.
McConnell: Journal of Medical Research, February, 1910.
Connell: Surg., Gyn. and Obstet., 1907, vol. iv, p. 13.
Queirel: Theses de Paris, 1897–1898, cit. Riberandi.
Masse: Theses de Paris, 1897–1898, cit. Riberandi.
Woodyatt: American Jour. Med. Sc., 1909, vol. cxxxviii, p. 244.
Whelan: Brit. Med. Jour., 1909, Apr. 24, p. 1006.
Griffin: Johns Hopkins Hosp. Bull., 1909, July, p. 218.
Denenholtz: N. Y. Med. Jour., 1909, Sept. 18, p. 548.
Owens and Eisendrath: Chicago Med. Recorder, 1898, vol. xv, p. 149.
Worbs: Inaug. Dis., Bonn, 1902.
Spencer: Westminster Hosp. Reports, 1895, Nos. 91–92.
Carpenter: Reports Soc. Study Diseases Children, 1906, vol. vi, p. 162.
Peachell: Lancet, 1906, Dec. 15, p. 1660.

Dr. John H. Gibbon said that during the last ten years he had operated upon four cases of tumor in the male, a comparatively rare disease, and as these four cases present a variety of tumors he detailed their histories, as follows:

In 1903 at the Pennsylvania Hospital he had a patient, a man 21 years of age, a shoemaker, who said that in his work he was accustomed to putting the leather against his chest and cutting it. This man had had a tumor for one month, hard, and with glandular involvement in the axilla. The growth appeared at the time of operation to be malignant, and he therefore removed the breast, the pectoral fascia, and glands of the neck, but not the muscles. The pathological report was adenofibroma. The axillary glands were inflammatory.

In 1910, at the Jefferson Hospital, he operated upon an elderly man who had had a tumor for seven or eight years, undoubtedly carcinoma, and it was so reported by the laboratory. The growth had ulcerated and involved the nipple and an area around it. He made a complete excision and used the X-ray afterward.

In May, 1911, he had another patient, a man 66 years of age, who had a large tumor of the breast, movable, ulcerated, which had existed for a number of years and had been treated in London by a quack with caustic. This proved to be a spindle-celled sarcoma. This man had a number of tumors over the body, which appeared to be lipomata, and it was thought that this tumor of the breast might have begun as a lipoma and undergone that rare change to sarcoma as a result of the irritation of the treatment received, but Dr. Longcope, who examined the specimen, did not agree in this, thinking the growth had begun as a sarcoma.

Dr. Gibbon had another case in an adult, a physician 73 years of age, who had a hard tumor in the left breast which was quite pendulous, the tissues being very flabby; he was quite sure it was a malignant growth, though there was no glandular involvement. The man suffered at the time from a very bad cardiac disease, from which he died suddenly a few years later. He had had a number of attacks, and Dr. Stengel advised against the use of a general anæsthetic, and therefore the breast was removed under infiltration anæsthesia. The growth proved to be a fibro-adenoma of the diffuse type. There was no recurrence. He had operated on one case of tuberculosis in the breast in the male, the patient being admitted to the Jefferson Hospital with this diagnosis. The breast was amputated. This man had previously had both testicles removed for tuberculosis.

Dr. Edward B. Hodge said the case of his mentioned by Dr. Speese was the only one he had operated on. It was in-

teresting from several standpoints, one of which was the previous history of mastitis. This had been entirely forgotten by the patient. He had had several definite attacks of inflammation of the gland with discharge from the nipple, beginning at 15 years of age and reappearing at varying periods. He was 55 years of age when seen by Dr. Hodge. He had also been impressed by the great difficulty of covering in the space left after doing a complete operation on men because of the lack of adipose tissue over the breast.

Dr. William L. Rodman agreed as to the rarity of benign neoplasms in the male breast. He had seen but two such cases, one of rather extensive fibro-adenoma, in a man about 35 years of age, which proved benign in character; another in a young boy who had been struck in the left breast with a base-ball. This patient was about twelve years of age and the appearance of the breast, especially the enlarged veins, was quite suggestive of sarcoma. A clinical diagnosis of probable sarcoma had been made, but after removal it turned out to be inflammatory. He had never seen a sarcoma in the male breast. He had, however, seen nine cases of carcinoma in the male breast, three of these in negroes. The first case he ever saw was at the Jefferson Hospital in 1879 or 1880 in a negro. The point he wished to emphasize—one which had already been mentioned by Dr. Speese—is that the time at which carcinoma in the male breast appears is considerably later than in the female. Furthermore, he thought that trauma as an etiological factor is far more important in cancer of the male than it is in cancer of the female breast. In two of his cases seemingly a direct connection between trauma and the growth appeared certain. One was a shoemaker who was in the habit of resting his last against the left breast; the other was in a laborer who in using the shovel was in the habit of resting it on the breast in his work. Operations for cancer in the male breast should give a better result than similar conditions in the female.

SUTURE OF FRACTURE OF BOTH PATELLÆ, UNDER INFILTRATION ANÆSTHESIA.

Dr. Charles F. Nassau reported the history of a man, aged 65 years, who, on October 3, 1911, slipped on a muddy street and fell, sustaining transverse fractures of both patellæ. He

was a man with advanced arteriosclerosis, and he had been for some time under the care of Dr. George DeSchweinitz who was treating him for a grave eye condition. The patient's blood-pressure was very high and he had albumin in his urine. He was an extremely intelligent man who readily grasped the danger of a general anæsthetic. His consent and co-operation were obtained to operate under infiltration anæsthesia.

Operation was on October 9, 1911: The infiltrating solution was made by dissolving one tablet in 50 c.c., and one tablet in 100 c.c. of normal salt solution. Each tablet contained cocaine, gr. ¾, adrenalin, gr. 1/400.

A skin flap was raised in exposing each patella. The right patella was drilled and sutured with very heavy silver wire. On the left side a heavy braided silk suture was placed around the fragments without drilling. Both wounds closed without drain. Silver leaf dressing.

The post-operative course was uneventful. Healing perfect. At this date, 12 weeks after operation, the patient writes that he can walk 8 to 10 blocks daily without pain or fatigue. There is a full range of motion in both knees.

Dr. John H. Jopson said that while he had not wired any patellæ under local anæsthesia, yet in one patient he sutured the quadriceps tendon to the patella, it having been torn from the bone. This old lady had advanced cardiac disease, she could not lie down, and suffered from more or less continuous dyspnœa, so that he did not dare give a general anæsthetic and used local anæsthesia, opening the joint during the operation practically as freely and widely as did Dr. Nassau. The patient made a rapid and complete recovery, however, without any infection of the wound.

Dr. George G. Ross said that local anæsthesia is a method often condemned because the man who is using it does not know how to use it correctly. He had used it in many instances, such as in the removal of bunions, whitlows, and minor surgery, with satisfactory results except in two instances. One of these was a healthy young woman with a lipoma of the shoulder; she was very much afraid of ether and he consented to operate under a local anæsthetic. She had a violent convulsion. Another case was a man 58 years of age with a large bunion. He injected the area with a 1 per cent. solution of cocaine, using, he should estimate, between 25 and 30 drops by the infiltration method.

The man inside of two minutes had a violent convulsion. He finally made a good recovery though he was mentally disturbed for twenty-four hours. In these two cases the results might have been due either to the strength of the solution or to the idiosyncrasy of the patients.

The speaker had had experience with quinine solution in six cases. One was an amputation of the toe, the other five were circumcisions. He concluded not to try it again owing to the extremely bad results obtained; the wounds sloughed over a long period of time and behaved very badly.

Dr. Charles F. Nassau (in closing) said that one should avoid the use of strong solutions of cocaine. A 1 per cent. solution of cocaine is strong enough under any circumstances. Too strong solutions, and also the use of tablets picked up indiscriminately from a table in the operating room which may have been handled by nurses, are more often the sources of infection than any inherent qualities in the tablets. The tablets he used are sterilized in little vials by dry heat, and he had never seen any wound where he had used them become infected.

OPERATION FOR ANEURISMAL VARIX OF THE POPLITEAL VESSELS.

BY JOHN CHALMERS DA COSTA, M.D.,

OF PHILADELPHIA.

Gross Professor of Surgery in Jefferson Medical College of Philadelphia.

Longitudinal incision of the popliteal vein. Suture of the opening into the artery from within the vein. Transverse division of the vein on each side of the opening with utilization of the isolated portion of the vein wall for a superimposed flap which was laid over the line of sutures in the artery. End-to-end union of the divided vein.

History.—Miss J., aged twenty-nine, white, native of New Jersey, was admitted to the Jefferson Hospital October 17, 1910. The previous July (something over three months before admission) the patient was accidentally shot. The weapon was a parlor rifle. The bullet, which was a No. 22 calibre, entered about the centre of the left popliteal space posteriorly and emerged anteriorly after passing through the head of the tibia. The knee-joint was not opened. The hemorrhage was moderately severe for a short time but soon ceased. The wound was dressed antiseptically and healed in a few days. A few hours after the accident the patient became conscious of a peculiar and annoying sensation in the popliteal space, which sensation has been continuously present ever since and has undergone a gradual increase. She describes it as a vibration or thrill that is like "feeling a roar." The thrill is and has been accompanied by marked pulsation, and both pulsation and thrill are growing more distinct every week. The patient has had no pain, although the leg has been and is weak. She has been wearing a rubber stocking because of swelling.

Examination on Entrance.—A small, depressed, white, irregularly circular scar is visible in the middle of the left popliteal space. A large and rather irregular cicatrix is noted below and to the outer side of the patella.

The leg and foot are a little swollen, somewhat œdematous, and decidedly pale when compared with the same parts of the

opposite extremity. The pulsation in the dorsalis pedis and the posterior tibial is very much weaker than in the corresponding vessels of the opposite side. The patient complains that the foot feels cold and it is distinctly colder to the examiner's touch than is the other foot.

The superficial veins of the leg and thigh are much enlarged and are tortuous but do not pulsate. The blood in the superficial veins flows in the normal direction. When the fingers are placed upon the surface over the popliteal space, a very distinct thrill is experienced. It is continuous and is characteristically the "purring thrill" described by Professor Matas and others. This thrill extends over an area from several inches above to several inches below the popliteal space, but is most marked over the middle of the space. It is most distinct at each cardiac systole. A murmur is heard on listening through a stethoscope. From the popliteal vessels a loud and continuous buzzing or purring murmur is heard, and this murmur becomes temporarily louder at each cardiac systole, that is to say, with each accentuation of the thrill. The stethoscope enables us to hear this murmur for several inches above the popliteal space and as low down as the ankle, but it is most marked over the popliteal vessels. When the thigh is raised to a vertical position, the thrill and murmur cease to be continuous and become appreciable only during cardiac systole. This observation accords with the observation made by Nélaton upon a case many years ago. Compression of the femoral artery in the thigh at once completely abolishes both thrill and murmur. There are no signs of trophic disturbance in the leg. The patient complains somewhat of aching, episodes of burning, and sensations of cold in the leg, and she walks stiffly and with difficulty. The pulse-rate is 70. Her general condition is excellent, and she is positive that the thrill is growing progressively worse. The condition is clearly one of arteriovenous aneurism.

[*Note to History.*—It is well known that a small percentage of cases of arteriovenous aneurism tend to spontaneous cure, but this event is too rare to be anticipated in any case, and it certainly is not to be anticipated when the signs of aneurism are growing worse instead of better. It is well recognized that many cases of arteriovenous aneurism last for years without causing

grave danger or even serious annoyance. This statement, however, applies to the trouble when it arises in the neck and upper extremities, and is not accurate when we are speaking of the lower extremities.

In a lower extremity the lessening in the amount of arterial blood distributed to the parts below the aneurism and the increased impediment to the venous return produce sooner or later serious or even grave trouble from failing nutrition of the parts, and difficulties born of venous engorgement are almost certain to arise.

In view of the fact that in this patient an insufficient amount of arterial blood is being distributed to the periphery, that the veins are much engorged, and that the condition is not improving but is growing distinctly worse, it seems advisable to recommend an operation.]

Operation (October 22, 1910).—Five days after her admission and with the valued aid of my friend and colleague, Professor Francis D. Stewart, I operated upon Miss J. My intention was to open the vein by a longitudinal incision, suture the opening into the artery through the open vein, and then close the opening in the vein wall, but I was obliged to modify this play by the developments during the operation. After etherization and with the patient supine, an Esmarch bandage was applied from the root of the toes to below the knee, at which point the band was applied and the bandage removed. After the extremity had been held for a time in a vertical position an Esmarch bandage was applied from above the knee well up upon the thigh, at which point the band was put in place and the bandage removed. The patient was then placed prone.

A longitudinal incision about six inches in length was made over the left popliteal space, and the vessels and the nerve were dissected free from the surrounding structures from above downward to the centre of the space. It was found that the vein and artery were directly fused somewhat below the centre of the space. There was no intervening sac. The artery distal to the point of fusion was small, but proximal to the same point was much dilated though not saccular. The vein distal to the point of fusion was very much dilated and much thickened. How far this thickening and dilatation extended could not be deter-

mined. The vein above the point of fusion was also enlarged and thickened. A longitudinal incision was made on the outer side of the vein, the opening into the artery found and sutured. The suturing was effected by means of interrupted sutures of No. 0 iodized catgut passed vertically and like Lembert sutures. The longitudinal incision in the vein and the sutures passed about the opening in the artery are shown in Fig. 1.

On tying the sutures, it was found that so much of the vein wall had been drawn in by the stitches that the calibre of the vein was greatly lessened (Fig. 2). It was considered useless to attempt restoration of the vein by the method we had at first contemplated, therefore the vein was divided transversely on each side of the point of fusion to the artery, and this portion of vein wall was used as a flap and superimposed over the suture line in the artery and was sewed to the artery by catgut stitches (Figs. 3 and 4). Thus we used a flap of vein to strengthen the sutured artery at that point. The flap was about one inch in length. The two ends of the vein were then brought together. As the lower end of the vein was the larger, the upper end was invaginated into the lower end and fixed there by four catgut sutures. The junction was re-enforced by a few catgut sutures passed through the external coat of the vein at the line of junction. The tourniquets were removed and the blood jumped into both vessels. The blood in the vein was moving toward the body. The artery pulsated strongly and there was not a bit of leakage. Bleeding vessels in the popliteal space were caught and tied. The wound was closed by silkworm gut sutures and no drainage was employed. The knee was placed in a position of semi-flexion over pillows.

The patient made an uninterrupted recovery. A week after the operation the stitches were removed, and day by day the leg was straightened out a little. For a couple of weeks the leg swelled a little but never notably.

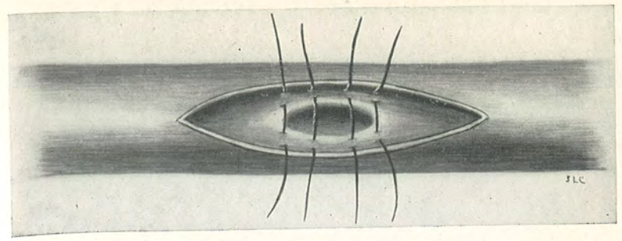
November 16: She was gotten up on crutches (a little over three weeks after operation).

November 24: She began to bear weight on the leg, still using crutches.

November 28: She left the hospital still using crutches as an aid.

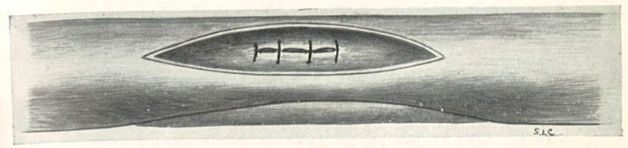
A month after this she put aside the crutches and walked

FIG. 1.



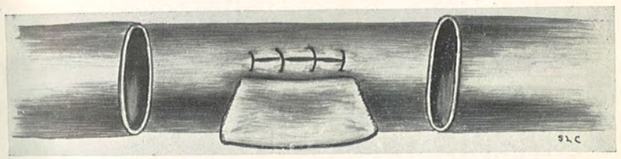
Longitudinal incision in the vein, and sutures passed through the margins of the arterial opening.

FIG. 2.



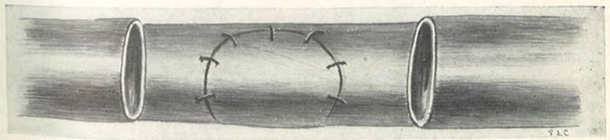
Sutures tied. Calibre of the vein greatly lessened by doing so (the diminution in calibre was more decided than is shown by the diagram).

FIG. 3.



Flap of vein left in place after transverse division of the vein at two points (the flap was larger than is shown by the cut).

FIG. 4.



Flap of vein sewed in place upon the artery so as to cover in and reinforce the sutures in the wall of the artery.

naturally. At the present time (October 20, 1911), which is a year and one month after the operation, she is in excellent condition, and walks easily and comfortably. The leg is free from swelling, pallor, and sense of coldness. The pulse in the dorsalis pedis and posterior tibial of the damaged side seems to be as good as the pulse in the corresponding vessels of the sound side. The superficial veins are much smaller though still visible. It would seem that it is justifiable to regard this case as a complete cure.

The interesting points about this case are the following:

1. That the symptoms appeared within a few hours of the accident. We know that symptoms may appear at once or in a very few hours, but as a rule they do not appear until weeks or even months have elapsed.

2. That although this was a gun-shot wound there was no intervening sac between artery and vein. The condition was an aneurismal varix and not a varicose aneurism. Of course a sac may have been present but have shrunken up and disappeared, although the fact that only three months had elapsed between the injury and the operation makes such an event improbable.

3. That it was necessary to destroy the vein in order to suture the artery. Perhaps this destruction could have been obviated if the sutures through the arterial opening had been passed in the direction of the long axis of the artery instead of vertically. In another case I would not pass them vertically, that is, I would not pass them at right angles to the long axis of the artery, but would insert them in the long axis.

4. That the destruction of the vein clinically added to the safety of the arterial suture by allowing the surgeon to reenforce the first suture line.

5. That the end-to-end union of the vein was apparently followed by immediate, complete, and permanent restitution of the blood current.

6. That iodized catgut sutures and intestinal needles were used for the vein and the artery.

Dr. G. G. Davis said that this case was somewhat similar to one which came under his notice not long ago. The patient was a child 7 years of age, who, when about 3 years old was being circumcised. From some movement of the child the knife, which was lying on the abdomen, penetrated the thigh and wounded the femoral artery; a surgeon was called in and he ligated the femoral artery. About four years passed when the case came under his notice; it illustrates very clearly the effect of this condition on the growth of the limb. The size of the limb was very distinctly increased. The evidences of arteriovenous connection were very apparent; one could get the thrill and murmur and could see the pulsation approximately at the apex of Scarpa's triangle. The child is active, running about, but has a marked disproportion between the limbs, the injured one being three-quarters inch longer than the other, and one inch greater in circumference, showing the influence of this condition upon the nutrition. One would expect that the nutrition of a part was best carried on by the normal arrangement, but according to this case it would hardly seem so.

Dr. John B. Roberts said that it had long seemed to him that the nomenclature of this condition was bad. We say arteriovenous aneurisms or aneurismal varix and varicose aneurism. Years ago he suggested that it would be much better if they were called arteriovenous fistulæ. Simple arteriovenous fistula and sacculated arteriovenous fistula were the names which he then suggested. There is a similarity to aneurism, but that term should be restricted to a tumor made up of coats of an artery.

STATED MEETING, HELD FEBRUARY 5, 1912

The President Dr. Gwilym G. Davis, in the Chair.

ARTHROTOMY FOR ELBOW LUXATION.

Dr. Edward B. Hodge exhibited a patient to show the result one year after arthrotomy for postero-external luxation of the elbow.

Male, 49 years of age, switchman, had his right arm amputated at the wrist following a crush 14 years ago. Six weeks before his admission to the Presbyterian Hospital, March 8, 1911, he fell from a freight car upon his left arm, injuring the elbow. There was swelling and disability. As the swelling lessened, he became able to use the arm, except bending the elbow. When admitted to hospital, the left elbow showed nearly full extension, flexion limited to 160 degrees. The olecranon was out of line with the condyles and to the outer side as well as posterior. The head of the radius rotated behind and below the external condyle. The X-ray confirmed the clinical diagnosis of postero-external luxation. It also showed several loose pieces of bone, chiefly in the region of the external condyle.

On March 10, under ether, several attempts at reduction failed. An external incision was then made, extending from above the external condyle down on the forearm. The muscles were separated from the region of the external condyle, and on retraction toward the median line a good exposure was obtained. The head of the radius, well posterior and behind the external condyle, showed a crack extending one inch down the shaft. A loose piece from the external condyle was removed. After much difficulty the bones were replaced, using the handle of an instrument as a lever. Muscles and ligaments were held in as nearly normal position as possible by chromic gut sutures. A cigarette drain was placed to the capsule, the skin closed with silkworm gut, and the arm dressed in acute flexion.

Convalescence was uneventful except for some numbness and tingling in the ulnar distribution. This is still present in

slight degree. There was discharge of synovial fluid for 10 days, but no infection. Passive motion was begun early, and on discharge one month after operation the patient had at least 75 degrees of motion and could easily touch the back of his head with the palm of his hand.

The reporter emphasized the excellent exposure obtained by the external incision in dislocations of this type.

RESULTS IN THE TREATMENT OF FRACTURES OF THE FOREARM WITHOUT OPERATION.

Dr. Astley P. C. Ashhurst presented a paper in which were detailed the results obtained by treatment without operation in 52 cases of fracture of the forearm.

By error this paper was bound up in Volume XIV of the Transactions of the Philadelphia Academy of Surgery (1911–1912, pp. 32–33.)

FRACTURE OF THE RADIUS ABOVE THE ATTACHMENT OF THE PRONATOR QUADRATUS MUSCLE.

BY EMORY G. ALEXANDER, M.D.,

OF PHILADELPHIA

Demonstrator of Fracture Dressings, Jefferson Medical College and Woman's Medica College; Assistant Surgeon, Kensington Hospital for Women; Surgeon to Out-Patient Department, Episcopal Hospital, and Children's Hospital, Mary J. Drexel Home.

In reviewing the writings of the old surgeons, one is filled with admiration for their great work in the treatment of fractures. Their knowledge of the causes, deformities, action of muscles, manner of reduction and keeping reduced was truly remarkable. If these men could have had that valuable aid, the X-ray, in studying and treating their fractures, I am sure they would have handed down to the surgeons of to-day methods far in advance of those now in vogue.

In presenting this paper with accompanying X-ray plates, I hope to show that good approximation can often be obtained, if one will but persist and not be too hasty to resort to operative measures.

The following case is a fairly typical one of a fracture in this region. The patient was admitted to the Episcopal Hospital, to the service of Dr. H. C. Deaver, to whom I am indebted for the privilege of treating and reporting the case.

Case I.—W. D., male, aged forty-one years. Ten days before admission, while at work, patient fell eight feet and as the result of direct force sustained a comminuted fracture of the radius above the attachment of the pronator quadratus muscle.

The attending physician, failing to get good approximation of the fragments, referred the case to the Episcopal Hospital for an operation.

The first X-ray showed the upper fragment abducted and

rotated outward and the lower fragment strongly pulled over toward the ulna.

The patient had been under the care of a very skilful physician, who had first treated the fracture in the usual semipronated position, with long palmar and short dorsal splints, and later on a Bond splint, without gaining a good approximation of the fragments.

We had made an internal angular splint (Fig. 1), somewhat pistol shaped at the wrist, so as to strongly adduct the hand, hoping through the action of the external lateral ligament, and possibly the cartilage and the carpal bones, to pull or force the lower fragment in position.

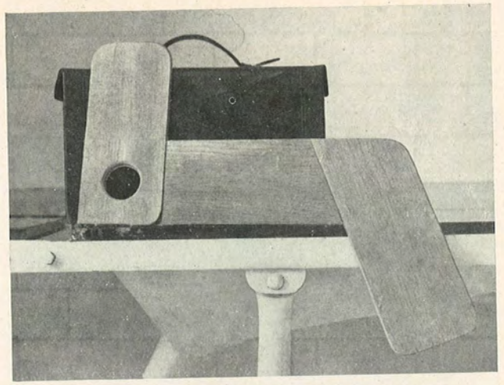
The X-ray of the bones in this position showed that our efforts had not been entirely successful (Fig. 2). The failure seemed to be due to the upper fragment, as this was not affected by the position or adduction of the hand. As the lower fragment seemed to occupy almost a normal position, our efforts at reduction were next directed to the upper fragment.

To overcome its deformity, the arm was placed on an anterior angular splint, likewise pistol shaped at the wrist (Fig. 3), and as in the previous dressing a short straight splint was applied posteriorly from the elbow to the wrist (Fig. 4). This changed the arm from a semipronated to a supinated position and relaxed the flexors of the forearm, thus producing one of the fundamental principles in the treatment of any fracture, muscular relaxation. It also supinated the lower fragment of the radius, bringing it in apposition to the upper fragment. The X-ray of the fracture in this position showed the bones to be in perfect alignment (Fig. 5). Fig. 6 shows end result.

As some difficulty had been encountered in gaining this approximation, and as the fracture had been frequently disturbed during the ten days prior to admission to the hospital, and as there was no attempt at union, the splints were left on for twelve days. During these twelve days the bandages were frequently removed, without disturbing the splints, which were held in place by adhesive plaster, the soft parts inspected and bathed with alcohol, and gentle passive motion given the fingers.

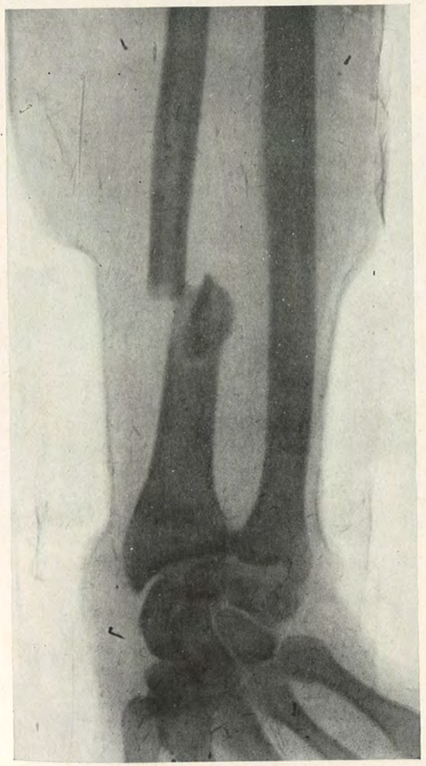
I believe this was unnecessarily long to keep the hand adducted, as a few days in this position would have been sufficient. At the expiration of the twelve days a short straight posterior

FIG. 1.



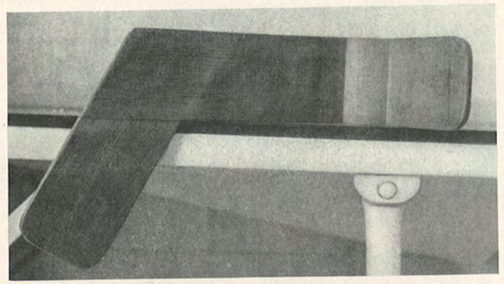
Internal angular splint to secure adduction of hand.

FIG. 2.



Arm on internal angular splint, pistol shaped at wrist; hand strongly adducted; deformity much improved.

FIG. 3.

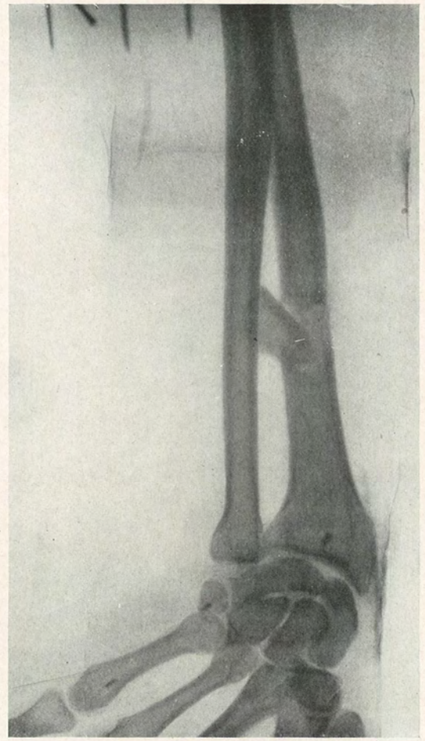


Anterior angular splint to procure adduction of hand.

FIG. 4.

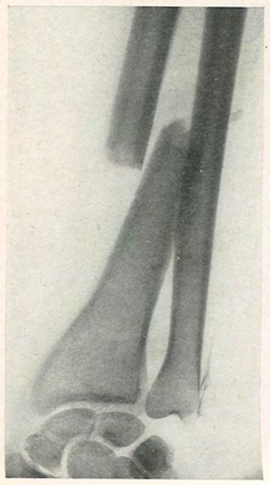
Position of arm as shown in X-ray plate (Fig. 5).

FIG. 5.



Arm on anterior angular splint, pistol shaped at wrist; hand adducted; perfect alignment.

Fig. 7.

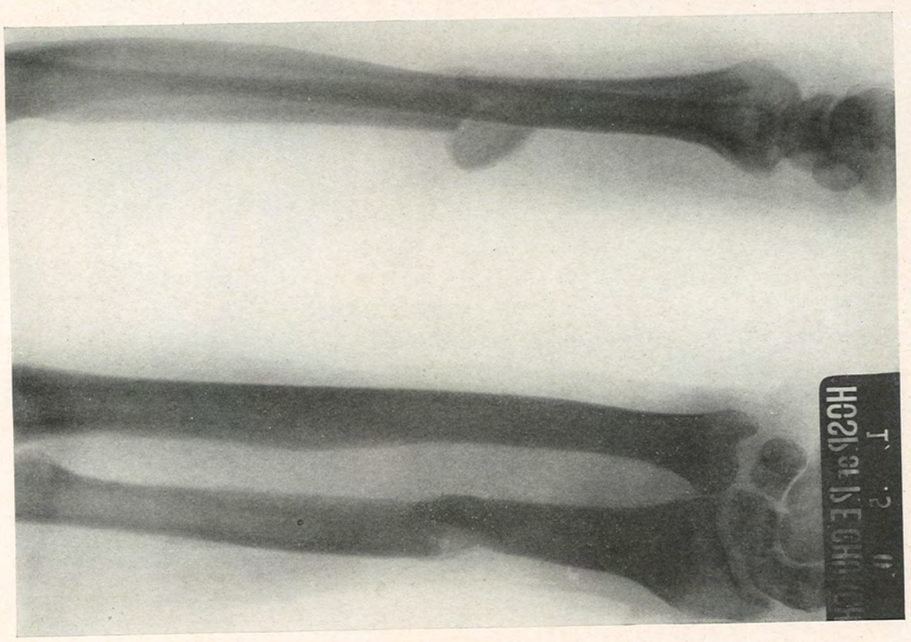


Fracture of radius with typical deformity.

Fig. 8.

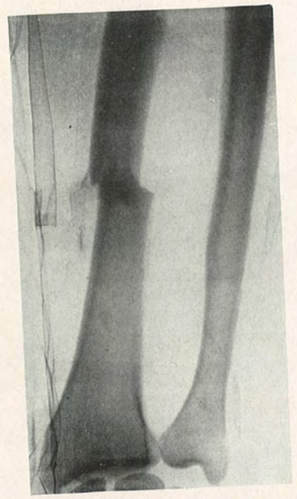
Deformity slightly corrected by interosseous padded splint; intolerable to patient; produced pressure ulceration.

Fig. 6.



End result of Fig. 2.

FIG. 9.



Arm semipronated; hand adducted; upper fragment tilted forward by action of biceps.

splint, combined with an anterior angular splint, straight at the wrist, was applied. This latter splint should be substituted as soon as possible, as it places the hand in a more comfortable position and minimizes the chances of a stiff wrist.

The method sometimes used of treating fractures of the forearm in a semi-pronated position with a small interosseous padded splint to force the fragments apart is a dangerous one, as so much force is required that pressure ulceration is apt to occur.

Caswell, in referring to this manner of treatment, says: "If useful, intolerable; if tolerable, useless." [1]

In a previous case (Fig. 7) of fracture of the radius above the pronator quadratus, an interosseous padded splint was used, correcting to a slight degree the deformity (Fig. 8). This treatment was discontinued, as the interosseous splint produced superficial ulceration. Later the arm was placed on an internal angular splint, pistol shaped at the wrist, to strongly adduct the hand (Fig. 9). This position produced almost a perfect approximation, except for the upper fragment, which was tilted forward by the action of the biceps.

In treating this fracture, not only should one try to get perfect alignment, but also, as Lansdale urged, "keep the fragments in their normal position as to their axis." [2]

Nélaton, in speaking of fractures of the lower end of the radius, says that Dupuytren laid great stress on the importance of overcoming radial displacement of the lower fragment. He used palmar and dorsal splints, as for fracture of both bones, and after they were applied added along the ulnar border of the forearm and hand an iron band, bent on the flat at the wrist, so as to draw the hand strongly to the ulnar side by means of tension on the external lateral ligament of the wrist.[3]

Amesbury, in speaking of fractures of the base of the radius, says not to allow the splint along the ulnar border to extend lower than the wrist. He says: "The hand should be suffered to drop as low as possible before it is confined to the

flat part of the back of the splint." "If the hand be confined down in this way it will act as a lever upon the carpal portion of the radius and tend to raise it." [4]

Lansdale, after describing Dupuytren's splint to secure adduction of the hand in fractures of the lower part of the shaft of the radius, says: "When the position of extreme supination is employed, neither the radial nor the ulnar splint is necessary, for then the portions of bone have not the same disposition to fall toward the ulna." [5]

According to Packard, Nélaton's dorsal splint for securing adduction of the hand was originally described by Goyrand in 1836.[6]

I wish to thank the radiographers of the Episcopal Hospital, Dr. T. S. Stewart and his assistant, Dr. A. R. Wilkinson, for the many excellent X-rays of these fractures.

REFERENCES.

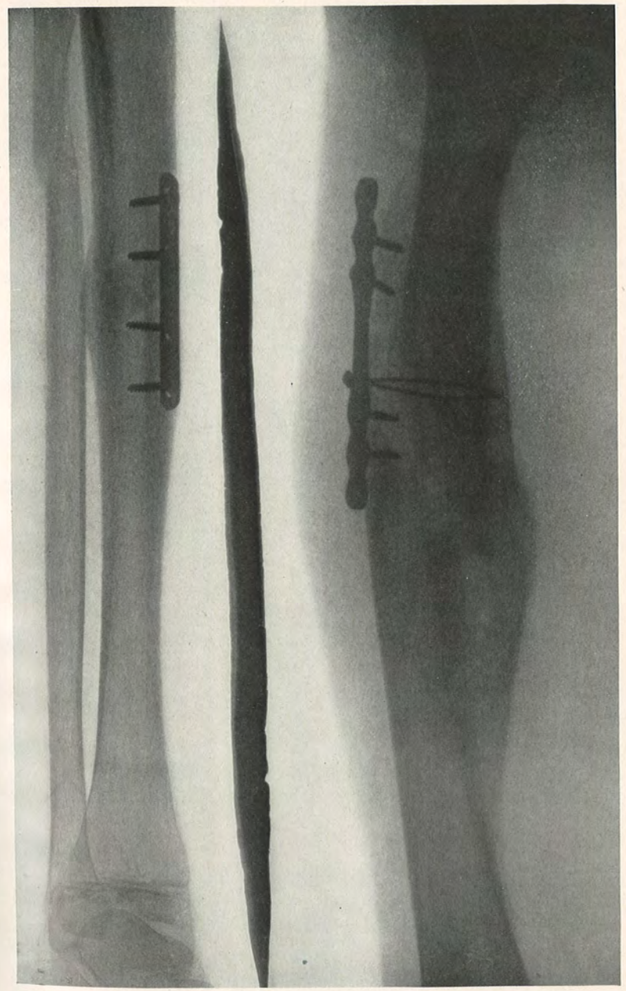
[1] Caswell: Holmes's System of Surgery, Am. Ed., vol. i, p. 861, as quoted by Packard.
[2] Packard: Ashhurst's International Encyclopædia of Surgery, vol. iv, page 164.
[3] Nélaton: Pathologie Chirurgicale, Paris, 1844, vol. i, page 745.
[4] Amesbury: Practical Remarks on the Nature and Treatment of Fractures, London, 1831, vol. ii, page 604.
[5] Lansdale: Practical Treatise on Fractures, London, 1838, page 148.
[6] Packard: Ashhurst's International Encyclopædia of Surgery, vol. iv, 1884.

OPEN OPERATION AND PLATING OF THE TIBIA AND FEMUR FOR RECENT FRACTURES IN A BOY OF TWELVE YEARS.

Dr. John H. Jopson reported the following case:

J. H., aged 12 years, was admitted to the Presbyterian Hospital November 6, 1911, with a history of having been run over by an automobile. Examination showed a compound fracture of the middle third of the right tibia, simple fracture of the right fibula, and a simple fracture of the middle of the shaft of the left femur. There was lateral displacement of the fragments of the tibia, and an oblique fracture of the femur, with overlapping of the fragments, outward bowing, and 1½ inches shortening. Three days later the right tibia was operated upon before some of the members of the American Congress of Clinical

Fig. 1.



Result after open operation and plating for compound fracture of tibia and fracture of femur in a boy of 12 years.

Surgeons, and a Lane plate used to fix the ends, after perfect approximation had been obtained by extension and manipulation. Superficial drainage was inserted and a plaster cast applied. Manual extension was used with the patient under ether, to overcome the shortening in the left femur, and lateral moulded splints applied in combination with Buck's extension. The operation wound healed without infection and with the fragments of the tibia in perfect position.

In spite of liberal weight extension to the left extremity, angulation and overlapping persisted in the fractured femur, with 1½ inches shortening. Nineteen days after the injury the left thigh was operated upon, when there was a large amount of callus already present surrounding the ends of the bone, and considerable union. The fragments were separated and extension was applied, using Dr. Eldridge L. Eliason's apparatus, which is a modification of that originally suggested by Dr. Edward Martin. In Martin's method strong extension is used to effect reduction, the extension being made directly over the upper end of the lower fragment, using a sterilized canvas band as a retractor. With Dr. Eliason's assistance the shortening due to muscular contraction was overcome, although there was some difficulty in maintaining approximation of the fragments after removal of the retractor, but with patience, satisfactory reduction was effected and a Lane plate applied on the outer side of the bone. The callus was so thick that the screws in the upper part of the plate did not penetrate to the solid bone, and longer screws not being at hand, it was deemed wise to reinforce the plate by passing a stout silver wire around it and the bone. The wire was then twisted and cut off short. The wound was closed with superficial drainage and a plaster cast applied, which included the pelvis.

Severe shock attended the latter stage of the operation, and the patient's condition for a time was very alarming, although hemorrhage had not been free, nor had the operation been unduly prolonged. The boy also developed a severe attack of erythema multiforma during his convalescence.

Primary healing occurred, and ten weeks after the accident the casts were permanently removed and union was firm in both tibia and femur. While the X-ray shows a slight overlapping

in the case of the latter bone, the shortening is almost imperceptible, being less than one-half inch, and the functional result is perfect.

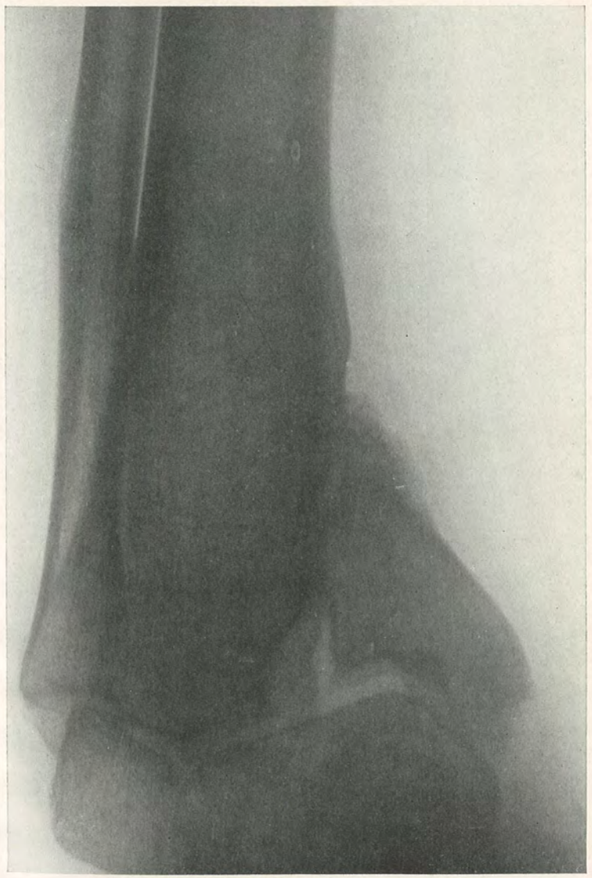
OPEN OPERATION AND PLATING FOR OLD FRACTURE OF BOTH MALLEOLI.

Dr. John H. Jopson reported also the history of a man, aged 28 years, who was admitted to the Presbyterian Hospital December 28, 1911. Six months before he had fallen a distance of 40 feet, catching his left foot between two uprights of an iron fence and fracturing his ankle. He was treated in a hospital in another city and wore a plaster cast for about two months. His ankle was greatly deformed, very painful, and he was unable to walk on it for any length of time, and was debarred from his occupation as a machinist.

An examination showed great inversion of the left foot, amounting to lateral dislocation, with displacement upward of the internal malleolus on the tibia, the external malleolus being turned inward at an acute angle. Flexion and extension were good, but lateral motion was abolished, and pain and disability pronounced (Fig. 2).

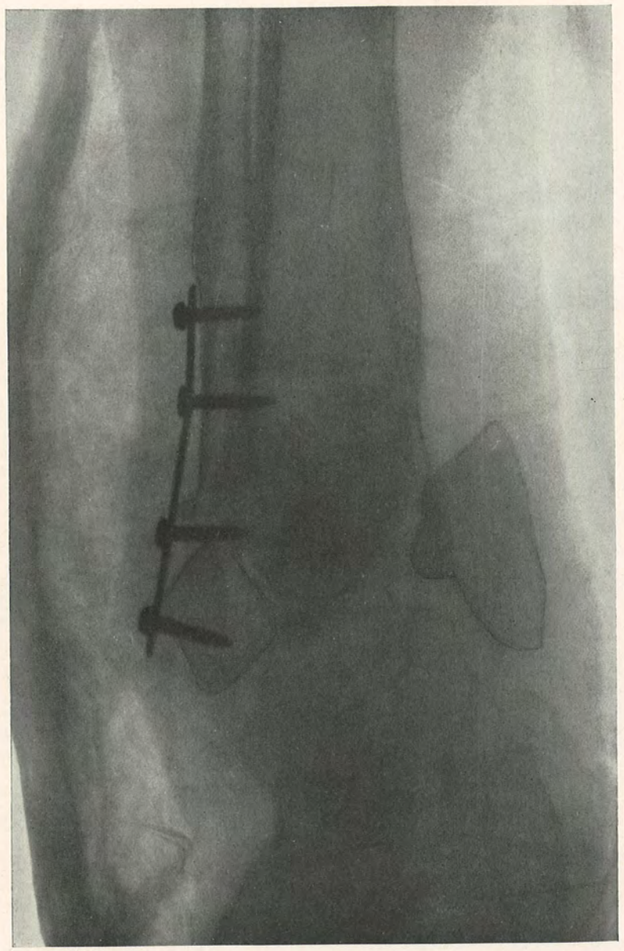
He was operated upon a few days later. An external incision over the fibula and external malleolus exposed the site of fracture, and the bone was divided at this point with an osteotome. A second incision was then made over the internal malleolus and inner surface of the tibia, the site of union between the two being exposed, and the malleolus was separated with an osteotome, following the line of union between the malleolus and shaft of the tibia. Attempts at reduction were made, but were resisted by the shortening of the tissues and upward displacement of the internal malleolus on the inner side of the ankle, and it was found necessary to remove a wedge of bone from the fibula at the site of the first osteotomy, after which the foot was forced outward into good position. A small Lane plate was applied over the point of division of the fibula to maintain correction, the upper edge of the internal malleolus having first been cut off where it was tilted widely from the shaft of the tibia. The limb was put up in a plaster cast. The wounds healed without infection. The cast was removed four weeks after operation, and union of the malleoli was then quite solid, the movements of

Fig. 2.



Fracture of both malleoli and internal dislocation of the ankle.

FIG. 3.



Result of open operation for fracture of both malleoli and internal dislocation of the ankle.

flexion and extension were good, and a new cast was applied and the patient sent home (Fig. 3).

DR. ASTLEY P. C. ASHHURST said, in regard to the method of securing extension in fractures of the femur for reduction of overlapping, he had used extension in the long axis of the leg by a compound pulley with a clove hitch above the knee in only three cases, and believes it is the best method, as one can get all the pull that the rope will stand. With the apparatus he employed a pull of 400 pounds was possible. This method well overcomes the shortening, making the limb longer by actual measurement than the normal, but makes the muscles so tense that one cannot feel the ends of the bones, and so cannot secure end-to-end apposition. In his first case, an ununited comminuted fracture which had been compound, and his second, a recent fracture, he operated, but even under ether and with the bone ends exposed he found extension by this method insufficient to reduce the fragments because the muscles were rendered so tense; but by putting an obstetrical hook over the ends of the fragments and angulating them until the ends met and then straightening them out again, reduction could be obtained without extension. In the third case he succeeded in getting perfect reduction by angulation over his forearm, without operation. They were all transverse fractures and therefore reduction, when once secured, was easier to maintain than is the case in oblique fractures.

DR. G. G. ROSS called attention to the statement Dr. Jopson made about the first case, that in any fracture of the femur in which the position was imperfect, and where he had to reinforce his Lane plate with a wire, he got prompt and satisfactory union, while in the tibia where he had perfect approximation he had delayed union. He had had this same thing happen many times to himself, where too perfect reduction with only a moderate degree of callus would be attended by delayed union.

DR. G. G. DAVIS remarked, as directly bearing on the point raised by Dr. Ross, namely the delayed union in fractures with too perfect reduction and too little callus formation, he had a recent fracture of the femur in which early operative reposition was made. Seven weeks later he cut down to remove the wire, and there was nothing to be seen on the outside of the femur but a sharply defined black line of fracture, not a bit of pro-

visional callus, and union firm, showing that apparently provisional callus is not essential to perfect union.

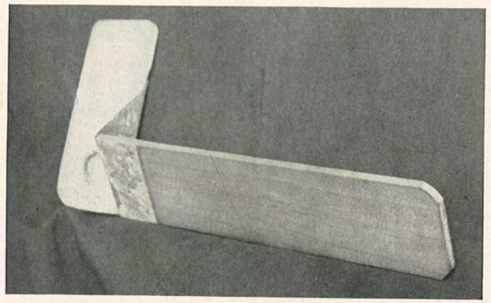
HOUR-GLASS STOMACH WITH PYLORIC STENOSIS.

Dr. John H. Jopson detailed the history of a woman, aged 35 years, who was referred to him by Dr. James E. Talley with a diagnosis of probable gastric ulcer and perigastric adhesions. She gave a history of gastric hemorrhages 15 years before and recurrent gastric symptoms 10 years later. Since that time she had suffered from repeated attacks of the same nature, and had been treated by routine medical measures; she was never entirely free from symptoms between attacks, suffering more or less constantly from pain, indigestion, and gaseous eructations and annoying hiccoughs. She was a semi-invalid, although pursuing by pressure of circumstances her occupation of stenographer.

The stomach contents after test meal showed an excess of hydrochloric acid, but no blood. Physical examination of the abdomen was practically negative, there being no gastric dilatation, no points of tenderness, no unusual muscular rigidity, and no tumor.

At the operation a typical hour-glass contraction of the stomach was found, which was produced by an old thickened ulcer about three-quarters of an inch in diameter, situated at the middle of the lesser curvature, and which had surrounded itself with numerous perigastric adhesions. These adhesions had resulted in a folding upon itself of the anterior stomach wall and an elevation of the same and of the greater curvature, with adhesion to the gastrohepatic omentum. The pyloric pouch was considerably larger than the cardiac pouch. An old smooth scar at the pylorus caused a marked stenosis at this point also. Gastrolysis was performed, careful dissection and division of the perigastric adhesions being sufficient to unfold the stomach until the lumen of the contracted portion was doubled and its patulousness insured. No plastic operation on the stomach wall appeared necessary, and posterior gastro-enterostomy to the pyloric pouch concluded the operation. The gastric symptoms were quickly relieved, and the patient has remained well, two years having now elapsed. She has gained in weight, digestion is good, and beyond an occasional hiccough, which is an ex-

Fig. 4.



Fulton's lateral angular splint.

plosive phenomenon to which she seems peculiarly liable, she exhibits no stomach symptoms.

Dr. William L. Rodman called attention to the unreliability of skiagrams in cases of supposed hour-glass contraction of the stomach. He had known of four or five cases where the skiagram pointed to a well-marked condition of this kind, yet on exploration no approach at hour-glass stomach could be found. He did not know how to explain this, unless it be due to a temporary contraction of the gastric walls, but it is nevertheless a well-attested fact.

A LATERAL ANGULAR ELBOW SPLINT.

Dr. Z. M. K. Fulton presented a new angular splint, saying that in the treatment of fractures of both bones of the forearm some form of angular splint, immobilizing the elbow, is advocated by many surgeons.

The chief objection to the internal angular splint is, that it gives a position of insufficient supination. Fractures, especially above the insertion of the pronator teres, are liable to be followed by incomplete supination when treated in this position. The anterior angular splint has the disadvantage of having to be applied to the rounded belly of the biceps muscle. If not carefully watched it is liable to "creep" downward and produce serious pressure upon the anterior surface of the forearm below the bend of the elbow. This position also is sometimes uncomfortable to the patient.

If a splint could be made to be attached to the inner surface of the arm and elbow, and at the same time retain the forearm in a position of sufficient supination, it would meet some or all of these objections.

The splint which he presented is very easily made by uniting the two parts with a piece of galvanized sheet iron or any other suitable metal, which can be shaped so as to give any degree of supination. A position of supination about midway between those commonly used is the ideal one. It brings the bones of the forearm in exactly the same plane, and each parallel to the surface of the splint. In this position also the greatest muscular relaxation is obtained (Fig. 4).

In actual use he had found this splint to be easily retained in position, very comfortable, and when combined with a short posterior splint, a very efficient dressing.

STATED MEETING, HELD MARCH 4, 1912

The President, Dr. Gwilym G. Davis, in the Chair.

GENERAL INFECTION FOLLOWING ACUTE TONSILLITIS.

BY WILLIAM J. TAYLOR, M.D.,
OF PHILADELPHIA.

It has been my fortune to have seen during the past few years a number of instances of profound constitutional and localized infection following acute tonsillitis. These have covered wide areas in the body and have involved various tissues and organs.

The first was that of a gentleman of forty-six years of age, who had a violent tonsillitis, evidently streptococcic and distinctly not diphtheritic in character, which was followed by arthritis of both elbows. This was presumed to be rheumatic and resulted ultimately in complete ankylosis of both joints.

After various methods of treatment had been tried by his physicians in a neighboring city, including repeated etherization and attempts to secure motion in the joints (fourteen attempts in as many weeks), he was finally referred to me for surgical treatment.

An examination by the X-ray showed complete and firm ankylosis of each elbow and almost total destruction of the joints. The elbows were fixed at such an angle that he was helpless, he could not dress nor feed himself and, what annoyed him almost more than anything else, he could not even use his handkerchief.

I resected his left elbow, removing the disorganized joint and being careful to take away an ample amount from the humerus as well as from the ulna.

The result from a practical stand-point has been most satisfactory in that he has perfect freedom of motion and a thoroughly serviceable arm.

I declined to resect both elbows at that time, preferring to

try what could be accomplished with the left one, leaving to a subsequent occasion operation upon the right.

He has been so much improved in every way and can carry on his business as draughtsman, that nothing further has been attempted.

The second case was that of a small child five years of age, who had an acute tonsillitis, presumably streptococcic, for there was no diphtheria, followed shortly by an epiphysitis of the left femur, and for months she was ill. Finally recovery took place, but with a permanently damaged hip-joint.

The third was that of a lady of twenty-nine years, the mother of three children, who was apparently in perfect health with the exception of a uvula which was somewhat long and annoying. The end of the uvula was clipped off in the office of a throat specialist and by the next day she had an acute tonsillitis followed by very high temperature and evidence of profound constitutional infection. At the end of 48 hours she complained of abdominal pain (she was menstruating at the time) over both ovaries, and this progressed until her symptoms were so urgent that the abdomen was opened by another surgeon. An abscess of the right ovary and tube was discovered with general septic peritonitis.

Death followed in less than a week from the onset of her symptoms and was clearly due to a streptococcic infection with the primary seat of invasion in the tonsil and uvula.

The fourth case was that of a lady of forty, who had an acute tonsillitis directly traceable to an infected telephone through which she had been speaking. Her butler had tonsillitis and used the telephone, then a member of the family developed tonsillitis shortly after speaking through this same telephone, and soon my patient was attacked. All of them were probably streptococcic in origin.

She was a frail and delicate woman and before her throat was entirely well she went to the opera, from which she returned with a chill and very violent headache, and marked increase in her throat discomfort.

A hypodermic injection of morphia was given to her in her left leg by her physician, who used every possible precaution against contamination by the needle. Soon there was another chill followed by fever and a violent cellular inflammation of the whole of the left leg.

When I saw her some days later, she was in a desperate condition. I opened the leg from the knee to the ankle and gave vent to much pus and broken-down fatty tissue. A smear from this pus showed pure streptococci, but a culture taken at the same time could not be depended upon through an unfortunate mishap in the laboratory.

I have never seen an instance of more profound sepsis; her blood was not red but of a chocolate color, and for a long time I feared she could not possibly live. She recovered only after weeks of illness.

I have seen several other instances of general sepsis following acute tonsillitis, but these four cases will amply illustrate the extreme danger which may result from the very common affection, and which I do not think has been fully appreciated by the general practitioner of medicine.

Enlargement of the cervical lymph-nodes following tonsillar infection is of course very common to all of us, and I have purposely not taken up that phase of the subject. Neither have I considered the infection of the mastoid cells and cerebral complications, of which we all see a few instances.

The masterly article by the late Dr. Frederick A. Packard, the Wesley Carpenter lecturer for 1899, "On Infection Through the Tonsil Especially Connected with Acute Articular Rheumatism," has drawn attention to the importance of this subject, and covered very thoroughly the literature up to that time.

Various observers have shown the relation between angina and rheumatism, and have shown that a large number of staphylococci and streptococci are present in the scrapings from the tongue and mouth, as well as many other forms of bacteria. As the tonsil belongs to the lymphadenoid tissue and is covered by plicated and involuted mucous membrane and is a collection of recesses and glands, it can readily be seen how general infection can follow an acute tonsillitis.

The question of absorption through the tonsils of various materials has been carefully studied, and their power of filtering bacteria is found to be somewhat similar to the lymph-nodes, and to this extent they are of great benefit.

We all know that endocarditis is not an unusual result of tonsillitis.

Packard mentions a case (B. Auche, *Annales de la Policlinique de Bordeaux,* 1892) of synovitis of the knee and ankle requiring operation, which was followed later by a pleural effusion, and also two cases of peritonitis occurring in the course of tonsillitis as recorded by Groedel and Froelich.

It has been proposed that in acute articular rheumatism (Vosanyi and Lenare, Sixteenth International Congress) the tonsils be immediately and completely removed, and in certain cases where this has been done, it has been followed by a prompt subsidence of joint symptoms and rapid convalescence of the patient.

This is such a radical procedure that it takes our breath away, and only in view of profound constitutional complications can it be considered.

The tonsils as points of entrance for tubercular infection have been well known for a long time. George B. Wood (*Jour. A. M. A.,* May 6, 1905, p. 1425) has demonstrated that in pigs the course of tuberculosis is through the pharyngeal and tonsillar structure, through the glands in the neck into the thorax, and finally to the lung itself. He proves that the tonsillar tissue is more resistive to the action of the tubercle bacilli than the adjacent lymph-glands.

David J. Davis (*Jour. A. M. A.,* July 2, 1910), in an experimental study of the bacteria isolated from the tonsils, found in nearly every instance a pure growth of *Streptococcus pyogenes* from the crypts, and an intravenous injection in rabbits was followed by acute arthritis in nearly every instance.

In a discussion at the last meeting of the American Surgical Association (*Transactions Amer. Surgical Assoc.,* vol. xxix, p. 148) Dr. Maurice H. Richardson mentions a series of cases of constitutional infection all preceded by a simple tonsillitis. Among these were three cases of fatal peritonitis, a phlegmon of the neck, a phlegmon of the fascia lata and all the muscles, a sepsis around the left hip, and total gangrene of the lower extremity.

Dr. John H. Jopson reported the case of a boy of 18 who during the past winter had been the subject of repeated attacks of acute tonsillitis, two or more of these attacks being succeeded by attacks of pyelitis or, as his physician, Dr. Geisler, diagnosed them, ureteritis. The connection between the two conditions was apparently very definite, and the kidney condition was exceedingly acute and disabling. Finally his tonsils, which were badly infected, were removed by Dr. Stout, and since then he has remained well.

Dr. Walter G. Elmer recalled a case which came under his own care. This was a lady 73 years of age in which the infection travelled from her throat through the Eustachian tube to the middle ear, her temperature reaching 105.5°. This was followed the next day by diffuse abdominal tenderness, marked distention, and marked tenderness over the appendix, so that in a younger subject a diagnosis of acute appendicitis would have been made and operation advised. She being 73, and the fact that the ear was relieved by drainage and the symptoms subsiding, of course operation was not considered. This case, however, shows the similar relationship between throat infection and the abdominal cavity of which Dr. Taylor spoke.

Dr. Charles F. Nassau said that some four weeks after a total hysterectomy, the patient being perfectly well and at her home, she developed an acute tonsillitis. This was treated by a physician who evidently cleaned out some tonsillar crypts. The patient said it had caused her great pain. About 48 hours after that she developed a thrombophlebitis of the right femoral vein and since then she has had a periurethral abscess. At no time was there any trouble with the hysterectomy wound, although that is necessarily under suspicion; but she had been so well prior to her tonsillitis that he could not think her later trouble had anything whatever to do with her abdominal operation, but was a spread of infection from the tonsils.

Dr. John B. Roberts said that he wished that Dr. Taylor's paper could be read by all laryngologists, who are so earnest and anxious to radically remove the tonsils of many children, between five and fifteen years of age. Dr. Taylor says that it was suggested, at the meeting in Budapest, that the tonsils be taken out in cases of acute rheumatism, because of the connection between tonsillar infections and this infection of the joints. His own feeling had been that nature puts the faucial tonsils, the

pharyngeal tonsil, and the lingual tonsil at the opening of the gastro-intestinal canal as a protection against general infections. When infection gets into our mouths the tonsils probably act as a filter plant, in a manner similar to the action of the inguinal and axillary glands, which catch the micro-organisms which come from the lower and upper extremities respectively. Therefore it is a very unwise thing to take out radically either moderately diseased or occasionally diseased tonsils of a child until we have more authoritative knowledge of the functions of these juvenile organs. These cases of Dr. Taylor's show apparently that the first place the infection stopped was at the tonsil. Of course if the infection gets beyond the tonsils, either because the tonsils have been removed or because their filter function is not in good working order, general infection occurs and may show arthritic, abdominal, or other symptoms.

Dr. Roberts related a case in which the tonsils and adenoids in the pharynx were extirpated for a young child, in whom it had been advised that the pharyngeal adenoid tissue be removed, because of earache. To his surprise the operator also removed the slightly enlarged tonsils. A few months later the child died of a very acute cerebrospinal infection, proved by autopsy and monkey inoculation. It is asserted that that disease, the so-called anterior poliomyelitis, comes usually through infection of the pharynx. Does it not seem possible that the acuteness and severity of the general infection in that particular patient were greater because one of the safeguards of the system, the tonsils, had been removed a few weeks prior to the time the bacterial cause of the disease happened to reach the mucous membrane of the child's throat?

Dr. Damon B. Pfeiffer related the history of a medical student who had fractured the external malleolus of the right fibula. While in the hospital he had a severe attack of tonsillitis, bilateral; he previously had had tonsillitis many times when a child, and claimed that the tonsils had been removed by cauterization, but there evidently was some submerged tissue which was not removed. He was given the ordinary treatment, in spite of which a tonsillar abscess formed, which was incised and considerable pus evacuated. He left the hospital in a few days and went home to recuperate. A few days later he noticed blood in the urine, which, upon standing, was sufficient to form a clot in the sedimented portion and he is now suffering from a very severe hemorrhagic nephritis.

OBSERVATIONS ON THE RADICAL CURE OF HERNIA.

BY CHARLES F. NASSAU, M.D.,

OF PHILADELPHIA.

Few subjects are of such perennial interest as hernia. In these days when most surgeons and even the occasional operator feel that they are protected by an indefinite fetish, by some termed aseptic by others antiseptic surgery, many patients are subjected to a so-called radical operation for the cure of hernia. Often operations seem to be performed with the idea that if the wound does not suppurate the hernia will be cured. Fortunately this is true in many cases. To operate upon a condition sometimes maiming but seldom mortal is to me a solemn procedure. How lightheartedly and carelessly many cases of hernia are subjected to operation by men who do not have even a hazy understanding of anatomy many of us know.

It is not the intention of this paper to magnify or to look upon as marvellous a properly performed operation. The mere technical and mechanical considerations entering into the surgical cleanliness and the plastic disposition of the tissues are simple. Like many simple things complications are often made artificially.

We shall confine our remarks to a consideration of inguinal hernia. Of the many operative procedures in vogue previous to the papers by Halsted and by Bassini, radical cure was a dubious outcome. To Halsted more than to any other man, we owe our knowledge of the causes of recurrence. In the exhaustive paper by Bloodgood (vol. vii of *The Johns Hopkins Hospital Report*) can be found the most careful analysis of the causes of failure and reasons for success ever published in any paper on hernia.

As you know, Bassini transplanted the whole spermatic cord so that it made its exit at an outer and higher level, and lay between the internal oblique muscle and the aponeurosis of the external oblique muscle. It is obvious that in direct hernia and in indirect hernia with atrophy of the conjoined tendon Bassini's operation is deficient. In Halsted's early operations he laid special emphasis upon reducing the size of the spermatic cord by excision of most of the veins. The vas deferens with its artery and a few veins was left as a thin structure, and was transplanted into the upper angle of a short incision through the lower border of the internal oblique muscle; one suture was placed above the cord, including in its grasp the aponeurosis of the external oblique muscle and the internal oblique. The next suture was placed below the cord, including the internal and external oblique, a special attempt being made to draw down the internal oblique muscle in such a way that in the continuation of the suturing the so-called new canal was lined by muscle tissue. After the introduction of a single row of deep mattress sutures the thinned spermatic cord lay beneath the skin. This was the fundamental Halsted operation; it has since been much modified. The edge of the internal oblique muscle is no longer cut, and the reason is obvious when one studies the distribution of the nerve supply. As a further advance Halsted has called attention to the fact that if the veins of the cord are excised it must be done only when the vas deferens is not torn from its bed and not transplanted. The utilization of the fibres of the cremaster muscle and the overlapping of the aponeurosis of the external oblique are later developments of Halsted's method.

The operation of Ferguson of Chicago is but a wider application of the principle, that in certain cases it is not wise nor necessary to transplant or even to disturb the spermatic cord.

For the past seven and a half years, except in direct hernias and not always then, we have not transplanted the spermatic cord, unless demonstrating the typical Bassini operation to students.

It will, we think, be granted that the higher the sac is obliterated, the better. In congenital and in sliding hernia of the sigmoid the surgeon is confronted with difficulties. For more than seven years, however, in all ordinary hernias, where there has been a well-defined sac that was not too thick, and when no adhesions were present in the sac or around its internal orifice, the inversion transposition method of Kocher has always been our choice. We have called attention to these few points with a definite purpose. We have now arrived at the point where Bloodgood's transplantation of the rectus muscle can be described, and emphasis placed upon the fact that, of all improvements introduced into the operation for hernia, this, indeed, is the most valuable.

It is true that Wölfler had described a so-called transplantation of the rectus muscle at the same time or perhaps previous to Bloodgood's publication.

Wölfler opens the anterior sheath of the rectus muscle and attempts to pull the side belly of the muscle over to Poupart's ligament, with the hope of course of supplying the deficiency in the conjoined tendon. It is apparent to any one versed in the anatomy of hernia that it would be necessary to drag the muscle over the front of the remaining outer portion of its sheath and over the inner portion of the internal oblique —a process almost impossible without devitalizing tension.

Bloodgood, in his transplantation, utilizes the outer border of the rectus muscle behind the internal oblique and just in front of the peritoneum, or, as a matter of fact, the bladder. In this way the outer edge of the rectus is available for the introduction of sutures, from the point of its insertion below to a point two or three inches above. The strong, thick muscle is easily brought over the site of the direct hernia, and always three and sometimes five interrupted sutures can be used to fasten it along the inner shelf of Poupart's ligament. Any remnants of conjoined tendon can be sutured on the anterior surface of the muscle, and farther out the internal oblique and cremaster muscles can then usually be sutured to the outer half or two-thirds of Poupart's ligament without tension.

The aponeurosis of the external oblique may be closed with a continuous suture, or the aponeurosis may be overlapped by one row of mattress and one row of ordinary interrupted sutures.

Widely divergent methods of skin suture are used according to the fancy of the individual operator.

The Cause of Failure.—Primary healing is an absolute essential in the perfect cure of a hernia, although a slight degree of skin infection may cause no actual harm if the deeper structures are not involved.

We believe, however, that wound infection is probably the most frequent cause of failure. Probably the most frequent cause of wound infection is that type described by Kocher as lesion infection. Given an operating room technic of a perfection that lowers the introduction of organisms into the wound to a harmless minimum, with careful handling of the wound and clean dissection, one attains the ideal result. If, however, fingers are introduced too frequently into the wound, parts are violently retracted and tissues torn apart by rough dissection; if there is carelessness, in hæmostasis, the tissues becoming blood stained; if there is too much tension in the sutures, then we shall have the lesion infection of Kocher and Tavel, and, undoubtedly, contribute in a very marked degree toward unfavorable healing. An extremely common cause of failure is the neglect on the part of the operator to properly appreciate the best way to distribute the structures at his command.

In many individuals the arching fibres of the internal oblique and transversalis muscles are frequently deficient even where the hernia is not of the direct type. In these cases and in all direct hernias Bloodgood's transplantation of the rectus muscle must be performed, not as a matter of choice but as a matter of necessity, if the hernia is to remain cured.

Method of Rectus Transplantation.—After the ligation of the neck of the sac, a small retractor is placed under the remnants of the conjoined tendon, the pull being upward and slightly toward the median line. With the finger-tip or long

dissecting forceps, any anterior bulging of the bladder is prevented, and a longitudinal incision is made along the outer border of the rectus muscle, exposing it to a distance of from two to three inches. A traction suture is then placed so as to grasp a large part of the belly of the muscle so that it can be drawn out from its sheath over toward Poupart's ligament. Suturing is begun from below upward. Usually from three to five sutures are introduced so that the entire area occupied by a direct hernia is covered by thick muscle. Care should be taken not to introduce these sutures in the same plane along the muscle to avoid splitting it.

The next step is to bring down the internal oblique muscle to Poupart's ligament, certainly along its outer half, and if possible so as to overlap the rectus; all that remains is the suturing of the aponeurosis of the external oblique and the skin.

Choice of an Anæsthetic.—In children up to the age of sixteen or seventeen and in neurotic individuals some form of general anæsthesia is as yet the necessary evil. In young adults, in the aged, and in all strangulated hernia, except in children, we believe that general anæsthesia should be avoided as far as possible. We strongly believe that a general anæsthetic given to a case of long-standing strangulation frequently turns the scale toward death. At the present time, methods of operating under local anæsthesia, as laid down by Dr. Mitchell of Washington, are so exact and so painless, that one who has given any study to the method will no longer use ether.

A study of the article by Cushing on "The Nerve Distribution of the Inguinal Region," a little practice in infiltration and nerve blocking, together with gentleness in handling tissues, render the method one easily learned after some experience.

The infiltrating solution that has given the best results in our hands is that recommended by Mitchell. The solution is made in two strengths. The strong solution is made by dissolving a hypodermic tablet containing ¾ grain of cocaine

and 1/400 grain of adrenalin in 50 c.c. of normal salt solution. The weak solution contains the same strength tablet in 100 c.c. of salt solution. These tablets should be sterilized in very small cotton stoppered vials with dry heat, raising the temperature gradually during one hour to 100° C. Only two tablets are sterilized in each vial and they should be placed in cotton to avoid contact with glass. After experimenting with various syringes the best has been found to be the Record of 2 c.c. capacity.

The first thing to accomplish in operating under local anæsthesia is to prevent the patient from believing that anything unusual is about to take place. In fact the best way is to say very little in way of explanation. If any question is raised, let it be known that the operator is not using ether as a mark of special favor to the patient.

A few quiet words to the effect that: "We are going to operate together, and if by any chance you feel any pain let me know," will create a proper mental attitude.

The patient's general nervous sensibilities are usually less on edge if a hypodermic injection of ¼ grain of morphine is administered a few moments before operation is begun.

Space is too limited to enter into a minute description of operation under local anæsthesia, but the points essential are: (1) Careful skin infiltration (strong solution); (2) perfect blocking of the iliohypogastric and ilio-inguinal nerves (strong solution); (3) avoiding unnecessary handling of tissues; (4) absolute prohibition as to gauze dissection; (5) forewarning patient that at this or that point some discomfort may be felt for a moment until a fresh infiltration with the weaker solution can be made.

The post-operative course of a patient operated upon under infiltration anæsthesia is so much more comfortable than with the use of ether that it is hard to institute comparisons.

The cases now reported comprise those operated upon in St. Joseph's Hospital up to May 1, 1909, at Frankford Hospital up to May 1, 1910, and at Jefferson Hospital to October 1,

1911; three operations on two patients at the Presbyterian Hospital, the last one in June, 1907.

A very large proportion of the Jefferson Hospital cases I owe to the courtesy of Dr. J. Chalmers DaCosta.

Statistical Summary.—Total number of operations, 133 on 119 patients.

Age varied from 35 days to 75 years.

There were 28 cases of strangulated hernia with 5 deaths.

One case of partial suppuration requiring removal of silk suture, result is perfect cure.

One case recurred in six months at site of transplanted cord.

Edward C., right inguinal hernia. Operation, St. Joseph's Hospital, Jan. 29, 1904. Kangaroo tendon sutures. Healing p. p. Re-operated at another hospital during my absence and was seen in September, 1904, with a second recurrence and a stitch sinus.

Dr. Richard H. Harte said that there is one important feature that is often overlooked in the question of operation for hernia, and that is the importance of having the wound thoroughly dried before closing. This is often responsible for the failure to get absolutely clean, healthy wounds. He firmly believed that this is the reason why so many men whose technic cannot be questioned get suppuration, from hemorrhage setting in after the reaction of the patient.

Dr. John H. Jopson could not agree with Dr. Nassau as to what he says of the lack of value of the rectus transplantation by the Wölfler method. He had nearly always incised the anterior covering of the rectus muscle when transplanting it, which he has done many times, in hernias, where the conjoined tendon was poorly developed, and he included in his stitches the conjoined tendon, and if the incision in the sheath is made of a fair length, one can bring the rectus muscle down to the desired point on Poupart's ligament without undue tension.

Dr. William L. Rodman believed that transplantation of the anterior sheath of the rectus is one of the most important steps that has been made in operations for hernia. It seemed to him that the transplantation of the sheath itself is more important than the fibres of the muscle, because the latter would

atrophy soon after transplantation and be of no real resistance to the future descent of a hernia. Another very important point is whether or not the cord shall be transplanted in the average case. Formerly he believed that the technic of Bassini was much the best, and he was prepared to believe so yet in a majority of cases; still he did not feel at the present time that it was absolutely necessary to transplant the cord in every case. Certainly it is a distinct disadvantage in some; as, for instance, if we have associated an undescended testis where the cord is already too short. It also seems an unnecessary step in the average case, in children, because almost any operation in them will be followed by cure. He had been omitting this step increasingly in the last five years, and although it was impossible for him to say that all these cases had done as well as where the cord was transplanted, as he had not reviewed them, yet that was his impression. Transplantation is necessary in direct hernia particularly, but in oblique hernias it may be an unnecessary step.

Most important in hernia operations is the choice of suture materials. Bassini used silk in his operations, and many others also until a number of fistulæ or sinuses caused them to abandon silk. He formerly used silk a great deal because he had not sufficient confidence in catgut or kangaroo tendon; but for the last 10 or 15 years he had very generally preferred the absorbable suture, and the best is small kangaroo tendon. Kangaroo sutures as generally used are much larger than is necessary and the knots have been the cause of trouble in the majority of instances; to this he attributed his late infections years ago. Small kangaroo tendon can be as completely sterilized as anything else and is sufficiently abiding. A suture should abide for three or four weeks to insure safety. The use of rubber gloves also has done more to make the results in hernias good than anything else except the absorbable suture materials. The use of gauze dissection is not disadvantageous if done carefully.

As to the use of cocaine, while it is undoubtedly a valuable advance, yet it is for the exceptional rather than the ordinary case. Where there are distinct contraindications to ether, cocaine should be used exactly in the way Dr. Nassau has shown. He had witnessed failures in the hands of those most familiar with cocaine.

Dr. Charles F. Nassau, in closing, remarked that he had

stated that Bloodgood in his transplantation utilizes the outer border of the rectus muscle behind the internal oblique and in front of the peritoneum. Dr. Halsted has in certain isolated cases utilized the whole sheath to cover the defect, but in the Wölfler method it is pulled out through the anterior sheath, and in Bloodgood's method the retractor is introduced beneath the internal oblique and transversalis and by pushing back the bladder the incision is made (along the outer border of the rectus), and the whole strength of the anterior sheath is then left to cover over and it may even spread out after the edge of it is freed. These are the advantages and differences between Wölfler's and Bloodgood's transplantations, it being the transplantation of the rectus muscle, not of the sheath, in any sense whatever, in every method.

He did not go into the question of suture material as he considered it unimportant. His own preference is for silk when the work is being done where he knew the silk stays in. In the Frankford Hospital where he had control of the technic and had had the same operating room nurse for years, he used silk almost exclusively as a buried suture until the last three years, when he had been using catgut, although also using silk in selected cases. He had taken out but one silk stitch from an inguinal hernia; he had taken out two buried silk sutures in seven years, and both of these he put in himself, the second time being in an epigastric hernia. Chromicized catgut, if the best brand is used, is all right.

In the question of operation under local anæsthesia, if the patient squirms over the table, suffers pain, and the surgeon is worried and things are prolonged, then it is better not to operate in this manner. On the other hand, if the surgeon does not make a reasonably persistent effort to master that technic in a certain number of cases, when the time comes where he needs it he cannot do it except his patient suffers pain, and he therefore does an incomplete operation. In one patient of 75, the only one of the series in which he resected nine inches of bowel, this was done painlessly and the old man got well. Through the courtesy of Dr. DaCosta he had two men patients in the wards at the Jefferson Hospital at the present time, both of whom went through their operations well, and he would be very glad to have any who are interested go in and see them. They lay on the operating table in perfect comfort with the exception of slight

sensations at one or two spots where they warned him he was impinging on tender ground. The thing can be perfectly accomplished if one gives a little time to it.

TWO CASES OF CAVAL OCCLUSION: (1) VENA CAVA INFERIOR; (2) VENA CAVA SUPERIOR.

Dr. Penn G. Skillern, Jr., described these cases with remarks.

Case I.—A man, 20 years of age, in April, 1910, contracted enteric fever, for which he was treated in the Pennsylvania Hospital for three months. During the third month of the disease he noticed that both legs were slightly flexed, painful, tender, and beginning to swell. They have remained swollen since. Pain started in feet and extended upward to pelvis, and also to the right lumbar region, which latter was but temporary. About two months after discharge from the hospital he noticed for the first time enlargement of the superficial veins, first in the left inguinal region, from whence the veins "began coming out all over"; he did not notice the time or order of appearance of the veins after this. These veins have not decreased in size until one week previous to this report (Feb. 26, 1912), when he noticed for the first time that they were undoubtedly diminishing in size. He feels well in other respects: no gastro-intestinal disturbances, not even piles.

Examination reveals an ulcer over each shin, in the course of the internal saphena, both 2 cm. in diameter and both presenting the usual characteristics of varicose ulcer. Moderate œdema of legs and feet.

After elevation of the lower extremities against the wall for 15 minutes, to gravitate as much of the fluid as possible from the limbs, each limb was encased in an Unna's paste dressing from the roots of the toes to the tibial tubercles.

Examination also revealed the condition of the superficial veins shown in the accompanying photograph (Fig. 1).

Along the course of both saphena there were dilated venules, taking for their pattern the delicate tracery of fine seaweed. The course of dilated and tortuous veins on the respective sides was noted as follows:

Right side. Thigh: Superficial circumflex iliac between saphenous opening and anterior superior iliac spine, just below

which it was markedly tortuous and enlarged. Abdomen: A dilated and tortuous vein receives the column of blood from the superficial external circumflex iliac and conveys it to the right axilla, passing lateral to the nipple. The superficial epigastric runs upward near the outer border of the rectus to inosculate with the superior epigastric. The superficial external pudic joins with its fellow. Chest: Anterior perforating cutaneous branches of internal mammary are more prominent below than above the nipple.

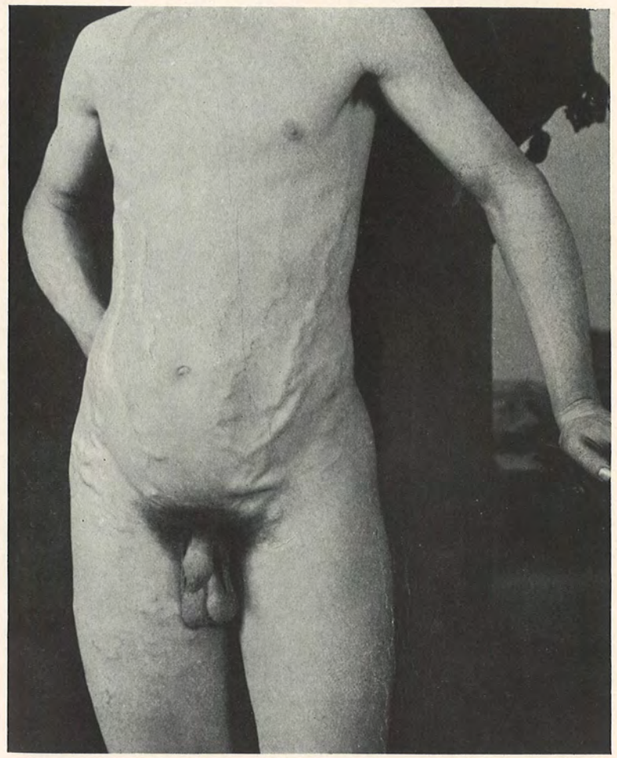
Left side: Thigh: Vascular mass over the saphenous opening, representing ampulla of saphena, and simulating femoral hernia. At the middle of Poupart's ligament there is the greatest dilation, the vessel here being 2 cm. in diameter as measured by the calipers. Abdomen: Superficial epigastric takes a prominent part. It sends a branch toward the navel which suggests the cœliotomy vein of Kelly, and which divides at the level of the navel, one branch inosculating with the superior epigastric, while the other makes almost a bee-line for the nipple, just short of which it disappears. Most of the current of the superficial epigastric, however, is diverted through a large tortuous vessel, which courses obliquely upward and outward to the middle of the axilla, and which corresponds to the vena thoracica epigastrica longa tegumentosa of Braune.

No noteworthy dilation immediately about navel. No piles. No varicocele. Area of hepatic and splenic dulness not increased. Examination of heart and lungs negative. Superficial cervical veins not enlarged.

The patient cherished an ambition to enter the service, so that the possibility of subsidence of the veins was pointed out to him. In the meantime he was advised to wear a leathern girdle with pelvic straps to support the vessels as well as to protect them from injury, and under no circumstances to permit excision of the veins.

Dr. Skillern recalled the statement of Osler that "There is no more interesting subject of study than the way in which channels of collateral circulation are established in occlusion of large vessels." As a corollary to this, he thought an equally interesting subject of study was to diagnose the character and location of the occlusion as indicated by the topography of the enlarged veins. In this case it is clear that we have to deal with a pre-

FIG. 1.



Enlargement of superficial veins consequent upon occlusion of the vena cava inferior.

viously occluding but now canalized thrombus situate at the beginning of the vena cava inferior just above its great iliac tributaries. It could not be in one of the iliac veins, as in the case depicted by Ashhurst (*Jour. A. M. A.*, 1907, xlviii, 1840), and in that by Davis (Applied Anatomy, 1910, 380), because of the bilateral involvement. There might be a thrombus in each common iliac, but this is very improbable, and is not in accord with the history of *simultaneous* swelling of both lower extremities. For the same reason the thrombus did not start in one iliac vein (or tributary) and propagate itself to the cava, or into the other common iliac. The history states that enlarged veins were first seen in the left groin, whence they spread in various directions. We can still reconcile this with the pathology, for until the veins on the left side began to enlarge the cava was not yet completely occluded, but the thrombus propagated itself retrograde to the current and occluded the left common iliac first and later the right. There is present, then, a T-shaped thrombus.

Nor was the thrombus as high as the diaphragm, as in the case reported by Osler (*Jour. of Anat. and Physiol.*, 1879, xiii, 291), in which there was great stenosis of orifices of hepatic veins, for this patient exhibited no signs of portal obstruction, to wit: enlargement of liver and of spleen, gastro-intestinal catarrh, and piles. Nor was it as high as the renal, owing to the absence of albuminuria, nor even as the spermatic, since there was no evidence of right-sided varicocele.

Direction of circulation was from below upward.

Welch in 1909 (Allbutt and Rolleston, System of Medicine, 1909, 751) states that there are reports of at least 140 cases of this affection, so that it is relatively rare. In addition to the superficial veins returning the diverted blood, there is also doubtless a deep collateral circulation by way of the subperitoneal plexus described by Sir William Turner, as well as by dilated venæ azygos minor et major. Were the burden of returning the blood borne wholly by the deep veins, diagnosis would be rendered difficult on account of the negative results of inspection.

Case II.—Clinical Summary: Aneurism of aortic and popliteal arteries; compression of vena cava superior; extensive extracaval collateral circulation. Male, aged 46. No history could be elicited that bore any causal relationship to his vascular disease.

In July, 1907, he sought surgical advice for aneurism of the

right popliteal artery, and underwent the operation of ligation of the superficial femoral artery at the apex of Scarpa's triangle, right side.

In 1903, four years previous to this operation, he noticed the superficial abdominal veins beginning to enlarge. These veins shortly reached their present size, and have neither increased nor diminished in calibre.

Examination reveals a tall, fairly well-developed man, whose appearance is indicative of good health. Impact of heart against chest-wall greater than normal. Râles scattered throughout lungs. Liver enlarged, particularly in epigastrium. Area of splenic dulness increased. Hemorrhoids present. No inequality of pupils or of radial pulses noted; voice clear and resonant. No brassy, unproductive cough.

Regarding the dilated and tortuous superficial veins, these were noted as follows:

Lower extremities: No varicose veins, no varicose ulcers, not even legacies of these lesions nor scars about knees were observed.

Right side: Abdomen: Superficial epigastric ascends to 1 cm. below navel and deviates to the right to cross the level of the navel 3 cm. laterally. It then inosculates with the superior epigastric, which fuses with its fellow over the ensiform. Chest: A dilated vein runs from the middle of the axilla to the fifth intercostal space, where it disappears. Neck: Dilation of superficial veins, particularly about root of neck.

Left side: Abdomen: Superficial epigastric, smaller than its fellow, crosses level of navel 6 cm. from mid-line. In this portion of its course it loops over to join its fellow across pubic hair 3 cm. above root of penis and again just below navel. It then inosculates with the superior epigastric, which fuses with its fellow over the ensiform. From the ensiform a single vein courses upward in front of the sternum to join both external jugular veins. This single vein receives as tributaries the anterior perforating cutaneous branches of both internal mammary veins. As on the right side, a dilated vein runs from the middle of the axilla to the fifth intercostal space, where it disappears. Neck: Dilation of superficial veins, particularly about root of neck.

Remarks.—Unfortunately this patient became sensitive to a degree in regard to his condition, and it was only out of courtesy to Dr. Miller that he submitted to examination, which was rather

hastily conducted in a dressing-room of the clothing shop. He would not consent to be photographed, to have blood taken for a Wassermann test, nor to appear before a medical society. There is no doubt, however, that the site of the venous occlusion is the vena cava superior; this is attested by signs of portal obstruction, namely, enlarged liver, enlarged spleen, and presence of piles; by the venous dilation about the root of the neck; and by the great similarity of the collateral venous circulation to previously reported cases, particularly that of Osler (*Johns Hop. Hosp. Bull.*, 1903, xiv, 171), the photograph of whose patient shows a collateral venous circulation which is almost the exact counterpart of those in this patient. That the compression of the cava is aneurismal in cause seems justified by the presence of arterial degeneration as shown by the existence of the popliteal aneurism, and by the chronic cough, backache, and intercostal neuralgia from which he suffers. That the cause of the cardiovascular disease is obscure is admitted, but the probability of its luetic nature is suggested in the history. Whether the man's occupation as a salesman of clothing for 20 years up to the time the disease first appeared, during which time he was on his feet all day and constantly lifting more or less heavy wearing apparel, had any causal relationship with his vascular disease, is problematical. It is noteworthy that he attributed his trouble to worry, which may or may not have been a cloak to conceal the real origin of the malady.

Welch (*loc. cit.*, p. 755) in 1909 found records of 35 instances of obliteration of the superior vena cava. He states that one-third of the cases are due to thrombosis, but that most depend either upon pressure from without, as by aneurisms, or upon syphilis. Dilation of superficial veins is especially marked over the anterior wall of the thorax and upper part of the abdomen, as held in Dr. Skillern's case. After reviewing a train of head and arm symptoms and signs that might be produced by venous obstruction near the superior thoracic aperture, he says: "In the light of the whimsicalities of venous thrombosis, it is hardly necessary to add that the symptoms may be less marked, and may deviate from what might naturally be expected."

The essential differences between these two cases are, first, the direction of the current. In Case I, where the inferior cava was obstructed, the blood was conducted efferent from the femoral

veins afferent into the axillary veins, so far at least as the superficial circulation is concerned. The direction of the current was from below upward. In Case II, on the contrary, where the superior cava was blocked, the blood was conducted efferent from the innominate and axillary veins afferent into the femoral veins. The direction of the current was from above downward. Then in Case I the veins of the lower extremities were involved, and there were varicose ulcers, while in Case II these vessels were uninvolved, probably because compensation by way of the deep abdominal veins was sufficient to obviate too much positive pressure upon the saphena veins, while the femorals below the latter took care of themselves by means of their powerful valves. In Case I there was no portal obstruction, while in Case II this was marked. In Case I there were no dilated veins over the sternum or at the root of the neck, while such was the feature of Case II. In Case I the etiology was unmistakable, while in Case II it was most likely luetic. Finally, the difference in ages. The first patient was 20 years of age, far below the period of vascular decadence, while the second patient was 37 when his malady started—well within the period of vascular degeneration.

FRAGMENT OF FILIFORM BOUGIE NUCLEUS OF VESICAL CALCULUS.

Dr. Henry R. Wharton related the history of a man, 30 years of age, who was admitted to the Presbyterian Hospital June 15, 1911, on account of retention of urine due to a close stricture of the membranous portion of the urethra; notwithstanding adequate dilatation of the stricture he continued to suffer from intermittent attacks of retention. Upon exploration of the bladder by a searcher a stone was felt. Median perineal aplotomy was then done, and two calculi were removed, each of which had developed upon either end of a four inch long fragment of a filiform bougie. Upon inquiry it developed that the man had been treated for his stricture one year before at another hospital, and it was presumable that in the course of this treatment the fragment of bougie had been left in the bladder. The mechanism of the intermittent retention may be explained by the fact that at times one of the stones attached to the fragment of bougie was forced into the urethra during micturition and for the time occluded it.

Dr. Morris Booth Miller said that some three or four years ago he had almost an identical experience. While on duty at the Philadelphia General Hospital he had a patient under his care with a persistent perineal fistula following an external urethrotomy. Nothing that he could do would close the fistula, so finally under ether he explored and found an incrustated filiform which had been cut off. The larger portion of it was in the bladder but a portion was in the urethra. Upon consulting the colleague under whose care the patient had previously been, he recollected that he had introduced two filiforms and thought they had both come out intact, but what had happened was that one had been cut off in the operation and a piece about three inches long had been allowed to remain in the bladder.

Dr. Thomas C. Stellwagen said that he had in four or five instances detected in the bladder with the cystoscope portions of a filiform bougie. The Gouley catheter is dangerous, for after long use the tip gets sharpened and cuts the end of the filiform, and the surgeon does not realize it.

Each filiform should be most carefully tested through the Gouley or set of Gouleys before using it, because the filiforms sometimes do not allow the Gouley to slide freely over them, and too much force may be used, and in this manner the end is forced into the bladder and cut off.

Dr. A. P. C. Ashhurst said that it used to be taught by the late Prof. John H. Brinton that when the Gouley catheter has been passed down to the stricture over the filiform, it was safer to push both the filiform and Gouley catheter together, passing them both at the same time from this point on; because if one pushed the catheter onward over the filiform one surely would cut the end off the latter.

Dr. G. G. Davis said that some filiforms are made of whalebone, some of the French of silk, others of hardened catgut or silkworm gut; the whalebone ones are quite brittle and they not infrequently break, while the French ones are more apt to double on themselves.

STATED MEETING, HELD APRIL 1, 1912

The Vice-President, Dr. John H. Gibbon, in the Chair.

EXCISION OF UPPER END OF HUMERUS FOR FRACTURE-DISLOCATION.

Dr. Charles F. Nassau presented a man, aged 36 years, who, on April 25, 1907, fell a distance of 26 feet, striking on his head and left shoulder. He was treated in a hospital, where he was partly unconscious for two weeks. He had a leg injury and lacerations that yielded to treatment perfectly and gave no trouble. He was admitted to the Jefferson Hospital, February 3, 1908. Careful skiagraphic study by Dr. Manges showed a partially unreduced dislocation of the head of the left humerus complicated by a longitudinal fracture through the head and upper part of the shaft, allowing the external rotators to pull the tuberosity posteriorly against the edge of the glenoid cavity. The shoulder-joint was practically anchylosed, and the scapula moved with every effort to use the arm. The muscles of the arm were much atrophied, particularly the deltoid. In order to avoid any further injury to the circumflex nerve and considering the position of the bone fragment, the Kocher posterior incision was resorted to. In this approach to the shoulder-joint no muscle-fibres are paralyzed. The skin incision starts slightly in front of the acromioclavicular joint, runs down over the acromion and spine of the scapula, and then curves away from the median line toward the lateral aspect of the chest. The acromioclavicular joint is exposed; the trapezius muscle is separated from the acromion and the deltoid is separated on the outer side of the acromion only, posterior to its base. The acromion is drilled previous to separating it from the scapula to facilitate replacement by wiring. The acromion and deltoid muscle are now laid outward, thus exposing the joint capsule, the supra- and infraspinatus muscles, circumflex nerve, etc. It was found necessary in this case, after removing the detached fragment, to excise about three inches of the head of humerus in order to obtain absolutely free and unlimited motion in every direction. The

arm was mobilized sufficiently to lay it up against the side of head.

At the close of the operation the acromion was wired in place with No. 14 silver wire and the muscles restored with No. 2 20-day chromic catgut. Two small tube drains were used for 48 hours. Healing occurred with primary union throughout, and the stay in the hospital after operation was 16 days.

The patient has now a powerfully developed arm with an almost perfect voluntary range of motion. He owes this to the early use of skilfully given massage and his own cheerful co-operation in active though at first painful movements.

Dr. George P. Müller said that he operated on a similar case two years ago. The patient, a woman of 60 years, was admitted to Dr. Frazier's service in the University Hospital with an old subcoracoid dislocation of the humerus and with stiffness of the shoulder and pain. He attempted, under ether anæsthesia, to loosen up the adhesions, and failing, again tried through an open incision but fractured the neck of the humerus high up. He then removed the fragments and obtained a good functional result. An anterior incision was made and he had some difficulty in getting a good exposure.

Dr. John H. Gibbon said that a few months ago he used this same incision for the subperiosteal excision of the head of the humerus in a case of congenital posterior dislocation. The result has been very satisfactory although the child has not obtained as good a result as in the case presented by Dr. Nassau. This condition was supposed to have been a birth palsy and the girl was 14 years old at the time of operation.

GOITRE.

Dr. Nathaniel Ginsburg presented the following patients:

Case I.—Woman, 41 years of age, who was the mother of the two succeeding cases, all of whom present some form of goitre. She has had a tumor of the right lobe and isthmus of the thyroid gland for ten years. There is no thyroid intoxication and she is unwilling to have any operative treatment at the present time. The tumor is probably an adenoma.

Case II.—Girl, 17 years of age, a daughter of the previous patient. She has noticed an enlargement of the neck for the past two years. Her mother and one sister each present hyper-

trophy of the thyroid gland; and a maternal aunt also has a goitre. She had diphtheria at eight years of age, and since then has been subject to frequent attacks of tonsillitis. At the present time she complains of palpitation and vertigo with considerable headache. She also states that she has occasional spells of depression with crying. The menstrual habit began at 13 years of age and was regular until within the last year. Her pulse is 104; except for some acceleration in the pulse-rate, there are no other symptoms pointing to hyperthyroidism. The swelling of the thyroid gland is bilateral and shows more involvement of the right lobe and isthmus than of the left lobe.

Case III.—Girl, 11 years of age, the third member of the family, who also presents an enlargement of the thyroid gland. She had diphtheria at 8 years of age and following the attack an enlargement of the thyroid gland occurred. She does not complain of any symptoms and otherwise appears to be perfectly well.

The two latter patients appear to have a simple physiological hypertrophy of the right gland which has the direct relationship to the onset of menstruation.

Case IV.—Woman, 43 years of age. This patient is one upon whom excision of the left lobe and isthmus of the thyroid gland was performed in conjunction with Dr. L. W. Steinbach. The patient prior to operation presented all the symptoms of extreme hyperthyroidism with the exception of exophthalmus. The pathological diagnosis confirmed the clinical diagnosis and showed evidences of reversion in the epithelial arrangement of the parenchyma of the gland. At the present time, one year following the operation, she presents some enlargement of the right lobe of the thyroid gland with some tremor and a pulse of 98. Dr. Ginsburg requested the opinion of the Society as to whether further operative interference would be justified in this case.

Case V.—Man, 20 years of age, who presents a symmetrical hypertrophy of the entire thyroid gland, the duration of which is indefinite. He believes that his neck has markedly grown larger during the past three months. The patient does not present any symptoms referable to hypersecretion of the gland. His neck measures sixteen inches. The veins on the anterior surface

of the neck are markedly enlarged, and the goitre appears to be of an extremely vascular type.

The gland is rapidly increasing in size, and operative interference seems to be justifiable for the purpose of preventing symptoms which will later appear, either in the form of thyroid intoxication or the effects of pressure upon the viscera, or adjacent structures in the neck. Dr. Ginsburg desired an expression of opinion on the part of the members of the Academy regarding the extent of operative interference which should be carried out in this case, with particular reference as to the advisability of ligation of the superior thyroid arteries, or excision of part of the gland.

Case VI.—Girl, 18 years of age, who had an excision of the right lobe and isthmus of the thyroid gland in May, 1911, for symptoms of hyperthyroidism. Improvement was marked following the operation, and except for some huskiness of the voice she is now in good health.

Case VII.—Girl, 16 years of age, who presents a simple goitre involving the right lobe and isthmus of the thyroid gland which dates back to the onset of her menstrual period 18 months ago. Her neck measures 12¾ inches and has increased in size during the past five months. This appears to be a simple physiological hypertrophy of the thyroid gland occurring at the onset of the menstrual habit.

Case VIII.—Girl, 15 years of age, who presents a simple goitre involving both lobes of the thyroid gland. Her menstruation habit began one year ago, shortly following which there appeared some enlargement of the thyroid gland. She is able to work and feels perfectly well, and there are no indications of hyperthyroidism. This case belongs to the classification of the preceding case of a simple goitre dating from the onset of the menstrual habit.

Case IX.—Woman, 21 years of age, who was observed in June of 1911 when she consulted the reporter for extreme nervousness and tremors of the hands and feet. She was unable to remain quiet during the examination, her whole body being in a constant tremulous state. There was some exophthalmus and the pulse-rate was 92. She had noticed the enlargement of the thyroid gland six months previously and believed the swelling was increasing in size. In addition to the above symptoms the

vasomotor symptoms were very marked. On November 9, 1911, excision of the right lobe and part of the isthmus was performed with some slight intoxication following operation, which subsided at the end of 48 hours, recovery after this being uneventful. At the present time (April, 1912) improvement is not as marked as he had hoped to have it and there is some suggestion in the mental attitude of the patient of a lack of nervous equilibrium which may not have any direct relationship to thyroid gland intoxication.

Dr. John H. Jopson said that he had had one case of recurrence of exophthalmic symptoms due to hypertrophy of the remaining lobe of the thyroid. A second operation, viz., resection, was required, and resulted in a permanent cure.

Dr. George G. Ross said that there was a case similar to the one shown by Dr. Ginsburg and to that reported by Dr. Jopson operated on recently by Dr. John B. Deaver, at the German Hospital. The left lobe was removed for exophthalmic goitre three years ago. The patient remained perfectly well for two years, then she was in a trolley accident, was not severely injured, but was frightened, and six months after had an enlargement of the right lobe with all the classical symptoms of exophthalmic goitre. She was watched carefully for ten days, the method of preliminary anæsthetization daily was carried out, and her pulse remained at 160. For the first 48 hours after operation the pulse remained about 160, but for the last 48 hours it has gotten down to 120–136. She is making a good recovery. In this case recurrence was brought on by fright rather than by injury.

Dr. Morris B. Miller remarked that fortunately Philadelphia is not in the goitre belt and its surgeons do not see these cases in great numbers; in consequence, compared with men in the West and in Switzerland, no man's experience here is very large. Nevertheless it is our duty as surgeons everywhere to point out to our medical confreres the importance of recognizing hyperthyroidism early. The time to consider goitre cases is before they get into serious trouble. It is well known that physiological goitre occurs in women at puberty and sometimes at recurring pregnancies, and the symptoms are definitely recognized, but in these cases there is always a little danger. However, there is a point when the recognition of hyperthyroidism

should be noticed before it reaches an extreme form. Many cases are referred to the surgeon uncomfortably late, and in these cases if early rest or early operation were undertaken a good deal of trouble would be avoided.

Dr. George P. Müller said that the treatment of these simple goitres should vary with the particular case. It is common to confuse the so-called unilateral or nodular goitre with the diffuse parenchymatous process. If one bears in mind a simple scheme of the pathology of this affection, confusion may be avoided. If we draw a circle and make eight or twelve dots representing the solid epithelial masses of the fetal thyroid, which after birth develop and produce a typical acinus in the thyroid lined with low cuboidal epithelium and containing colloid, the dots become circles. At the occurrence of menstruation and at pregnancy, the thyroid often enlarges uniformly over the neck, and it enlarges because each acinus is enlarged because of interference with iodine metabolism. This is an ordinary hypertrophy. These patients, if properly treated medically, often recover completely. In other cases, however, something happens to the absorption of the colloid material and we have a permanent enlargement, unchanging in size, due to dilated acini —multiple retention cysts as it were. These physiological hypertrophies do not require operation unless they cause distinct pressure, an objectionable disfigurement, or because of the possibility of carcinomatous degeneration or because of the onset of exophthalmic symptoms. In another class of cases, development fails in one area of acini or becomes abnormal, so when the patient grows older we have again the ordinary acini but in one lobe we have a proliferation of the acini and a tumor forms, gradually increasing in size until we have a unilateral nodular goitre surrounded by normal thyroid, often compressed to a mere shell. These are adenomas, potential causes for exophthalmic goitre or for malignant change, and should be removed, no matter at what age they occur. Such a patient was operated on at the University Hospital a month or so ago by Dr. Martin for exophthalmic symptoms, and in two weeks most of her symptoms had disappeared and she is now making a good recovery.

With regard to the boy shown by Dr. Ginsburg, his opinion was that if the growth is only of three months' duration, it

should be treated conservatively, say for a year by medical means, but it will ultimately come to operation. He did not see how ligation of the superior thyroid could be of any value in this case.

ANTERIOR LUXATION OF THE TENDONS OF THE PERONEUS LONGUS AND BREVIS.

Dr. Morris Booth Miller presented a man, aged 28, who was seen on April 19, 1908. About three months previously, while riding on the platform of a trolley car, he was suddenly thrown to the street as the result of a collision of the car with a wagon. As he was falling he managed to grasp a hand rail, and he made violent and finally successful efforts to get upon his feet. Both ankles were badly sprained and he was under the impression that the right one was struck by the wagon. He was not able to walk, was taken to a nearby hospital in the patrol wagon and later to his home. He was confined to the house for six weeks and did not return to work until two weeks later.

When examined the left ankle was about well of what had been apparently a sprain. As to the right side he complained of being lame to a slight extent and that he was apt to twist the ankle without any decided cause, often while walking on a level surface. If he was obliged to stand for a long time without rest he felt that it was less secure and strong, and as much of his work was on ladders he felt bothered and handicapped by a sense of insecurity.

He was a tall young man of healthy appearance and fair general musculature. When his feet and legs were bared it was noted that he had pes planus present on both sides and to about the same degree. This he stated had existed as long as he could remember, never gave him any trouble, and was not affected by the accident. In walking he favored very slightly the right side and seemed a trifle unsteady in gait, but he had no definite lameness. He had naturally rather broad ankles. On the left side the joint was free, the range normal. On the right side the condition was different. A swelling was present over and below the external malleolus, which was due in part to slight thickening of the external lateral ligament but in the main to the fact that he had sustained an unusual injury, namely, that the tendons of the peroneus longus and brevis had been

torn out of their common sheath and were over-riding the malleolus instead of lying behind it. Both tendons could be made out in their superficial location and were absent from their usual site. They were not appreciably thickened and were not tender. Their mobility was somewhat decreased. No atrophy of either muscle could be made out. The tendons could not be pressed back by pressure.

It will be recalled that the peroneus longus tendon angulates twice, first in the groove common to it and to the peroneus brevis behind the external malleolus, and second, on the plantar surface of the cuboid beneath the long calcaneocuboid ligament, where it turns again toward its insertion on the outer side of the base of the first metatarsal. The course of the peroneus brevis is more direct and only the first bend exists. As the result of the displacement the angulation behind the malleolus was practically obliterated. The cause undoubtedly was violent muscular effort to overcome inward twist of the ankle. The effect on function was not as serious as might be expected. It served to prevent him rising far on his toes, it had a tendency to render his gait a little unsteady, and, of course, his balance was not good when he stood on that foot, but the actual disability was not very material even for a working man. He was advised to return for operation providing the displacement continued to affect him after a few more weeks of use. As he has not been seen since it is presumed that satisfactory compensation has occurred.

PRIMARY TUBERCULOSIS OF THE TENDONS OF THE PERONEUS LONGUS AND BREVIS.

Dr. Miller reported the case of a twelve-year-old boy who was referred to him by Dr. J. S. Watson early in April, 1911. The story given by the patient and his mother was to the effect that in June, 1910, he had twisted or turned his right ankle while at play, and in consequence he had developed some pain, a tendency to drag the foot, and the ankle was weak and apt to turn. Slight swelling had been noticed over the outer ankle quite early, and this had slowly increased. There was no discoloration at any time. Pain and swelling had been constant phenomena since the first; both were made worse by walking or by the accidental

ankle twists to which he was subject. No member of his immediate family had ever had tuberculosis.

He was a well-developed lad for his age and in good physical state except for the local condition. There was a tendency to limp, scarcely noticeable when he walked slowly but perfectly clear when he moved briskly. The right leg was perceptibly smaller than the left and the calf musculature was distinctly less firm to the touch. No atrophy of any muscle or muscle group could be made out. From a point posterior to the external malleolus downward and below the malleolus there was well-marked swelling over an area corresponding to the tendons of the peroneus longus and brevis. The maximum fulness was on the outer side of the foot, approximately at the location where the common sheath divides, and it gradually tapered upward until it merged into normal structures. It was not doughy nor œdematous but was rather elastic. No crepitation could be felt. It was not tender to direct pressure, and pain was not occasioned by the simple movements of the joint, but when the foot was strongly inverted he complained of discomfort. He could easily balance himself on his left foot but not at all on the right.

He was admitted to the Polyclinic Hospital and was operated on, April 14, 1911. A three-inch incision down to and into the tendon sheath exposed a mass of degenerated tissue, some portions of which were filled with riziform bodies and other portions showed tuberculous granulations. The tendon sheath was much altered and thickened, but the tendons themselves were not affected and had their normal smooth surface. There was little if any caseation. The diseased tissue was removed by the curette and scissors, and so thoroughly was this done that for a space of over two inches none of the sheath wall was left. In tracing down the peroneus brevis tendon into its separate sheath another adjacent mass was opened up and similarly removed. The wound was partially closed with sutures, the affected areas packed with iodoform gauze, a dry sterile gauze dressing was applied, and the ankle was immobilized with plaster of Paris. Patient was discharged from the hospital in two weeks. Healing was tedious and it was several weeks before the wound finally closed. During this time the ankle was kept at rest by plaster and silicate dressings, and subsequently for nearly three months he wore a steel brace attached to the shoe to prevent lateral movements of the foot. He made a perfect recovery with no lameness, no limitation of motion, and no local evidences of disease.

The pathological report submitted by Dr. James A. Kelly stated that the microscopical examination showed the tissue to consist of œdematous granulation tissue containing tubercles, giant-cells, fibroblasts, and areas of necrosis. The diagnosis subjoined was tuberculous tenosynovitis.

TUBERCULOUS TENDOVAGINITIS.

Dr. George P. Müller said that tuberculous tendovaginitis would seem to be a rare condition judging from the scarce mention made of it in the periodical literature. It may occur in persons who have no other tuberculous lesions, and appears as a serous or serofibrinous effusion or a granular proliferation in the tendon sheaths. These give rise to an increasing swelling, sometimes tender, sometimes doughy, and often with a characteristic grating sensation due to the formation of rice bodies and their movement to and fro beneath the annular ligament. In the cases here reported the swelling was globular, not elongated, and there was no grating whatever in either case. In the treatment, the endeavor was made to dissect out the sheath and remove all of the disease, sparing the tendon if possible. In neither of these cases could this have been done, owing to the involvement of the carpal bones and the extensive involvement of the soft tissues. In none of the text-books is mention made of amputation being the final resort.

Case I.—Woman, age 48 years, domestic, a stout florid person with no disturbance in the general health, no pulmonary lesions, and no family history bearing upon the disease. About two years ago the left wrist began to increase in size with some interference to the motion of the fingers. It was not inflammatory nor painful and was only slightly tender. Examination revealed two swellings, one over the radial aspect and the other over the ulnar aspect of the wrist-joint, the entire joint also being increased in size, which were doughy, soft and slightly tender, without adherence nor reddening of the skin. Movement of the wrist was unduly free, but the patient could not completely flex the fingers. An X-ray examination revealed marked necrosis of all the carpal bones, of the ends of the radius and ulna, and

of the bases of the metacarpals. The bones seemed to have dissolved and to have run together.

It was thought best to amputate through the middle of the forearm. The flaps healed by first intention, and one month later the patient was entirely well.

Case II.—Man, aged 62 years. Three or four years ago after catching cold he suffered from cough but without expectoration. This left a residual sense of soreness beneath the sternum which has persisted up to the present time. In the early part of 1911 a swelling of the right wrist was noted, associated with stinging pain. During the fall the left wrist also became involved. There were no inflammatory signs and no sinuses. Health was otherwise good. Some dyspnœa for the last six months, but no cough and no loss of weight. At present time, complains bitterly of the soreness beneath the sternum, which he states often keeps him awake at night. He has no complaint whatever in regard to the wrists. He states that when he moves there is a grating sensation beneath the sternum, and upon examination of this place a prominence is detected at the junction of the manubrium and gladiolus. There is no tenderness nor redness. At the right apex the note is high pitched and there is bronchial breathing, but there are no râles. Heart somewhat enlarged and pushed to the left with weak and slow sounds. The X-ray revealed the existence of a mass, possibly tubercular, in the mediastinum (Pancoast). No other findings.

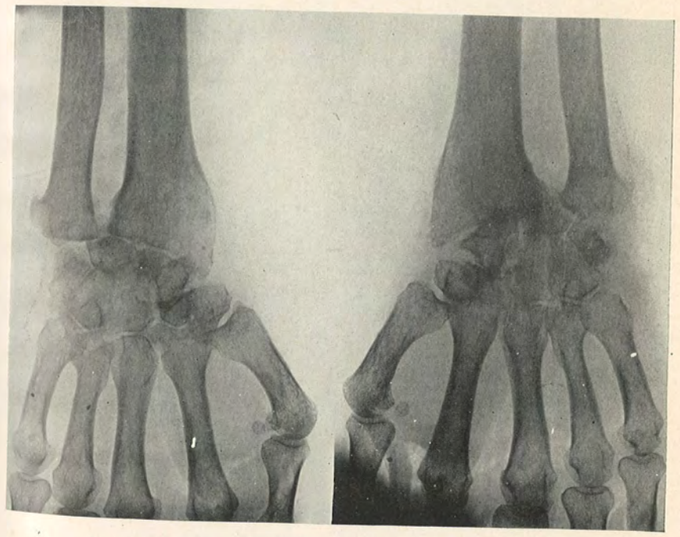
Patient remained in the hospital for two weeks, during which time the temperature range was slightly subnormal; pulse 56 to 72; respiration about 20. He was given tuberculin and reacted moderately. An X-ray of his wrists revealed marked softening and destruction of the carpal bones with evidence of relaxation through destruction of ligaments, as the semilunar bone was dislocated downward between the radius and ulna. Patient sent back to his home and two courses of *tuberculinum purum* were given, at the end of which his doctor reports that he is much improved.

Dr. John H. Jopson referred to two cases of tuberculous tenosynovitis upon which he had operated. One patient was an old Italian who first had an involvement of the sheath of the flexor tendon of the third finger. A fairly thorough operation was done in this case but the disease progressed upward and

Fig. 1.

Tuberculous tendovaginitis. The wrists have decreased about half in size since using tuberculin. Pain is entirely absent. It was constant.

Fig. 2.



Conditions of bones in case of tendovaginitis shown in Fig. 1.

involved the tendons of his wrist, necessitating a second operation, which was much more extensive. The wound healed and although he still complained of pain, the result was for a time satisfactory. The other case was that of a young woman who presented a swelling on the extensor tendons of the left wrist about level of the styloid process of the ulna, practically a case of compound ganglion. These cases of compound ganglion are nearly always instances of tuberculous tenosynovitis. An exception to this was the case of a well-known surgeon of Philadelphia, long since dead, who had a compound ganglion of the hand for many years. A diagnosis of tuberculosis was not made at the time of operation upon this young woman, but œdematous granulation tissue was dissected, but with considerable difficulty, owing to the extent to which it involved the extensor tendons. The report came back from the pathologist that the condition was one of tuberculosis. A year or two later the patient developed pulmonary tuberculosis. The speaker remembered another case under the care of Dr. Edward Martin in which amputation was the last resort.

Dr. John H. Gibbon said that he operated on a patient a year ago for tuberculous infection of the extensor tendon sheaths of the ulnar side of the wrist. He had a recurrence but in that case they obtained a most satisfactory result and controlled the condition very well by the X-ray. The man was greatly relieved of his pain and went back to his work, that of a painter. The X-ray treatment was continued for some time. He was also given iodides. The speaker said he had lost track of the case and whether there was an ultimate recovery he did not know.

TORSION OF THE OMENTUM.

Dr. George P. Müller reported the case of a woman aged 42 years, who had had a right inguinal hernia for 25 years. She did not wear a truss for it. Two years ago, a mass appeared in the inguinal region, hard but not tender. At the same time she began to complain of gastric symptoms, distress, and fulness after eating, and vomiting in the mornings. Four weeks ago she began to suffer from pain in the right inguinal region gradually increasing in severity and spreading to the right iliac fossa. Twenty-four hours before admission to the Chester

County Hospital, the pain became acute and was accompanied by marked nausea and vomiting.

On examination, he detected a mass in the right iliac fossa, very tender to palpation and quite hard. Temperature was 100°; pulse 90.

Upon opening the abdomen, November 17, 1910, bloody fluid escaped and a mass of omentum presented itself, purplish in color. There was no pus but the adjacent intestines were red and infected. The mass was attached below by a narrow pedicle to the internal ring, and above, near the colon, was twisted five times into a cord. The intervening portion, as large as a cocoa-nut, was the strangulated omentum. It was removed. The appendix was also removed. The hernial sac was opened and found also to contain omentum adherent to the sac. The sac and contents were removed and a Bassini herniorrhaphy done.

On April 1, 1912, patient states that she is perfectly well.

In connection with this Dr. Müller said that the first mention of torsion of the omentum seems to be by Oberst, in 1882, but it is only during the past 15 years that the reports of cases have become more frequent. In 1900, Wiener (ANNALS OF SURGERY, 1900, vol. xxxii, 648) wrote a statistical paper and reported a few cases. In 1905, Corner and Pinches (*A. J. M. S.*, 1905, vol. cxxxv, 314) were able to collect 54 cases from the literature. Finsterer in 1910 (*Beit. z. klin. Chir.*, Bd. 68, Heft. 2, p. 521) reported that the number of cases had increased to 72. In 1911, Hedley (*Brit. Med. Jour.*, Nov. 11, 1911, p. 1246) found reference to 93 cases of which he obtained details of 73.

"The term, torsion of the omentum, should include only those cases in which twisting of the omentum on itself has caused a sufficient obstruction of the circulation to produce evidence of strangulation" (Richardson). A study of the reported cases suggests that torsion may be divided into the following (Payr):

1. Torsion without co-existing hernia: (*a*) Simple cases involving the omentum only; (*b*) complicated cases involving other adherent abdominal organs.

2. Torsion with pre-existing hernia: (*a*) Intra-abdominal torsion without involvement of the hernia; (*b*) intra-abdominal torsion with involvement of the hernia (strangulation, inflammation); (*c*) omental torsion within the hernial sac only; (*d*) complicated cases: (1) both intra-abdominal and hernial twisting; (2) either intra-hernial or intra-abdominal torsion associated with a retrograde incarceration.

Another classification is that suggested by Richardson into: (*a*) Intrahernial omental torsion; (*b*) Intra-abdominal omental torsion; (*c*) Intrahernial and intra-abdominal omental torsion.

In the first group, he includes those cases in which the point of torsion lies at least in part within the sac, and the mass of strangulated omentum lies entirely within the sac. These cases are distinguished from strangulated epiplocele by the presence of a twisted pedicle and by the presence of constriction at the hernial ring.

In the second group, the point of torsion lies within the abdominal cavity or partly within the abdomen and partly within the sac of a hernia but not constricted at the hernial ring. This class contains by far the largest number of the reported cases.

In the third class, there exist two points of torsion,—one within the abdomen and the other within the sac of a hernia; there will thus be formed one or two strangulated masses of omentum according to the location of the distal point of torsion.

Etiology and Mechanism.—The torsion may occur about one point, about two separate points, or may be complicated in its mechanism as when the strangulation is produced by the twisting of separate shreds of omentum about each other or of one shred about the main mass.

The etiology of torsion of the omentum is not particularly clear. Omental adhesions either at a single point or at many points are common in the experience of every surgeon, and the adhesion of the omentum to the hernial sac is also of common occurrence, and yet torsion of the omentum is peculiarly uncommon.

Richardson states that the formation of a mass of matted omentum at its free extremity or the formation of a second fixed point of adhesion of the free end to some other structure is necessary for its production. Griffith (*A. J. M. S.*, 1910, vol. cxxxix) believes that it is necessary for the great omentum to be attached primarily to the peritoneum over the right kidney, thus forming a point of adhesion and torsion, while Luckett (*J. A. M. A.*, 1910, liv, 1364) believes that enlarged full veins are a

factor. It is probable that some irregular and increased peristaltic action or some unusual effort of the abdominal muscles acting on an already enlarged or adherent omentum is the principal immediate cause of torsion.

The symptoms frequently simulate other acute abdominal conditions such as volvulus and appendicitis. There is a sudden onset of pain, nausea or vomiting, constipation, tenderness, rigidity etc. The pulse and temperature do not rise as rapidly as in acute appendicitis and the area of tenderness is wider. It is significant if there are signs of acute trouble in a co-existing hernia, but all of the above symptoms could be simulated by a strangulated hernia alone. In the cases reported the diagnosis was generally not made before opening the abdomen. Whenever it was made, however, it was based on the finding of a tender mass in the abdomen, or there was some connection with a hernia. Even though the previous history disclosed the existence of gastric symptoms, due to dragging on the stomach by a chronically inflamed omentum, these might be similar to those produced by chronic gall-bladder or appendiceal trouble.

Treatment.—The only treatment is by operation. The prognosis in the cases operated upon is about 14 per cent., a death rate entirely too high for the existing pathology.

Dr. Walter G. Elmer remarked that acute torsion of an ovarian cyst might perfectly simulate torsion of the omentum and that it might be impossible, under certain circumstances, to differentiate them.

BEVAN'S OPERATION FOR UNDESCENDED TESTICLE.

WITH A SUGGESTION AS TO ONE FACTOR CAUSING UNDESCENDED TESTICLE.

BY JOHN H. JOPSON, M.D.,
OF PHILADELPHIA,
Surgeon to the Presbyterian and to the Children's Hospitals.

The subject of the surgical treatment of undescended testicle has received an increasing amount of attention in recent years, and many valuable clinical and a few experimental studies on the subject have appeared during that time. The attitude of surgeons has undergone a very marked change, as the rapidly accumulating reports as to the value of operation in the correction of the deformity have appeared in the literature, and operations are now undertaken with a degree of hopefulness as to the prognosis which was unknown a comparatively short time ago. Indeed, we have reached a period where the light-hearted sacrifice of an undescended testicle, even though very poorly developed, is not to be countenanced by the conscientious operator until a carefully planned procedure for its scrotal implantation has been proven unfeasible.

It is not necessary to dwell at length on the physical and mental features which are often associated with cryptorchidism and to a lesser extent with monorchidism, and it must be at once confessed that for some of these, surgical measures do not offer certain relief. The spermatogenic function of the undescended testicle may be and probably usually is absent, according to the observations of those with most experience in this field; while, according to others, it is lost at a comparatively early period of life. If it is to be preserved at all, the scrotal implantation before the age of puberty would seem to be the most rational measure to be recommended. Even where spermatogenesis is entirely absent, the preserva-

tion of the internal secretion, which is so essential to the development of manly physical and mental characteristics, is of primary importance to the individual, and this is never to be sacrificed by deliberate castration unless the indications are exceedingly well defined.

The recognition of the important fact that in all or nearly all cases of undescended testicle there is either a hernia present, or a potential one due to the presence of an open vaginal process of peritoneum, is a very strong indication for attempted radical cure of both hernia and non-descent. Coley [1] dwells upon the rarity of strangulation of the hernia cases, he having personally operated on but one, a strangulation of the omentum, while not one case has been admitted to the Hospital for Ruptured and Crippled. Erdmann,[2] in the same discussion, recalled four or five cases of strangulation in hernias of this type on which he had operated, and we recall that the first case of strangulated hernia which we ever saw operated upon was associated with undescended testicle and was in Dr. Deaver's service at the German Hospital during our student days.

Aside from the accident of strangulation, cure of the hernia is impossible without operation, and truss treatment is often painful and ineffectual. Repeated attacks of epididymo-orchitis are frequently observed. Torsion of the cord is an ever-present danger, and malignant disease of the testicle, while not of frequent occurrence, is certainly predisposed to by non-descent of the organ, every theoretical condition favoring malignant growth being provided (Von Foth [3]).

The modern operation for undescended testicle would probably date from 1881, when M. Schüller first recommended division of the tunica vaginalis as an aid to bringing down the testicle, and this measure, in connection with high ligation or suture of the neck of the vaginal process, is now a recognized feature of all operations. Schüller also sutured the testicle to the bottom of the scrotum to prevent its subsequent retraction. The futility of such suture, without previous lengthening of and relief of tension upon the spermatic cord,

is now appreciated. In such cases the scrotum is simply invaginated by traction of the cord and testicle upon it, and follows the testicle unwillingly but surely in the direction of the external ring, leaving a funnel-shaped depression instead of the normal scrotal fulness.

Moschcowitz [4] reviews the numerous and ingenious methods devised to bring down the testicle and to prevent relapse. Among these continuous traction on the testicle as a means of lengthening the cord has been practised (Lanz), sutures being passed through the fascial coverings of the organ and the bottom of the scrotum, and fastened to external wire supports or cages, or to the thigh, or even by a long cord to the big toe. The Keetley-Torek operation is sometimes successful, complicated as it is, and moreover a two-stage operation. It consists in incision into the scrotum and the skin of the thigh, and suture of testis and scrotum to the thigh, with retention in that position until the cord is permanently lengthened, after which they are freed. Starr [5] uses a straight silver wire splint inserted into the scrotum, one end being sutured against the pubis while the other end is fastened to the bottom of the scrotum and to the testicle, holding it down, absorbable sutures being used to hold the splint in place during the process of healing, after which time the splint is withdrawn through the bottom of the scrotum.

This does not by any means complete the list. Unravelling of the epididymis has been tried and discarded (Moschcowitz), and dissection of vas and vessels free of the epididymis, so that the testicle hangs inverted, suspended with the globus major downward, has been suggested and practised (Eccles [6]).

While the operation of Bevan [7] has been before the profession since 1899, it is only recently that it has received the general recognition to which its merits entitle it. This is probably due to the fact that these cases are not too frequently offered for operation, and that the individual operator's experience grows slowly. Moschcowitz, writing less than two years ago, reported 18 cases operated upon by Bevan's method, and states he writes, not only from a sense of pleasure which

the results have afforded him, but also because the operation, if the infrequency with which it has found its way into the literature be a criterion, has thus far found few adherents.

What are the essential features of the operation? Bevan,[8] who should know if ever father knows his own child, enumerates them in the following order: incision; laying open of the inguinal canal; exposure of peritoneal pouch; division of cremaster muscle and fascia and transversalis fascia overlying it; transverse division of the sac (tunica) and ligation of upper end, as in hernia operation; purse-string closure of lower end, to form a new tunica vaginalis testis; gauze dissection of peritoneum from cord, including vas and vessels, and accompanied by division and separation of everything in the way of fibres or fascial bands from the vas and vessels, leaving these structures alone undivided. Then follows the preparation of a pocket or pouch in the same side of the scrotum, which is usually undeveloped, and after measuring the length of the cord by laying it downward upon the thigh, the testicle is placed in the scrotum and retained there by a purse-string at the base of the scrotum. Closure of the canal by the Bassini method, omitting transplantation of the cord, completes the operation. Exceptionally, and I would emphasize this, or to quote Bevan himself, "in a few cases, but these will be quite the exception," sufficient lengthening is not obtained by such free dissection of the cord to permit of the placing of the testicle well down into the scrotum, and in these cases it will be noted that the spermatic vessels, the artery and veins, and not the vas deferens, are the agents which are holding it back, and division of these vessels between ligatures is then indicated, leaving the artery and veins of the vas to care for the nutrition of the testicle, a task to which they are nearly always equal. This is Bevan's view. Moschcowitz, who is an enthusiastic advocate of the operation, states that while the cord may be sufficiently lengthened by dissection, without division of the spermatic vessels, in most cases the latter procedure is necessary to bring the testicle to the bottom of the scrotum. In the discussion following the presentation of Moschcowitz's paper before the New York Surgical Society, W. A. Downes[9] called attention to the fact we have emphasized, viz., that division of the vessels was not considered an essential feature of the operation by its originator, to which Moschcowitz replied that, if Bevan did not so consider it, he was sorry, because he, Moschcowitz, did.

Numerous surgeons have now appreciated the merits of the operation, and it bids fair to be as much the standard in its field as the Bassini operation has been in the radical cure of hernia. Division of the spermatic vessels has been followed by necrosis of the testicle clinically, and by necrosis or fibroid degeneration in experimental procedures. Clinically, necrosis is apparently of very rare occurrence, nor have fibroid changes of slower development been noticed in the cases that have been followed for some time, although these might be present, and never detected. It seems to us that it is of the greatest importance to avoid undue interference with and limitation of the blood supply of an organ whose development we wish to foster and encourage, and we would therefore urge the preservation of the spermatic vessels where possible, at least in cases operated upon in the early years of life. It would appear to us, from our own very slender experience as well as from the observations of Bevan, that this procedure is not always necessary, and that with the exercise of great care in dissection, and that training and experience which one acquires in the performance of all radical operations on hernia in young children, and with careful division of all muscular and fascial bands, combined with a very free dissection of the peritoneal investments, sufficient lengthening of the cord can usually be obtained without it.

Nor has the hand of the surgeon been withheld from further modifications of this technic. The division of the transversalis fascia downward from the internal ring to the pubis makes a shorter path for the vas deferens from the pelvis to the external ring, although without influence on the spermatic vessels. Davisson[10] suggests in addition to such division of the transversalis fascia, with separation of the

vas, that a freeing of the spermatic vessels from the outer surface of the peritoneum, pushing them downward from that bulging membrane and abolishing the double curve which they pursue to emerge from the internal ring, is of advantage in providing a real lengthening of these structures. Dowd's suggestion, an old one, of stitching the cord to the pillars of the external ring, is good practice, if there be anything left to stitch but vas and vessels. It is immaterial whether one does or does not stitch the testis to the bottom of the scrotum. If the operation has been successful in lengthening the cord sufficiently, orchidopexy is unnecessary. If it is not successful in accomplishing such lengthening, the additional fixation will hardly save it from failure. It seems to us that preservation of the lower portion of the peritoneal process and its utilization to form a tunica vaginalis testis are important, because, as Bevan points out, in those cases in which it is excised, and this is the practice of some operators, the testicle becomes imbedded in a mass of fibrous tissue, which is unlikely to favor its functional activity.

We have followed the Bevan technic with success in six cases, and have failed in two others. The successful cases were aged 4, 12, 16, 23, and 35 respectively. In the youngest both testicles were undescended, one being abdominal. In the others the right testicle was undescended in three cases and the left in two. In three there was a distinct hernia noted in association with the undescended organ before operation, and in another there was a hernia on the opposite side, which was also operated upon at the same time. In the case of the child with double non-descent, the testicle in the right inguinal region which was associated with a hernia was operated upon. The left testicle was in the abdomen and could not be palpated. Owing to the tender age of the patient it was not operated upon. Since then it has descended almost to the external ring and will probably come down spontaneously. Three years is probably the earliest age at which operation is justifiable, except in the presence of a strangulated or large and bothersome hernia.

We have examined four of these cases recently, two at the expiration of a year and two after six months. The results in the young men are excellent, and also in the youngest patient. In one of the boys, aged 12 years, both testicles are very small and almost buried in the subpubic fold of fat. The boy is extremely stout, and there is evidently a threatened retardation of development of virile characteristics. The operative result is fairly good.

In a very young child, operated upon mainly because of the hernia which was present, with a small and atrophic organ and a very short and poorly-developed cord, we had to remove the testicle. We had a similar experience in an adult operated upon for hernia, although, had we in this case divided the vessels, we might have had better success.

It has been emphasized by all recent operators that shortening of the vas deferens is not a cause of non-descent, its length being ample, while that of the vessels may be materially curtailed, and this shortening of the spermatic vessels has been looked upon by some as primary and a probable cause of the condition. Until the mechanism of normal descent is understood, and authorities differ widely as to its cause and mechanism, seven or eight explanations being mentioned by Eberth[11], we can only theorize as to the causes of non-descent and malposition. One possible explanation has suggested itself to us. It has seemed to us in operating on these cases that the length and position of the vas deferens, which usually lies in a loop on the surface of the vaginal process, extending down below the level of the testicle, indicate that traction on the vas itself had been made at some period, and at a point some distance from its attachment to the epididymis. An exaggerated instance of this is well shown in the illustration contained in Coley's article, where the vas extends to the bottom of the scrotum—in this case the herniai sac accompanying it, while the testicle is arrested at the external ring. The question then arises, how and by what could this traction have been made? The rôle played by the gubernaculum Hunteri in descent of the testicle has by no means been cleared up.

That it exercises at least some active or passive influence in aiding to bring down the testicle seems probable, from its position and prominence in fetal life. In fetal life, its attachment above is not to the testicle but to its ligament at a point which corresponds later to the origin of the vas deferens from the epididymis (Piersol[12]). At a still earlier stage one observes that the muscular fibres of the gubernaculum extend only to the vas deferens at a point where it crosses the vas, although later extending as far as the testicle (Eccles, *loc. cit.*). May it not be that a failure of development at this stage may result in an adhesion to the vas alone, and in traction, active or passive, on the vas rather than on the testicle itself, pulling the vas down as a loop, in which position, as we have seen, it is often found, and leaving the testicle some distance behind, at a level depending on the distance from the testicle to the point on the vas at which the gubernaculum is attached? In a recent case we have observed a band extending from the first portion of the vas to the neighborhood of the external ring, which seemed to favor this explanation. Further observations along this line are suggested.

REFERENCES.

[1] Coley, W. B.: Annals of Surgery, 1908, xlviii, p. 321.
[2] Erdmann, J. F.: *Ibid.*, p. 469.
[3] Von Foth, H.: Über Abnorme Lage der Männlichen Keimdrüsen.
[4] Moschcowitz, A. V.: Annals of Surgery, 1910, lii, p. 821.
[5] Starr, F. N. G.: *Ibid.*, 1908, xlviii, p. 351.
[6] Eccles, W. McAdam: The Imperfectly Descended Testis.
[7] Bevan, A. D.: Jour. Amer. Med. Assoc., Sept. 23, 1899, Sept. 19, 1903.
[8] Bevan, A. D.: Keen and DaCosta's Surgery, vol. iv.
[9] Downes, W. A.: Annals of Surgery, 1910, lii, p. 861.
[10] Davisson, C.: Surg. Gynæc., and Obstetrics, 1911, xii, 283.
[11] Eberth, C. J.: Die Männlichen Geschlechtorgane, von Bardeleben's Handbuch d. Anat. d. Menschen.
[12] Piersol, G. A.: Human Anatomy.

Dr. B. A. Thomas said that his distinct understanding of the Bevan operation is that the most important feature is the severance of the spermatic vessels. That certainly is the only theoretical objection to the operation for undescended testicle, namely that severance of these vessels to some extent at least should and does interfere with the further development of an already atrophied testicle. If the spermatic vessels can be conserved as they may be by doing the Davison operation, it seems that the ideal operation may be attempted in these cases. Davison's idea is to straighten the spermatic vessels, inasmuch as they are the restraining influence in the attempt to elongate the cord, in order to place the testicle comfortably in the scrotum. The inguinal canal is exposed, the vas and its vessels isolated, the hernia, if present, treated, and the tunica vaginalis sutured to enclose the testicle as in the common performance of the operation. The deep epigastric artery is then doubly ligated, and the transversalis fascia split from the internal to the external abdominal ring. The spermatic vessels are then freed by gauze dissection from the preperitoneal fat and peritoneum much as a rubber band is made to slip over the end of an egg. Both the spermatic vessels and vas are then brought through the lower angle of the transversalis wound at a point behind the external ring. Thus it will be seen that the gain in length of the spermatic vessels for the purpose of elongation is the difference between the hypothenuse—the new line of the vessels—and the sum of the other two legs—the former line—of a right-angle triangle. After securing the testicle in the scrotum, the transversalis fascia and the other layers of the wound are closed.

Dr. William L. Rodman remarked that Dr. Jopson is undoubtedly right in the statement that many former authors overrated the danger of undescended testes subsequently becoming carcinomatous. Any imperfect gland is somewhat more prone to malignancy, but this tendency is not so great as to make it imperative to sacrifice a testicle. Practically all these cases are accompanied by hernia. He did not think he had ever seen a case of undescended testis where he looked for hernia that he did not find it.

In one or two cases where he had attempted to carry out the operation as laid down by Bevan he had failed to make the cord sufficiently long to bring the testis down and keep it in the bottom of the scrotum, but where this operation fails all others will. It may really be unnecessary to suture the testicle in the scrotum when the cord is sufficiently long, yet it should be done as a

precautionary measure. It is conceivable that in the process of healing there may be adhesions which might again draw the testicle into the canal.

Dr. Henry R. Wharton said that he had never performed Bevan's operation for undescended testicle, but had seen good results following it, and shall employ it. He did not have any difficulty in getting the testis into the scrotum, but had never been able to get the organ well down in the scrotum.

With regard to replacing the undescended testicle in the abdomen if the cord is found too short to permit the organ to be placed in the scrotum, he would not advise it. He remembered one case of gangrene of an undescended testicle associated with appendicitis, and such a possibility would argue against its replacement.

Dr. John H. Gibbon said that he had done Bevan's operation whenever he could not easily replace the testicle, and he had never hesitated to cut the veins in liberating the vas and its individual vessels from the surrounding structures. It mobilizes the testicle to a remarkable degree. The removal of the testicle in these cases he could never understand. If a testicle is going to become sarcomatous it is going to become so because it is arrested in its development, and whether in the abdomen, canal, or scrotum it will make no difference. If it has that disposition it will have it always. As for taking it out he did not think he had ever done it, and did not think it justifiable.

Regarding traction, he was convinced that in young babies with undescended testes these can be brought by proper manipulation on the part of the mother or nurse into the scrotum. This has been done. If one can correct a club-foot or lessen a cleft in a palate by manipulation it stands to reason that one should be able to elongate the attachments of a testicle. If the testicle can be brought out of the external ring it can be brought into the scrotum.

Regarding suturing the testicle in the scrotum he had not done it in recent cases. A good purse-string as Bevan suggests will hold the testicle down. He had not always been able to get the testicle into the bottom of the scrotum, but always pretty low down. The results with the Bevan operation have been most satisfactory.

STATED MEETING, HELD MAY 6, 1912

Dr. Gwilym G. Davis, President, in the Chair.

TREATMENT OF DISLOCATION OF THE HEAD OF THE RADIUS COMPLICATED BY FRACTURE OF THE ULNA.

BY ASTLEY P. C. ASHHURST, M.D.,
OF PHILADELPHIA.

In small children so-called subluxation of the head of the radius (" pulled elbow ") occurs not infrequently, usually from vertical traction on the forearm, as the child's care-taker helps or lifts him across an obstruction in the street. If the forearm is in supination this vertical traction tends to bring the forearm and arm into a straight line, causing momentary loss of the carrying angle; or forced pronation may pry the radius forward over the ulna as a fulcrum. Strong contraction of the biceps, on the child's part, no doubt aids materially in causing the displacement. The pathology of these slight injuries is not very definite; but the disability is quickly relieved by full supination of the forearm, followed by direct backward and inward pressure on the displaced head of the radius. The explanation of Duverney (1751), that the head of the radius is drawn downward and caught in the orbicular ligament, is accepted by Stimson as the most satisfactory of the numerous explanations which have been suggested; but at the risk of adding a new theory to many that are unsatisfactory, it has occurred to me that a very simple explanation may be that the head of the radius merely is " decentered," so to speak, on the capitellum of the humerus, and is held in this malposition by muscular spasm or ligamentous tension. Such an idea is expressed, but not very definitely, by Malgaigne. The deformity is scarcely appreciable, and the disability is so very easily corrected and

has in some cases corrected itself with such facility, that it seems hard to accept a definite rupture of ligaments as a cause. Moreover, recurrence of the condition is not unusual, without recognizable trauma.

Of more interest are the complete luxations of the radial head, because in many cases they are irreducible. The head may indeed be forced back seemingly into place, but as soon as the dressings are discontinued, and full extension is allowed, it is seen that nothing has been gained, as re-luxation occurs. The explanation is that real reduction never was secured. If reduction had been secured, and the torn orbicular ligament had re-united in proper position in front of the neck of the bone, it does not seem likely that the action of the biceps could destroy Nature's efforts at repair with such amazing facility and the production of so little pain.

Anterior luxation of the head of the radius alone is considered by most writers a much rarer injury than the same lesion accompanied by fracture of the ulna. Perrin (Paris Thesis, 1909, p. 17) says that every year Kirmisson sees two or three instances of the latter injury; and he quotes with astonishment the statistics of Zieger (1901), who found only 15 out of 95 cases of anterior luxation, and only 16 out of 42 cases of outward luxation of the radial head were accompanied by fracture of the ulna. Under my own care, during the last 10 years, I have had 23 cases of isolated fracture of the shaft of the ulna. Among these there were two cases accompanied by dislocation of the head of the radius, and a third with concomitant fracture of the neck of the radius. The dislocations were successfully reduced without arthrotomy, and had not shown any tendency to recur up to the time of consolidation of the ulnar fractures. The patients cannot be found now. During the same time there has been only one isolated dislocation of the head of the radius; this also was successfully reduced and had not recurred one month later, when the patient was last seen.

That the combined injury is by no means rare, is proved

by the large number of isolated case reports (119) collected by Stetten in 1908 (ANNALS OF SURGERY, 1908, xlviii, 275). To these may be added 20 previously unpublished cases included in Perrin's Thesis. Indeed the association of these injuries is so classical, that since the time of Malgaigne (1854) there has been a rule that in every case of fracture of the ulna alone, the existence of an anterior luxation of the radius should be suspected; and it may be added that in every case of anterior luxation of the radial head the surgeon should make very sure that no concomitant fracture of the ulna is overlooked.

As a matter of fact, while the fracture of the ulna usually is recognized, the luxation of the radius often is overlooked; and when swelling of the soft parts has subsided and the luxation is first noted, the surgeon should blame himself for neglecting the additional lesion. Modern text-books do not lay enough stress on this injury. It is true that the surgeon may argue that even had he recognized the luxation at first it might have been impossible to keep it reduced; and in this way he may console himself that no harm has been done. But in many cases harm will have been done, for the fracture of the ulna may unite with such deformity as to interfere very materially with subsequent treatment, or only fibrous union may result.

The association of nerve lesions, especially paralysis of the musculo-spiral nerve, has been studied with care by Stetten. He collected 9 such cases, and these, with 6 others mentioned by Perrin, make a total of 15 examples of nerve injury among a total of about 140 instances of the combined injury (luxation of the radial head and fracture of the ulna). Two of these cases of musculo-spiral paralysis appear to have developed immediately after the injury (Helferich, Albertin); in some of the others the time of onset is not mentioned, but in most it developed late, being due to secondary neuritis from pressure on the nerve or from its being stretched over the displaced radial head.

It is therefore very evident that reduction of the luxation in recent cases is extremely important. If reduction is ob-

tained, the ulnar fracture as a rule will heal in good position without further trouble. If, however, reduction of the dislocation is not obtained, the ulnar fragments will overlap or angulate, and union with deformity or non-union will result.

Recent Cases with Irreducible Luxation.—If reduction in a recent case cannot be secured by manipulation alone, the surgeon should resort to arthrotomy; but he should be sure that reduction is impossible without. Perrin says Destot attempted reduction seven times, with the aid of chloroform, and only at the seventh attempt was successful. But Stetten warns, and I think rightly, of the danger of injury to the musculo-spiral nerve by too strong pressure on the radial head, and by hyperextension of the elbow. Perrin, moreover, would confine operative reduction in recent cases to patients over 15 years of age; but as of 86 patients whose age is mentioned 52 were under 15 years of age, this rule would exclude a large proportion of cases. The only reason for not operating on young patients is the expectation that the luxation will prove irreducible even after arthrotomy, and that excision of the head will be required, which of course would be undesirable before full growth was attained; but there seems no good reason why reduction should prove impossible in a recent case, if the operation is properly performed. In adults, I agree with Perrin that excision should be done for irreducible luxation, since here as elsewhere such a lesion is very apt to lead to dystrophic arthritis, which is painful and disabling.

The object of the operation is to remove the torn capsule from its obstructing position in front of the capitellum of the humerus, and from over the lesser sigmoid cavity of the ulna, and to suture it around the neck of radius. It is said that usually the capsule is torn transversely above the head of the radius, while the orbicular ligament is split longitudinally; thus the tear in the capsule is T-shaped, and the inner triangular flap is blamed as the obstructing factor. Unless operation is done this flap is just pushed ahead of the radius, and no matter how long the head of the radius is held in proper position it will not stay there of itself.

Perrin collected five operations for recent injury, and I have been unable to find any published since the appearance of his Thesis, up to January 1, 1912. These cases are the following:

1. Le Dentu (1892): Case complicated by rupture of brachial artery; resection of radial head for irreducibility. Good motion recovered. Adult.
2. Delorme (1902): First operation, suture of ulnar fracture, and suture of head of radius to ulna. Dislocation recurred. Second operation, excision of radial head. Adult.
3. Durand (1909): Dislocation of radius reduced without operation; but fracture of ulna plated later. Adult. Perfect result.
4. Herman (1908): Case complicated also by fracture of neck of radius. Reduction of luxation by arthrotomy not permanent until the fracture of neck of radius was sutured. Then the luxation stayed reduced, and the ulnar fracture came into good position. Age 8 years.
5. Kirmisson (1902): Luxation irreducible by arthrotomy until ulna was sutured; this procured reduction of radius. Age 10 years. Examination 4 years later showed luxation had recurred; there was cubitus valgus of 166 degrees; flexion was incomplete, but the other movements were normal.

The results of these operations are not very encouraging, perhaps, but in the earlier operations there does not seem to have been very great effort made to suture the orbicular ligament around the neck of the radius, so as to prevent recurrence of the luxation.

In cases not complicated by ulnar fracture, operation in recent cases of anterior luxation of the head of the radius appears to have been undertaken only four times; by Sprengel, Reerink, Schede, and Bardenheuer; and in every case arthrotomy without resection was successful, as it was in the case of an old dislocation without fracture reported by G. G. Davis (*Amer. Jour. of Orthop. Surg.*, 1911, viii, 585).

Old Cases, with Unreduced Luxation.—Perrin recommends a delay of four or five months in adults, and longer in children, to see whether sufficient function will be secured without operation. Even in the best cases flexion and supination are limited; and in most cases the patients not only are unable to do any heavy work, but cannot even feed or shave themselves, or brush their own hair with the injured arm.

Perrin collected 25 operations for old unreduced luxation of the head of the radius complicated by fracture of the ulna.[1] To these may be added the operation by Kammerer, recorded by Stetten, and that by myself, which is the occasion of this paper.

These cases are as follows:

1. G. W. Norris (1843): Adult, non-union of ulna. Resection of ulna to secure end to end apposition. Infection. Only fibrous union.

2. Swinburne (1859): Age 8 years. Eight weeks after injury did osteoclasis for deformity of ulna; then reduced luxation, set fracture, and got excellent result.

3. Dorfler (1885): Osteoclasis, but luxation could not be completely reduced by manipulation. No age or end result.

4. Kirmisson (1889): Non-union of ulna, cured by insertion of ivory peg. Good union secured, but movements of elbow not improved (luxation not reduced). Adult.

5. Gerard-Marchant (1890): Non-union of ulna. Suture of ulna; later resection of head of radius. Only fibrous union secured, but condition improved by operation.

6. Chevassu (1897): Ulna in good position. Head of radius excised. No attempt mentioned at reduction and capsulorrhaphy. Good result.

7. Albertin (1898): Paralysis of musculo-spiral nerve, treated by excision of head of radius. Good result.

8. Annequin (1898): Ulna in good position; head of radius excised. No attempt mentioned at reduction and capsulorrhaphy. Good result.

9. Gerard-Marchant (1898): Ulna in good position; head of radius excised. No mention of attempt at reduction and capsulorrhaphy. Good result.

10. Lejars (1898): For non-union of ulna. Ulna sutured by silver wire. Only fibrous union, but improvement.

11. Report by Perrin, operation by unknown surgeon in 1899. For non-union of ulna. Suture of ulna, and resection of head of radius. When seen by Perrin some years later, pseudarthrosis persisted, and state of patient was deplorable.

12. Tillmann (1901): Ulna in good position. Arthrotomy and suture of capsule. Luxation recurred.

13. Tillmann (1901): Same case as No. 12. Later excision of head of radius. Good result.

[1] F. J. Cotton (Dislocations and Joint Fractures, Phila., 1910, pp. 236 and 295) mentions a case of old anterior dislocation of head of radius with ununited fracture of shaft of ulna. He reduced the luxation by arthrotomy and held the radius in place by a new ligament made of fascia and wired the ulnar fracture. Though bony union was not secured the dislocation remained reduced, and a useful arm was obtained.

14. Schwartz (1902): Ulna in good position. Excision of head of radius. No mention of attempt at capsulorrhaphy. Good recovery.

15. Katzenstein (1903): Ulna in good position. Arthrotomy, reduction, and capsulorrhaphy. Age 8 years. Perfect functional result, but head of radius remained subluxated.

16. Loison (1903): Malunion of ulna. Osteotomy of ulna, and reduction of luxation by arthrotomy; no suture of capsule mentioned. Luxation recurred.

17. Loison (1903): Same case as No. 16. Later excision of head of radius. No operation on ulna this time, although union in bad position had again occurred. Poor result. Motion only from 90 to 120 degrees, rotation only half normal, and marked atrophy of limb.

18. Riese (1903): Ulna in good position. Arthrotomy and reduction; suture of capsule proved impossible. The end result gave great improvement, but head of radius still subluxated. Adult.

19. Bérard (1904): Non-union of ulna. Resection of head of radius, and modelling resection of lower fragment of ulna. No mention of attempt at reduction and capsulorrhaphy. Excellent result. Adult.

20. Zschock (1904): Non-union of ulna, and radial paralysis. Suture of ulna, and later excision of head of radius for persistence of radial paralysis. Adult. Good union in ulna, better elbow motion, no improvement in radial paralysis. No mention of attempt at reduction and capsulorrhaphy.

21. Legueu (1905): Excision of elbow for ankylosis following badly united fracture of olecranon with anterior dislocation of radius. Good result.

22. Capron (1906): Ulna in good position. Head of radius excised. No mention of attempt at reduction and capsulorrhaphy.

23. Tricot (1906): Ulna in good position. Reduction by arthrotomy. Capsule not sutured. Luxation recurred.

24. Tricot (1906): Same case as No. 23. Excision of head of radius for recurrence of dislocation. Good result.

25. Lambotte (1908): Malunion of ulna. Osteotomy of ulna, and excision of head of radius, as reduction proved impossible. Perfect result.

26. Kammerer (1908): Ulna in good position, musculo-spiral paralysis. Head of radius excised. Age 19 years. No attempt at reduction and capsulorrhaphy mentioned. Perfect recovery of power in three years, but luxation persisted.

27. Ashhurst (1911): See below.

These operations may be thus classified:

A. Fourteen cases in which the ulna had united in fairly good position:

Five treated by attempts at reduction of dislocation of radius. (In two of these the capsule was not sutured.) Luxation recurred in two cases (Tillmann, capsulorrhaphy done;

Tricot, capsulorrhaphy not done). Good result in three cases (Katzenstein, Riese, Ashhurst; capsule sutured except in Riese's case).

Nine treated by excision of head of radius. In two cases (Tillmann, Tricot) for recurrence of luxation after reduction by arthrotomy; in two cases there was also musculo-spiral paralysis (Albertin, Kammerer). Good result in all.

B. Six cases in which ulna had united in bad position:

Two treated by osteoclasis of ulna and reduction of radius without arthrotomy (Swinburne, excellent result; Dorfler, result unknown).

One treated by osteotomy of ulna and reduction of radius by arthrotomy (Loison, luxation recurred).

One treated by osteotomy and excision of head (Lambotte, excellent result).

One treated by excision of elbow joint, for ankylosis (Legueu, good result).

One treated by excision of radius, for recurrence of luxation (Loison, poor result).

C. Seven cases in which ulna was ununited:

Three treated by operation on ulna, nothing done to radius (Norris, Kirmisson, Lejars, all improved).

Four treated by operation on ulna and excision of head of radius (Gerard-Marchant, with improvement; unknown surgeon, with bad result; Bérard, with excellent result; and Zschock, with improvement, but no relief of accompanying musculo-spiral paralysis).

Case Report.—Thomas O'B., age eleven years, in July, 1911, fell on the ulnar surface of his left forearm, causing a fracture of the ulna, at the junction of its middle and upper thirds; and by continuance of the force the head of the radius was dislocated forward. It does not appear that the existence of a dislocation was recognized. His arm was dressed on a splint, but he did not return to have his arm redressed until three weeks later. He then came under the care of Dr. Z. M. K. Fulton, my colleague at the Episcopal Hospital, and through his interest the patient was later referred to me for operation. At this time union in the ulna was

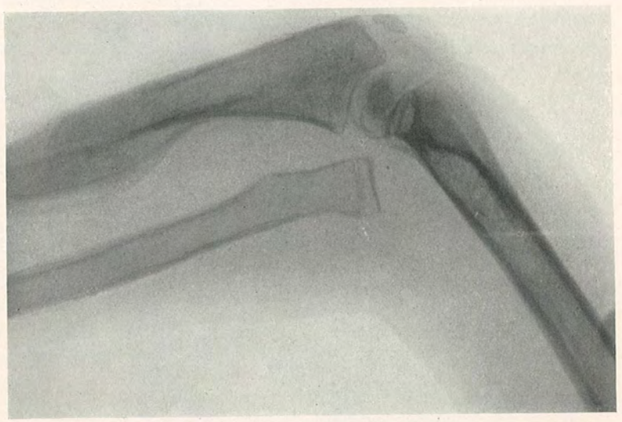


Fig. 1.

Anterior and outward dislocation of head of radius, with fracture of shaft of ulna. Four months after injury.

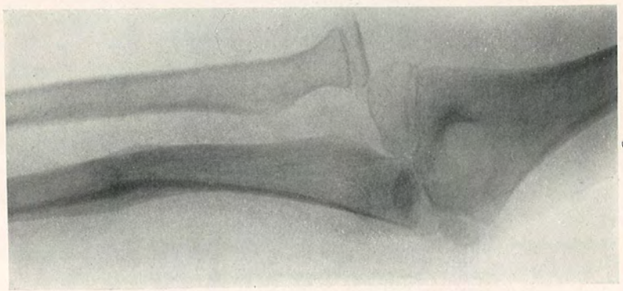


Fig. 2.

FIG. 3.

Anterior and outward dislocation of head of radius, three months after reduction by arthrotomy and capsulorrhaphy. Compare with Fig. 1.

fairly firm, there was not much deformity, but the dislocation could not be reduced. Four months after injury the boy was admitted to the Episcopal Hospital, in the service of Dr. Chas. H. Frazier. Figs. 1 and 2, from skiagraphs made at this time, show the condition of the bones. The ulna had united with slight angular deformity toward the extensor surface, and the head of the radius was luxated far forward. Flexion was stopped at 50 degrees by the radius butting against the shaft of the humerus; this caused considerable pain. Extension was complete. The carrying angle was 160 degrees, that of the normal elbow being 170 degrees. Rotation of the forearm, as measured by the writer's instrument (*Amer. Jour. Med. Sc.*, 1912, i, 848), was possible through a range of 150 degrees (from 20 to 170 degrees); that is to say, there was a loss of at least 20 degrees of supination, and an increase in the range of pronation. The head of the radius was displaced upward and outward from its normal place, and was rather freely movable. There were no nerve lesions. Even momentary reduction was impossible; evidently the normal site of the radial head was filled up with soft tissues. There was a decided hollow in this location.

Operation (Nov. 22, 1911).—No Esmarch band was used. An external incision was made, three inches and a half in length, along the supracondylar ridge and downward between the brachioradialis and the extensor carpi radialis longior. This interspace was opened and the head of the radius identified. The supinator brevis was partially detached from the neck of the radius, and pushed downward. The musculo-spiral nerve was displaced forward. The tendon of the forearm extensors was next dissected partially off the external lateral ligament of the elbow. The remains of the orbicular ligament were then plainly seen crushed against the capitellum of the humerus. At no time could there have been any possibility of reduction of the luxation without arthrotomy. The opening in the capsule was not large enough to readmit the head of the radius. The cup-shaped depression in the head of the radius was filled with granulation tissue, showing there had been some change in the cartilage. This granulation tissue was removed by sharp gouge forceps. The orbicular ligament was then raised from in front of the capitellum, it was incised in the long axis of the arm, and the head of the radius was replaced in its normal relation to the external condyle. The

orbicular ligament was then carefully sutured with mattress sutures of chromic gut to the periosteum covering the neck of the radius, to the supinator brevis, and to the ulnar attachments of the external lateral ligament. From six to eight such sutures were inserted, and there was then no tendency for the radial head to reluxate. The supinator brevis was then sutured over the head of the radius; the extensor tendon was again attached to the external lateral ligament and the external condylar ridge; and the brachio-radialis was sutured to the extensor carpi radialis longior. The skin wound was closed with chromic catgut without drainage. Not one ligature was required throughout the operation, which consumed an hour. The elbow was dressed in hyperflexion.

Some infection of the skin sutures occurred, but the deeper structures healed perfectly. The elbow was kept in hyperflexion for about five weeks, to give the orbicular ligament plenty of time to cicatrize. Rotation of the forearm was practised at each dressing, and never was painful.

The further progress of the case was slow, as regards the return of extension. Fig. 3 shows the elbow region three months after operation. Full extension was not regained for six months after operation, being aided by gentle massage and passive motion, which were instituted first three months after operation.

At present, over six months since operation,[2] the head of the radius retains its normal site in all positions of the elbow; and it cannot be forced into subluxation even by direct pressure. Flexion is present to 40 or 45 degrees, there is complete extension, the carrying angle has been restored to normal, and the arm feels much stronger than before the dislocation was reduced. There is no palpable evidence of the ulnar fracture. The result may be considered nearly perfect.

From this study, I think certain rational conclusions may be drawn:

In *recent cases* secure reduction of the dislocated radial head, by arthrotomy and capsulorrhaphy if necessary. As Kirmisson says, in such injuries, the dislocation is everything,

[2] Now, when reading proof, over nine months since operation, function is perfect.

the fracture is nothing. When reduction is secured the fracture almost invariably will fall into good position. If it does not, it may be fixed by suture or plate.

In *old cases with the ulna united* attempt reduction of the dislocation by arthrotomy and retain the radius in place by capsulorrhaphy. If reduction after arthrotomy proves impossible, as it may if the ulna has united in bad position, it is better to excise the head of the radius than to interfere with the ulna, unless the deformity in the ulna is very extreme. In such cases osteotomy of the ulna may be done.

In *old cases with non-union of the ulna* expose the ulnar fracture first, and after freeing the fragments, secure reduction of the dislocation (by arthrotomy if necessary, including capsulorrhaphy); then treat the ulnar fracture as if no dislocation had existed.

In *cases with musculo-spiral paralysis* excision of the radial head failed to secure a good result in one case (Zschock), and there is no evidence that reduction and capsulorrhaphy would not have been successful in two others (Albertin, Kammerer) in which excision was done.

ARTHROTOMY OF THE KNEE.

Dr. Astley P. C. Ashhurst reported the following cases:

1. *For "hydrops articuli." Perfect function eight years later.* James L. was a grave-digger, aged 30 years. He had never been ill, but one day in the summer of 1903 he had a sudden pain in his right knee, which continued all one day, and then left him never to return. In June, 1904, this knee began to feel clumsy and weak; he had not injured it, and it did not hurt him. After three months of increasing disability he came to the Orthopædic Hospital, service of Dr. G. G. Davis. Examination showed the knee irregularly swelled up by what was thought to be an intra-articular growth, of semifluid consistency; the patella was raised, and there was a marked prominence on each side of the tendon of the quadriceps extensor. The swelling felt "myxomatous" rather than fluid. On September 1 an aspirating needle was introduced, but no fluid could be withdrawn. On September 5, 1904, the man was etherized, and Dr. Ashhurst made an incision on each side

of the patella; the joint contents were turbid serum; no flakes of lymph nor rice bodies were present. The under surface of the patella was eroded, as was the apposed surface of the femur; there was no roughening of the capsule. The joint was wiped out with iodoform gauze, and a large double drainage tube was passed from one side of the joint to the other. A sterile dressing and a posterior splint were applied.

The tubes were removed within a few days, as soon as all discharge ceased. On September 28 the incisions were healed, and the limb was put up in plaster of Paris. There had been no pain since operation. On October 13 the patient was discharged, still wearing the gypsum case. This was removed in November, and an elastic bandage was worn for about a year. Some disability persisted for nearly a year.

In the summer of 1906, two years after operation, examination showed perfect function. He still wore an elastic knee-cap, and there was slight atrophy of the thigh.

At present, nearly eight years after operation, the patient is in perfect condition. Flexion and extension in the knee are normal; the patella is freely movable; there is no effusion; and the joint is symptomless. He is still digging graves, and never has had any pain or discomfort in the knee since the operation.

2. *For recently dislocated semilunar cartilage.* Florence S., 24 years of age, wore high heeled shoes, and tripped and fell on the street. Her right knee was violently flexed, causing great pain; but with her hands she managed to straighten the leg out, and then found she could not bend it up again. She felt a tender lump on the outside of the knee, just below the femoral condyle. She was brought to the Episcopal Hospital the same day, August 29, 1911, and was admitted to the service of Dr. Chas. H. Frazier. Examination confirmed the above sad state of affairs. There was a tender lump below the external condyle, the knee was locked in extension, and could not be flexed. X-rays showed nothing. The next day Dr. Ashhurst operated. While the patient was being etherized, the lump, which up to that time had been immovable, suddenly disappeared, and motion in the joint became free. On opening the joint over the external semilunar cartilage, there was a gush of turbid synovial fluid. The external semilunar moved freely on the head of the tibia, but retained its attachments to the capsule, as well as anteriorly and posteriorly. No other

lesions were observed. The loose cartilage was excised by the aid of a sharp hook and scissors, and the joint was closed without irrigation or drainage, and plaster-of-Paris dressing applied.

On the fourth day the temperature rose to 102° F., and there was a great deal of pain in the joint; but the pulse was only 85.

Three weeks after operation the gypsum case was removed, and the wound was found healed. Subsequently there was a little skin infection, but culture of the pus showed no growth, and smears showed no bacteria. One month after operation the knee could be flexed to 150 degrees. In November the patient, who had resumed her high heeled shoes, fell again in the street, and suddenly flexed the injured knee to more than a right angle; this caused slight effusion, and she was laid up for a few days. But on subsidence of this, no disability remained, and she has now recovered perfect function, and spends much of her time in dance-halls, as before her accident.

3. *For recurrent dislocation of semilunar cartilage.* John W. hurt his left knee playing football, when 23 years of age. It always troubled him since. In March, 1911, when 30 years old, and twice between that date and September, 1911, he suffered from acute dislocation of the internal semilunar cartilage of this knee. Suddenly, following twist or sprain, a lump appears below the internal condyle, the knee locks in flexion, and when straightened out by force cannot be bent. Acute synovitis follows, and he is laid up for a few days. He was admitted to Dr. Frazier's service in the Episcopal Hospital three weeks after the last attack. On September 9, 1911, Dr. Ashhurst removed a frayed-out internal semilunar cartilage, which was entirely unattached except to the capsule and at its posterior end to the tibia. The whole cartilage was removed. The gypsum case was discarded three weeks after operation, and in two months the knee had become entirely normal and has remained so since, now eight months.

OPERATIONS FOR OLD FRACTURES OF THE ELBOW.

Dr. A. P. C. Ashhurst also presented the records of the following cases:

1. *Arthroplastic operation for old fracture of external condyle of humerus, with gunstock deformity.* James W., aged five years, broke his right elbow in July, 1908. When he came under Dr. Ashhurst's care in October, 1908, flexion was possible only to

50 degrees and extension only to 145 degrees. There was cubitus varus, the forearm making an angle of about 200 degrees with the arm. Skiagraph showed fracture with outward rotation of the external condyle. For six weeks subsequently light massage and passive motion were employed, with the result that motion was increased 10 degrees in flexion, the range now being from 40 to 145 degrees.

On November 18, 1908, Dr. Ashhurst operated, in the Episcopal Hospital, service of Dr. C. H. Frazier. The joint was opened by an external longitudinal incision. A little granulation tissue, springing from the humerus and inside the joint cavity, was excised. The external condyle was found to be displaced down and back, as well as rotated. Enough of this was removed to permit full extension of the elbow, as well as to overcome the cubitus varus. The olecranon fossa on the posterior surface of the humerus was also deepened by curette, so as to admit the olecranon in full extension. A cross incision was then made in the skin, backward across the arm from the upper extremity of the longitudinal incision, and a flap of fat was dissected up, with its base below; this fatty flap was then inverted over the surface of the external condyle, all the cartilage of which had been removed down to the bony centre for the capitellum. The fatty flap was sutured in place with chromic gut, and this was used for repairing the external lateral ligament and for closing the skin. The elbow was dressed in hyperflexion. The time of the operation was 50 minutes.

The first dressing was made ten days later, when the wound was found healed, and all the skin sutures absorbed. Motion was free and painless from 45 to 90 degrees. The arm was now carried in a sling. On December 5, there was motion from 40 to 140 degrees.

At present, three and half years after operation, there is perfect function, no varus deformity, full flexion, but extension only to 150 degrees.

2. *Arthrotomy and suture of fragment for ununited fracture of external condyle of humerus.* Mary G. fractured her right elbow when two years old. At the age of nine years she applied to Dr. Ashhurst for deformity and slight disability from weakness of the joint. Examination showed an ununited fracture of the external condyle, which moved with the head of the radius in

flexion and extension movements, which were not limited. The condyle was freely movable on the shaft of the humerus anteroposteriorly. In full extension there was cubitus valgus of 160 degrees; and this could be increased to 140 degrees by abduction of the forearm, which caused ascent of the external condyle on the shaft of the humerus. A skiagraph showed an ununited fracture of the external condyle, with rotation of the fragment anteriorly and outward, around a longitudinal axis.

The girl was admitted to the Episcopal Hospital, in the service of Dr. C. H. Frazier, and Dr. Ashhurst operated on October 23, 1909.

An incision four inches long was made on the outer side of the joint, between the supinator longus (brachioradialis) and the extensor muscles; the radial nerve was displaced anteriorly with the brachioradialis, and the humerus was bared. The elbow-joint was then opened through the line of fracture, and fibrous union was found. The humeral side of the fracture was chiselled off until healthy bone was found, and an attempt was made to rotate the condyle inward and backward, to restore normal relations. To accomplish this most of its attachments had to be severed, but the external lateral ligament passing from it to the orbicular ligament of the radius was carefully preserved. It was impossible to secure very accurate apposition. Then the fractured surface of the condyle was chiselled off. Best apposition was obtained with the elbow in full extension. The condyle was then sutured to the shaft with three chromic gut sutures, one of which passed through bone on both sides (shaft of humerus and centre for capitellum), and the others through cartilage and periosteum. The deep fascia was closed with chromic gut sutures and the skin with silkworm gut. A few strands of plain catgut were inserted as a drain. The arm was dressed in full extension, with the forearm in full supination, on a straight anterior splint, the carrying angle being about 170 degrees. The time of the operation was 70 minutes.

The first dressing was made ten days later (November 2, 1909). The catgut drain had been absorbed, the skin incision was healed, and the silkworm gut skin sutures were removed. Rotation in the forearm was normal in extent and painless; flexion to about 160 degrees was made without pain. The arm was again dressed in full extension. A week later the elbow was dressed at an angle of 135 degrees, flexion beyond which was painful. The

fragment seemed firm, but in full extension there was still a little lateral mobility. Progress thereafter was uneventful.

At present, two and a half years after operation, there is perfect function, flexion and extension being complete as before operation. There is no more lateral mobility in the joint than in the normal left elbow, the external condyle is firmly united to the humerus, and the only deformity is slight increase in cubitus valgus, which is 150 degrees, the normal carrying angle in this girl being 170 degrees. This may be remedied by an osteotomy of the humerus above the condyles.

3. *Old supracondylar fracture of humerus, with inward displacement of lower fragment, giving gunstock deformity.* James L., a boy of seven years, on July 26, 1911, fell over backward, crushing his left elbow between his back and the ground, his arm being held across his back at the time. The physician who was consulted dressed the elbow in a flexed position, probably corresponding to the "Velpeau" position. That night the father removed all the bandages because the arm was painful. The next day another physician dressed the elbow. Three weeks later the child was first seen by Dr. Ashhurst. The elbow at that time was dressed at an angle of 80 degrees, and was held against the chest by adhesive plaster. Motion was limited and painful. There was a sharp projection of bone in the region of the external condyle, and the skin overlying this was on the point of sloughing. On account of the swelling the exact relation of the bones could not be determined. The elbow was kept quiet until all inflammatory symptoms had subsided.

Skiagraphs made Sept. 19, 1911 (Figs. 1 and 2), showed a supra-condylar fracture, with marked internal displacement of the lower fragment; the sharp bony projection was caused by the lower end of the upper fragment jutting into the soft parts above the external condyle. A photograph made from behind, with the elbow flexed to a right angle and the bony points marked in ink, shows the deformity very well (Fig. 4). By October 27, three months after injury, the range of motion was still limited to 35 degrees of flexion and 140 degrees of extension. The carrying angle was lost, there being cubitus varus of 200 degrees (*i.e.*, the forearm was 20 degrees to the inner side of the axis of the arm, instead of about 10 degrees to the outside). There being no prospect of further improvement without operation, the patient

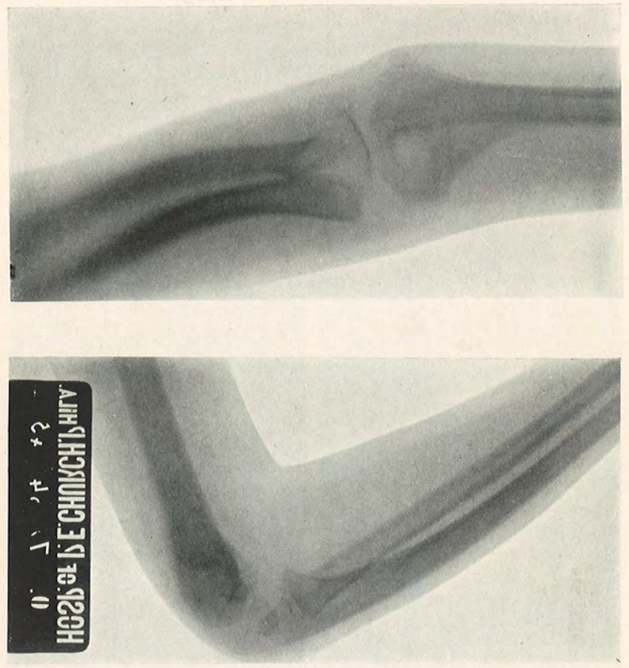


FIG. 1

Old supracondylar fracture of humerus, inward displacement of lower fragment producing cubitus varus. (Case III.) (Figs. 1 and 2, before operation.)

FIG. 2.

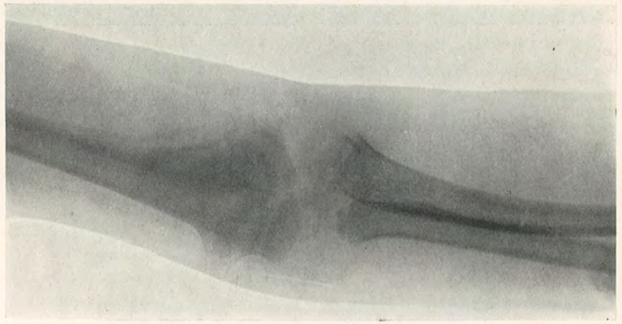
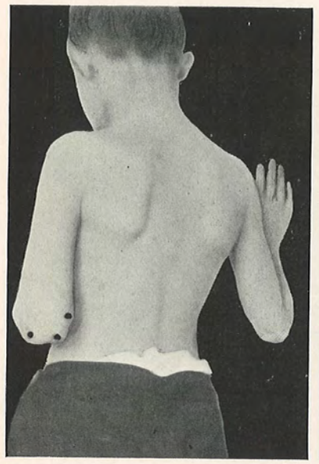


FIG. 3.

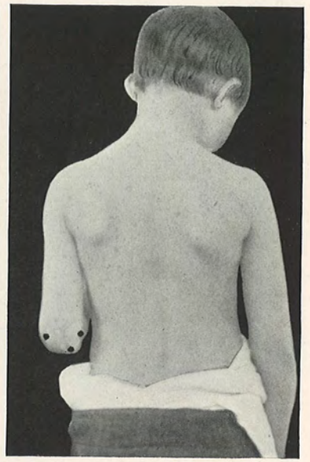
Four months after operation.

FIG. 4.



Old supracondylar fracture of left humerus, inward displacement of lower fragment. (Case III.)

FIG. 5.



Same patient six months after operation. Dots on condyles and olecranon. (Case III.)

was admitted to the Episcopal Hospital, in Dr. C. H. Frazier's service, and was operated on by Dr. Ashhurst before the members of the Congress of Surgeons of North America, November 10, 1911.

Operation: An incision four inches long was made on the posterior surface of the elbow, splitting the triceps muscle down to the shaft of the humerus. The periosteum was stripped away from the shaft on both sides of the incision, and *all around the shaft,* carrying the ulnar nerve well out of harm's way. A smooth retractor was then passed around the humerus, to protect the soft parts on the anterior aspect of the joint. The triangle of new formed subperiosteal bone, above the internal condyle, was then excised. Then the humerus was cut across in the line of the old fracture, just above the condyles, the section being made by osteotome and mallet. The lower fragment was then pushed forward. The elbow-joint had not been opened. Then, with Hey's saw, one-eighth of an inch of the lower end of the diaphysis was sawed off, and by means of gouge forceps and Liston's bone forceps the lower end of the diaphysis was trimmed until it fitted the elbow fragment of the humerus. This lower fragment was very small, extending only from the level of the olecranon fossa down into the joint, and nothing could have been removed from it without entering the joint, which it was not desired to do. The transverse axis of the upper fragment was made such that when fitted to the joint fragment the carrying angle was restored. It was then ascertained that both in hyperflexion and in extension to 170 degrees the lower fragment held its normal relation to the upper fragment without bone suture. The wound was then closed by interrupted chromic catgut sutures in layers, as follows: (1) periosteum; (2) deep fascia over triceps; (3) skin. No drain. After the wound was sutured, the fracture was reduced (by hyperextension, direct traction, and subsequent hyperflexion) just as if it was a recent injury, with no wound present. The elbow was dressed in hyperflexion (20 degrees), the forearm being brought up upon the arm directly in the sagittal plane. The wound was then dressed, and the elbow maintained in hyperflexion by the usual bandage. The time of the operation was 35 minutes.

A skiagraph (lateral view) made four days later showed that the lower fragment was tilted a little forward, so the hyperflexion was slightly reduced at the first dressing, November 15.

There was some infection of the skin sutures, but otherwise healing was uneventful and entirely painless. After three weeks the arm was carried in a sling, and soon after this active use was encouraged.

As extension was slow in returning, a light brace with a Stromeyer screw was applied, at the suggestion of Dr. G. G. Davis, some three months after operation. This was worn at night, and in a few weeks full extension could be secured every evening, very soon after the brace was put on, but during the day when it was not worn voluntary extension was somewhat limited.

At present, six months after operation, there is easy voluntary extension to 160 degrees, flexion to 35 degrees, a normal carrying angle, and scarcely any visible deformity (Figs. 3 and 5).

Dr. William L. Rodman said that in his experience when he had opened and drained these cases, especially the very septic cases where the joint was filled with pus, recovery occurred without ankylosis. When he had tried the more modern plan of aspirating these joints and throwing in formalin he had not gotten good results. He had at present a case on hand where the latter method has been pursued for streptococcic infection and there will be, he was sure, almost complete ankylosis. He could recall a number of cases where the opposite plan has been used with the most perfect successes. He recalled the case of a man under his care three months ago with a joint full of pus, where he aspirated the joint and put in formalin; the man got so much worse in 48 hours that he opened it, and put a tube in the joint, and the day the patient left the hospital he had about half as good motion as usual, but to-day his motion seems practically normal. He remembered a painter on a house who fell and a headless nail went into the knee-joint, and when he saw him the joint was full of pus, and there was an erysipelatous inflammation up to the thigh. He opened the joint, found a large amount of pus and also the headless nail. Two tubes were introduced for four weeks. About five years ago he met this man walking on the street and he had as good motion as any one could want. The erysipelatous inflammation was so extensive that all the superficial fascia sloughed out between the knee and hip.

He remembered also the case of a boy with pyæmia caused by osteomyelitis of the right tibia. The bone was entirely destroyed from one end to the other, the superficial tissues infiltrated extensively, and the joint full of pus, requiring an amputation at the lower third of the thigh. The opposite joint was also full of pus and yet there was no destruction of bone below, so feeling it would be most deplorable if the one leg he had were stiff, he put in a tube, irrigated daily with bichloride solution for weeks, and there was no ankylosis.

Another man with marked tuberculosis had a condition of most extensive involvement of the inner condyle of the femur, which was removed. He wore a drainage tube for six weeks, the joint being irrigated from day to day. He then weighed 85 pounds; to-day he weighs 150 pounds and there is no difference in the motion of his two joints. In Dr. Rodman's opinion open arthrotomy and drainage in purulent conditions particularly is the treatment of choice in spite of the positive statements from many surgeons that it is practically invariably followed by ankylosis. There has not been marked pain accompanying the injection in his hands of a 2 per cent. glycerin solution of formalin. He had also used it in empyema cases and had never seen any case relieved by it.

THE TREATMENT OF INTRACAPSULAR FRACTURES OF THE HIP.

BY GWILYM G. DAVIS, M.D.,

OF PHILADELPHIA,

Associate Professor of Applied Anatomy in the University of Pennsylvania.

In spite of the amount of attention which has been bestowed on this subject we still come across cases of ununited intracapsular fractures of the hip in patients totally disabled who are otherwise in good health. This is evidence that the treatment to which they were subjected was inefficient. Most of these cases which have come under my notice have been treated as is not unusual with fractures of the shaft of the femur, that is, by longitudinal weight traction and sand bags. I am thoroughly convinced of the utter inefficiency of this method of treatment, and think it time for the profession generally to recognize that such is the case. In the aged, at times, it is justifiable to ignore attempts at union in order to preserve life, but in many cases, even though advanced in years, we can make some effort to obtain better local results. Of all the methods suggested for the treatment of recent fractures I am most partial to that originally suggested by Phillips and later by Maxwell and advocated by Ruth of Iowa, many years ago. It consists of the usual longitudinal traction with weights and sand bags or other device to hold the foot vertical, supplemented by lateral traction by a weight over the side of the bed, drawing the upper portion of the thigh out. I have also obtained good results by the use of plaster of Paris, putting the limb up in extreme abduction as advised by Whitman in cases of children. Of these two methods the lateral traction is the one usually easier to apply and carry out, and as it is efficient I prefer it.

In regard to ununited intracapsular fractures of the hip there are of course many cases in old people abroad in the community, but they do not seem to be the ones clamoring for

treatment. These patients are naturally not very active and are probably warned that their condition is hopeless and hence accept the inevitable with resignation. There is a younger set, however, all the way from comparatively young adults up to fifty-five or sixty years of age, who come to our hospitals and apply for relief, usually using crutches and practically totally disabled. They usually apply from about four or five months to a year and a half after the injury. In the *University Medical Magazine,* September, 1900, I reported two cases in which I had operated on two such cases, using in one steel pins to hold the fragments together and in the other ivory pegs. In a subsequent article in the *American Journal of Orthopædic Surgery* of February, 1909, I briefly reported the use of steel screws to pin the fragments in three cases, but the main object of the paper was to show that satisfactory results could be obtained by freshening the ends of the fragments and keeping them in contact by placing the limb in forced abduction encased in plaster of Paris. Three additional cases were reported illustrative of this method of treatment, in which no foreign bodies were used for fixing the fragments in position.

Finally, the idea suggested itself that if it is possible to dispense with the use of fixation by the insertion of nails, screws, etc., it might also be possible to secure a sufficient amount of fixation and support of the part by persistently fixing it in an abducted position and allowing the patient to walk on it without doing any open operation at all.

Occasionally a case will present itself in which operation for one reason or another is not advisable; therefore it is in the highest degree desirable to know what can be done for these cases by non-operative measures. To obtain any reliable information on this point, cases must be followed for a long time, which is usually a matter of considerable difficulty. The following experiences are submitted. Skiagraphs were made of nearly all of them.

Case I.—A man aged thirty-seven applied for treatment with an ununited intracapsular fracture of the femur of nine months' standing. It had resulted from a fall or other violence and had

been treated with rest in bed for five weeks, after which he got up and around on crutches. On admission to the hospital he had about 1½ inches shortening, his greater trochanter could be felt sliding up and down when weight was put on it; he had marked eversion of the foot, grating on motion, considerable pain, and was only able to get around with crutches.

Treatment.—For a week he was put in bed with weight extension with the limb in an abducted position. Good abduction having been obtained, the limb was placed in marked abduction and a plaster-of-Paris cast applied from the waist to the toes. Four days later he was gotten out of bed and left to go around with a crutch and cane. The plaster-of-Paris cast was kept on for six or eight weeks, and then an abduction splint was substituted for it.

The amelioration of symptoms was marked from the start. At first he used crutches, but soon discarded these for a cane, which he has continued to use since.

When he started to walk he felt the fragments move in the hip, but that has ceased and he feels no movement when walking, but still can feel it a little when he makes an unusual or side step. His latest communication, nearly two years after commencing treatment, stated that his leg was getting less painful and that he was still improving. He can walk as much as three miles at a time. The shortening remains as at first, the position of the foot is natural. Flexion and extension are perfect, abduction limited, and rotation somewhat limited.

This man has nearly as good a result as if he had been operated on, but not quite, and operation would probably have saved him a good bit of time and considerable pain. This man has a lawsuit on hand, a fact which is liable to make these patients pessimistic.

Case II.—The patient was a man aged forty-six. His fracture was of five months' standing. He complained of constant pain, marked disability, walked with crutches, shortening one inch, and not very much movement of the fragments.

Treatment.—A plaster cast was applied and worn for six weeks. The pain in the hip disappeared, but he had pain in the knee, which still remained after five months.

This man is walking around now, about two years after the injury, with a cane. He still complains of pain in the knee and he is not working and is not looking for work. No motion is perceptible in the hip.

This case resulted in the man being permanently disabled, that is, he is not earning his living. He looks like a tramp and, as is not uncommon, he may have seized on his injury as an excuse for loafing.

Case III.—A man aged forty-eight years was treated for the original injury in a hospital with longitudinal extension and sand bags. Injury occurred eight months previously and on application for treatment walks only with crutches, has difficulty in going up and down stairs. Hip feels weak and gives way. There is considerable movement to be felt when he puts his weight on the limb and there is shortening of an inch or more. Pain severe, especially at night, and cannot lie on the affected side.

Treatment.—He was treated with a plaster cast and the limb placed in abduction for four months and then an abduction splint was applied. The splint did not please him and he never wore it. It is now two years since the injury and he has no pain. He says the hip does not slip, but on putting one's hand on the hip and having him bear his weight on it, it does seem to slip somewhat. He says he can walk all day with a cane and could go to work, but he cannot find any. He desires to tend horses and work in a stable. He says his hip is getting stronger all the time.

This man will be probably all right in a few more months.

Case IV.—A man aged fifty-two. Treated for the original injury by straight extension and sand bags. He complained of bad pain in his right hip, loss of power, and there was movement and shortening. The time which had elapsed since the accident was not stated.

Treatment.—He was put up in plaster, the limb being markedly abducted. The cast was worn for about two months and then replaced with a brace. Improvement was prompt and satisfactory from the start and seven weeks after the cast was first applied he could walk 20 squares (two miles), using only a cane. Now two years after first applying for treatment he can walk practically all day. He carries a cane and limps. He has been

a watchman and janitor in a club, going up and down four flights of stairs. The hip does not slip. He wears no brace, but he says he sometimes has a pain in the thigh when he gets in a cramped position. This is a good result.

CASE V.—Man, aged fifty. He was treated for the original injury six weeks in a hospital and then laid up home for four weeks more. Since going around (not stated how long) he uses two crutches, and while he could go two miles just allowing the toes to touch the ground, still he had so much pain anteriorly down the thigh and knee that he applied for treatment. The hip was very insecure and very painful.

Treatment.—He was put to bed and weight extension with the limb in abduction was applied for four weeks. A plaster cast was then applied and in seven weeks he was walking about the ward without crutches and only complained of a little pain posteriorly. A brace was then fitted and he left the hospital, discontinuing treatment. This man had a lawsuit on hand and it appeared as if he thought he was getting well so quickly that it would prejudice his case before a jury, so he kept away and declined further treatment.

CASE VI.—Woman, about forty-eight years of age, was treated for the original injury in a hospital for a fractured nerve (?) with sand bags only, no weights. When she came under treatment 10 months after the injury, pain was constant and very severe. She used crutches.

Treatment.—She was treated as an out-patient and the hip put up in abduction in plaster of Paris for nine weeks and after that an abduction splint applied. She improved very markedly for a time, and finally used only one cane, but still complained of pain.

At present, one year and nine months after first seen, she is still going around on one cane and complaining so much of pain that she wishes to be operated on.

Unfortunately this patient is addicted to the use of liquor and it is questionable as to what extent her bad habits are influencing her general condition. She has apparently changed her mind about having the operation because she has failed to avail herself of an opportunity to enter the hospital for treatment.

CASE VII.—Man aged sixty-five years. On entering on a term of service in one of our hospitals this patient was found

helplessly bedridden for months with an ununited intracapsular fracture of the hip.

Treatment.—He was put up in plaster of Paris with the limb abducted, and in two months he was up and walking about.

CASE VIII.—Man aged forty-one years was hurt by being thrown from a wagon. His treatment is unknown. Three months later there was non-union. He lay on a lounge five months longer and then began walking around with a cane. Four months later, or a little over a year from the time of the accident, he began to do a little work and has worked steadily since a year and seven months after the accident. He is a driver and can go on and off his wagon without trouble.

This was a case probably of fracture low down toward the trochanters and after a year's time firm union occurred.

Since my attention was first directed to these cases of intracapsular fracture of the hip, with regard especially to the question of serviceable union, I have operated and reported on about five cases in which screws, pins, etc., were used for fixation; on three cases in which the edges of the fragments were freshened by open operation and the limb then treated in abduction with a plaster splint; and now submit eight cases in which no operation whatever was done, most of which have been under observation for about two years. Other cases have come under my care, mainly recent ones, in which the fragments have either been fastened with a screw or the cases treated conservatively by means of the combined lateral and longitudinal traction or by fixing the limb in forced abduction by means of a plaster-of-Paris cast. From these and other experiences we feel justified in concluding as follows:

1. Fracture of the neck of the femur in children is best treated by putting the limb up in plaster in the abducted position as suggested by Whitman. Success will almost certainly be achieved by this method. A lack of treatment is usually followed by union with a certain amount of shortening, limp, and coxa vara.

2. Fracture of the neck of the femur is not a rare injury

in young adults or in those whose bones have not weakened with age.

3. In these otherwise healthy adults, say up to fifty-five years, treatment of the injury by longitudinal traction alone will not infrequently result in loose and disabling non-union, often with severe pain, for a year and a half or longer.

4. Treatment in this same class of cases by longitudinal combined with lateral traction or by putting them up in wide abduction in plaster of Paris will usually result in sufficient fixation to give a useful and serviceable limb.

5. Of the two methods of treatment, that by longitudinal and lateral traction is by far the easier to apply and is more suitable the older the patient. For the plaster cast to be efficient requires great skill in its application and is better adapted to the younger patients.

6. In those cases in which the fracture runs down toward the trochanters, firm union and fixation may take place after a period of disability lasting more than a year.

7. The surest way of remedying cases of ununited fracture of the neck of the femur is to cut down, freshen the edges of the fragments, pin them together with screws, nails, or other means, and put them up in the abducted position.

8. When foreign bodies are inserted to pin the fragments together they are likely to cause discomfort sufficient to necessitate their removal. Considerable discomfort follows the operation and the patient is inclined to attribute this to the nail or screw and demand its removal.

9. Firm union can be obtained by freshening the surfaces of the fragments and then jamming them together by widely abducting the limb and fixing it in plaster of Paris without the use of any nails, screws, or other fixation appliances.

10. Convalescence, even after operations, may be prolonged and it may even be a year before good use of the limb is obtained; at all events its condition continues to improve for a long time.

11. If no operation is done non-union results in total disability, necessitating the use of crutches for a long time. The pain is often distressing and the hip insecure. Even these cases

tend to improve and ultimately the pain may disappear and locomotion be fairly satisfactory.

12. In cases in which operation for one reason or another is inadvisable, much relief can be given by conservative measures and it is well worth while to institute them.

13. The best means of treatment by conservative measures is to fix the affected limb in a position of wide abduction by means of a plaster-of-Paris cast extending from the waist to the toes.

14. This abduction is to be obtained either under general anæsthesia or by weight extension with the limb in an abducted position, which is increased to its limit while the patient is confined to bed for a week or two.

15. The immediate result of the application of the cast is to cause a marked lessening of the pain and increased comfort in locomotion.

16. A persistent use of the plaster bandage gives the greatest relief and causes the quickest fixation.

17. When, for any reason, the use of the plaster-of-Paris bandage is undesirable, then it may be substituted by a brace, which, however, is usually not so efficient as is the plaster of Paris.

18. Persistent use of non-operative conservative measures may be roughly estimated to give after the lapse of two years about 40 per cent. of cases with firm, painless hips. Another 40 per cent. will be very much improved and may or may not earn their living, according to their industry, their habits, and their surroundings. Twenty per cent. will probably remain so much disabled as to be unwilling to work even though pain may not be great. They will usually walk with a cane.

19. The treatment by operation either with or without fixing of the fragments by screws, nails, etc., according to the wishes of the surgeon, results in quicker and better healing than by non-operative means.

20. In the aged many cases are of necessity to be treated with a view solely to maintaining life.

21. In not a few aged cases the vitality is such as to justify an attempt to give a serviceable limb. In these cases the com-

bined longitudinal and lateral traction is usually the method of choice, although under exceptionable circumstances, such as abundant skilful aid and sufficient facilities, fixation in the abducted position in plaster of Paris may also be used.

Dr. John B. Roberts asked Dr. Davis to tell how to treat fracture of the neck of the femur in comparatively aged women, in whom the line of fracture runs through the base of the neck and far enough down the shaft to allow the lesser trochanter to be part of the upper fragment. That is the fracture which to him is the most difficult to manage and it needs orthopædic work which he had not been able to give it. In the ordinary fracture through the base of the neck he expected fair union through longitudinal traction with some form of Buck's extension, but the fracture higher up is the one apt to be followed by non-union. When the fracture runs downward leaving the lesser trochanter attached to the cervical fragment, there is an opportunity for the iliopsoas muscle to tilt the upper fragment upward and outward. Such deformity should be nailed or treated with Hodgen's or Smith's splint, or by vertical traction, such as is used in fractures of the femur in infants. By the last method it is more easily possible to get the bed-pan under the buttocks.

Dr. John H. Jopson took exception to one point in the paper, that is to say the inefficiency of longitudinal extension in fracture of the neck of the femur either in middle-aged or old people. He was not as gloomy about the prognosis of these cases as a good many surgeons are. It is mainly a question as to whether they will stand confinement to bed; in the majority of cases, if the treatment is persisted in a good result will follow. He had seen recovery with good function in one patient aged 95.

Dr. Joseph M. Spellissy said that he was surprised at the frequency with which Dr. Davis met with non-union of fractures in middle-aged people. Dr. Spellissy agreed with Dr. Jopson that, usually, with persistence of longitudinal extension even in the very aged, union can be obtained, and stated that he had obtained union in a patient aged 86 years.

He emphasized the need of lateral counter-traction when lateral traction is employed in fractures of the femur.

Dr. A. P. C. Ashhurst said that some years ago with the help of his resident at the Episcopal Hospital he traced the fractures of the femur which had been treated there for the previous three

years and he found that the results in fractures of the neck of the femur were not as bad as he expected; 13 out of 21 patients traced had no other disability than a limp; and he thought Dr. Davis's unfortunate experience was due to the fact that the Orthopædic Hospital is a clearing house from all over the city and surrounding districts for all the bad bone results from all surgeons. They come there helpless, and Dr. Davis turns them out with good results.

It is a matter also of literary interest to recall that it was a surgeon named Phillips in 1869 who introduced the method of longitudinal and lateral traction which is now known by the names of Ruth and Maxwell. In the *American Journal of the Medical Sciences* for 1869 he explains the reasons for using this method, and gives an excellent illustration of his method.

Dr. Addinell Hewson differed with the statement regarding the falling of the fragments of the capsule between the ends of the severed bones. If a careful dissection is made, it will be found that the obturator muscles, particularly the external obturator, is in such close contact with the neck and head of the bone and is of such density as to act as a band holding the neck of the femur firmly in place. Ventrally, the psoas and iliacus act as a band in the opposite direction; while portions of the capsule are extremely thin in contact with these tendons mentioned, there are other portions, as the Y-shaped ligaments, the pubo femoral and the ischio femoral, these are for the most part, away from the attachments of the muscles named. He believed that surgeons fail to take into consideration these obturator muscles because of their forgetfulness of the anatomy of the part. If a dissection is made, it is really surprising to see the extent of the obturator muscles and the iliopsoas in relation to this joint. Dr. Davis spoke of Smith's anterior splint in the treatment of fracture of the femur. He thoroughly believed with him, in the use of this splint in preference to Buck's extension. If the former is properly applied, the extension thus obtained will reduce a certain amount, if not all, of the deformity. Certainly the patients are much more comfortable than with the Buck's extension. He failed to see how one could, with Buck's extension alone, keep the hip joint absolutely quiet when the patient is called upon to use the bed-pan, whereas in the use of Smith's anterior splint, the seat of fracture is kept perfectly at rest, and the patient can use the bed-pan and be clean, without disturbing the fragments in any way.

Dr. G. G. Davis (in closing) remarked that as regards Dr. Roberts's peculiar fracture, he had not seen many of that type. Ordinarily the cases have been first those of the neck high up, entirely intracapsular, next those down toward the base of the trochanter, third those through the trochanter, and finally those at the juncture of the upper and middle thirds of the shaft of the femur. The last partake of the troubles peculiar to the fracture that Dr. Roberts relates; that is the type in which one must resort either to having the leg vertical, as Bryant suggested, or to the Smith or Hodgen anterior swinging splint or the double inclined plane, all of which are efficient, or to operation. When it comes to the fractures through the trochanter he had never had the slightest difficulty with them. There has been no trouble in their uniting and he had never seen non-union in that type.

He regretted very much that Dr. Jopson should have so publicly stated his preference for the simple longitudinal traction for fractures of the neck of the femur, because he was perfectly well convinced that the bulk of cases of ununited fractures of the neck of the femur have been treated in that manner. Not only that, but that the treatment is very much more inefficient than is the Phillips, or the Ruth and Maxwell method of lateral and longitudinal traction or the method of extreme abduction.

As regards the number of cases, he referred in his paper to 16 cases. He had just gone on service at Blockley where there are two more, and there is another case he had been asked about in California, and no doubt before the year ends he would come across one or two more. They are certainly prevalent in this community. Most of them have been treated with longitudinal traction. He knew very well the course these cases take without treatment, and it was to illustrate this that he added his last case, in which there was a person who had, three months after injury, absolute non-union and disability for a whole year, and yet afterwards obtained excellent results. But when a patient has been operated on, then goes to work and is the means of getting another patient to come who has not been operated on, he took it as evidence that when these patients discuss things they find the condition of the operated better than the non-operated case, otherwise they would not apply for treatment by operation.

As regards the capsule between the fragments it does not get between them as it is pushed upward.

A STUDY OF SPRAIN-FRACTURE AS AN ESSENTIAL TO THE OCCURRENCE OF DISLOCATION.

BY GEORGE G. ROSS, M.D.,

OF PHILADELPHIA,

Surgeon to the Germantown and Stetson Hospitals; Assistant Surgeon to the German and University of Pennsylvania Hospitals,

AND

LEVER FLEGAL STEWART, M.D.,

Resident Physician in the German Hospital of Philadelphia.

In a study of sprain-fracture recently presented before the Academy of Surgery of Philadelphia occasion was taken to make the statement that we thought probably all dislocations were permitted by the primary occurrence of sprain-fracture. Our statement was based on the fact that when tension was made on tendons or ligaments we found that the bony tissue to which the tendons or ligaments were attached, and not the tendons or ligaments, gave way (Ross and Stewart).[1] Therefore we reasoned: since the integrity of joints is maintained by strong ligaments, a luxation must occur by a giving way of one or more of the strong ligaments, and this giving way must be by the occurrence of sprain-fracture, and not by rupture of the ligaments. This reasoning applies to ordinary uncomplicated traumatic luxations, not the so-called pathological dislocations (those of slow production due to disease of the joint structures, and not those dislocations due to trauma, that are permitted by rupture of diseased ligaments). In this connection we wish to discuss fracture dislocation, a condition which is well recognized and which we also know is produced most often through the agency of ligaments or tendons, though occasionally produced by direct violence.

Our modern text-books have nothing to say concerning sprain-fracture by itself or in connection with dislocation excepting in a very vague and indefinite way that obtains in their

discussions of symptomatology and treatment. Nevertheless, they seem to be unanimous in the opinion that sprain-fracture under any circumstance is rare.

EXPERIMENTAL DISLOCATIONS ON DOGS.

In working for practical verification of the truth of our assertions we made thirty-six attempts to produce luxations in the joints of dogs, which, with two cases previously studied in dogs, allowed an observation of the pathology in thirty-eight attempts at luxation carried out on living tissues.

These experiments were carried out at the Laboratories of Surgical Research of the University of Pennsylvania. The animals were completely anæsthetized with ether, as is the rule governing all animal experimentation carried out in the laboratory. Following the production of the dislocations on each dog, that dog was killed by poisoning with illuminating gas while still deeply anæsthetized.

Dog and human anatomy differ but slightly; as applied to this work there is no difference between the two, and, to facilitate the understanding of these experiments, the same terminology used in human anatomy will be adhered to.

EXPERIMENT I.—The left leg and foot were taken in either hand and the foot was then turned outward until the resistance encountered was overcome.

Dissection of the ankle-joint showed no lesion, but an epiphyseal separation from the lower tibia was found.

EXPERIMENT II.—By the method used in Experiment I, the right foot was turned inward until the resistance encountered was overcome.

Dissection showed an internal luxation of the foot, sprain-fracture of the external malleolus, sprain-fracture of the external articular border of the astragalus, and sprain-fracture of the tuberosity of the fifth metatarsal.

EXPERIMENT III.—By grasping the thigh and leg in either hand, placing the thumbs on the external junction of the femur and tibia, and pulling toward the thumbs, an attempt was made to separate the internal articulating surfaces of the femur and tibia.

Dissection revealed a sprain-fracture of the external condyle of the femur, produced by the short band of the external lateral ligament of the knee-joint, and an epiphyseal separation at the lower end of the femur.

EXPERIMENT IV.—With the thigh and leg grasped in either hand, the leg was forced to bend laterally on the femur in both directions.

Dissection showed an epiphyseal separation at the lower end of the femur.

EXPERIMENT V.—An anterior luxation of the left hip-joint was produced. An assistant held the pelvis to the table while the femur was carried through the motions Allis[2] described for the production of such a luxation.

Dissection of the joint showed anterior luxation of the head of the femur, epiphyseal separation at the upper end of the femur, sprain-fracture involving the head of the femur where the posterior inferior portion of the capsular ligament was attached, sprain-fractures at the sites of attachment of most of the tendons in this region, and fracture of each trochanter.

EXPERIMENT VI.—By the means described in Experiment V, a posterior luxation of the right hip was produced according to the method described by Allis.

Dissection of the hip-joint permitted the detection of a posterior luxation of the head of the femur, an epiphyseal separation of the great trochanter of the femur, a sprain-fracture of the acetabulum at the attachment of the ligamentum teres to it, a sprain-fracture of the acetabular rim through the agency of the posterior superior portion of the capsular ligament, sprain-fractures at the sites of attachment of most of the tendons attached in this region, and a pulling from the upper femur (from the trochanters up) of most of its periosteum.

EXPERIMENT VII.—The left arm and forearm were grasped in either hand and, using the thumbs as a fulcrum, the internal joint surfaces were separated.

Dissection exposed a subluxated joint with sprain-fracture of the radius at the site of attachment of the anterior capsular ligament, of the ulna at the anterior attachment of the orbicular ligament, and of the humerus at the attachment of the external lateral ligament.

EXPERIMENT VIII.—Using the same mechanism as in Experiment VII, an attempt was made to separate the external joint surfaces at the right elbow.

Exposure by dissection showed a sprain-fracture of the ulna at the posterior attachment of the orbicular ligament, and an epiphyseal separation at the lower end of the humerus.

EXPERIMENT IX.—Right knee-joint.

EXPERIMENT X.—Left knee-joint.

EXPERIMENT XI.—Right tarsometatarsal joint.

EXPERIMENT XII.—Left tarsometatarsal joint.

These joints were subluxated by grasping the bones above and below them in either hand and forcing motion in those directions where resistance was met with.

On cutting down on these joints it was found that subluxations and sprain-fractures had occurred in all. In the right knee-joint both crucial ligaments were pulled from the femur. However, the anterior crucial liga-

ment alone pulled fragments of bone with it. In the left knee-joint both crucial ligaments pulled bony tissue with them. Both tarsometatarsal joints showed sprain-fractures involving the superior articulating surfaces of the tarsal and, to a lesser extent, metatarsal bones.

EXPERIMENT XIII.—The left elbow-joint was luxated by placing the thumbs on the joint laterally and externally and pulling the humerus and bones of the forearm toward the operator, thus shoving the olecranon and head of the radius inward.

Examination showed luxation inward of the forearm, and a sprain-fracture involving the internal condyle at the attachment of the internal lateral ligament.

EXPERIMENT XIV.—An attempt was made to luxate both wrists by twisting and bending the hand bones on the arm. A giving way was felt.

Incision showed the joints to be intact, but fractures of both bones of the forearm just above the wrist were discovered.

EXPERIMENT XV.—The right humerus was abducted and turned so as to overcome all resistance.

The joint was exposed, showing a subluxation of the humerus, a sprain-fracture of the posterior border of the glenoid fossa produced by the posterior capsular ligament, and a fracture of the neck of the scapula.

EXPERIMENT XVI.—The left shoulder-joint was treated as was the right in Experiment XV.

The humerus was subluxated. Sprain-fractures involving the posterior border of the glenoid fossa and the attachment of the biceps tendon were found.

EXPERIMENT XVII.—The thumbs were placed on the olecranon process of the right arm and the arm and forearm were bent backward on them; after a certain point was reached the humerus and the bones of the forearm took an inward course.

The joint was cut down upon exposing a supracondylar fracture and a pulling away of bony tissue from the internal condyles by the internal lateral ligaments.

EXPERIMENT XVIII.—The same as Experiment XVII, done on the left arm, with the same result.

EXPERIMENT XIX.—The left forearm was held firmly in one hand just above the wrist and the hand was bent back upon it until resistance ceased to exist.

In this way fracture of the bones of the forearm was produced.

EXPERIMENT XX.—The left leg was extended on its thigh until there was a giving way.

Epiphyseal separation from the upper part of the tibia was found.

EXPERIMENT XXI.—The same as Experiment XX, excepting it was done on the right side.

The result was the same as in Experiment XX.

EXPERIMENT XXII.—The left foot was bent outward until a partial luxation was produced at the ankle-joint.

Subluxation of the foot, and sprain-fractures of the internal malleolus and of the tibia and astragalus were found.

EXPERIMENT XXIII.—Experiment XXII was repeated on the right side.

The same result was obtained.

EXPERIMENT XXIV.—Flexion and extension were practised on the right tarsometatarsal articulation until subluxation resulted.

Subluxation and large and small sprain-fractures of the bones involved in the articulation were found.

EXPERIMENT XXV.—The same experiment (XXIV) was repeated on the left.

The result was the same as that in Experiment XXIV.

EXPERIMENT XXVI.—The left foot was turned outward, seemingly producing an external luxation at the ankle-joint.

An epiphyseal separation was found at the lower end of the tibia.

EXPERIMENT XXVII.—The right foot was turned inward, producing an internal luxation.

Examination showed luxation of the foot inward and sprain-fractures involving the external malleolus and the external articular border of the astragalus.

EXPERIMENT XXVIII.—The left lower extremity was bent at the knee by pulling the leg and thigh outward and pressing the joint inward.

Thus a separation of the lower epiphysis from the femur and a pulling away of bony tissue from the external condyle were produced.

EXPERIMENT XXIX.—The right leg was bent to either side on the femur.

Examination showed a separation of the lower epiphysis from the femur.

EXPERIMENT XXX.—After making the pelvis fast, an anterior luxation of the left hip-joint was produced by carrying the femur through the motions described by Allis as producing anterior luxation of the hip-joint.

Dissection showed luxation of the head, separation of the upper epiphysis from the femur, fractures of both trochanters, and sprain-fractures of the head of the femur (especially at the attachment of the posterior inferior capsular ligament) and of all the bones in this vicinity, from which most of the tendons pulled fragments.

EXPERIMENT XXXI.—The pelvis remaining fixed, the right hip was made the object of a posterior luxation after the description of Allis concerning the way in which it was prone to occur.

Isolation of the structures in the joint region showed posterior luxation of the head of the femur, sprain-fractures of the acetabulum at the attachment of the ligamentum teres and the posterior superior portion of the capsular ligament, sprain-fractures of the bones in this region at the attachments of most of the joint tendons, separation of the epiphysis from the greater trochanter, and a pulling from the bone of all the periosteum from the level of the trochanters up.

EXPERIMENT XXXII.—The left elbow was bent laterally so that the lower humerus and the upper radius and ulna went inward.

Subluxation was produced, and at the sites of attachment of the orbicular ligament to the anterior ulna, the anterior capsular ligament to the radius, and the external lateral ligament to the humerus, sprain-fractures were found.

EXPERIMENT XXXIII.—The right elbow was bent laterally so that the lower humerus and the upper radius and ulna went outward.

Sprain-fracture of the ulna at the posterior attachment of the orbicular ligament and separation of the lower epiphysis from the humerus were found.

EXPERIMENT XXXIV.—Right shoulder-joint.

EXPERIMENT XXXV.—Left shoulder-joint.

EXPERIMENT XXXVI.—Right elbow-joint.

Strain was placed on these joints by twisting; this was persisted in until a crackling was heard, but the integrity of the joints was not disturbed.

Dissection in all three cases showed avulsion of the tendons around the joints from their normal channels.

EXPERIMENT XXXVII (Experiment I).—The skin, ligamentum patella, and all tendon attachments around the left knee-joint were severed. The femur was held in a vice and the leg was grasped with the hand and hyperextended and twisted until the joint was flail-like (subluxated).

Examination showed no gross lesions of the capsule. Further, opening of the joint showed the external lateral ligament partly torn from its attachment to the external condyle of the femur; the tear involved the osseous and not the ligamentous tissue (a sprain-fracture). The tear was due evidently to a lateral twist, as it did not occur in the direction of the course of the ligament.

(The above experiment was done after it was found that weight aggregating 160 to 175 pounds, hung from the tibia, would not make the joint give way.)

EXPERIMENT XXXVIII (Experiment XV).—The left hip was exposed; all of the muscular attachments in this region were cut, leaving the articulation surrounded by its capsule alone. The femur was rotated externally and abducted, producing a luxation.

Examination showed a tear (?) of the weak upper postero-external portion of the capsule and a sprain-fracture at the insertion of the ligamentum teres.

We feel compelled to again refer to Experiments VIII and XII of our previous work on sprain-fracture, as they give admirable demonstration of a stage through which the joint passes before becoming luxated.

EXPERIMENT XXXIX (Experiment VIII).—All skin was removed from the region of the left ankle-joint. All of the tendons passing between points above and below the joint were severed. The tibia was held tightly in a vice. A two-pronged hook was hung from the foot; one prong was hooked around the os calcis, while the other was hooked around the foot over the anterior tarsal bones; weights were hung on the hook.

Fracture of the calcaneum, involving the surfaces articulating with the astragalus, resulted. No ligamentous tears were found.

EXPERIMENT XL (Experiment XII).—Same as Experiment XXXIX. The hook slipped from its attachment after some pulling force had been brought to bear.

Examination showed that the anterior band of the external lateral ligament of the ankle had pulled away some bony tissue at its point of attachment to the astragalus. No injury to the ligament occurred.

Of these thirty-eight cases, thirteen showed no dislocation; three cases in which an attempt was made to do nothing more than use a straining force, such as if increased would cause dislocation, showed avulsion of the tendons in the joint region (by this we mean a migration of all or parts of the tendons from their normal courses or channels, permitted by a giving way of the tissue binding them to their courses, there being, however, no giving way of tendon fibres); ten cases showed either fracture or epiphyseal separation above or below the joint receiving our attention, two of these showed sprain-fracture in addition, but in neither of these was the integrity of the objective joint distinctly disturbed; seventeen cases showed subluxation, and in all sprain-fractures were demonstrable; further, four of them showed fracture in addition to sprain-fracture; eight cases showed complete luxation with sprain-fractures accompanying; four were also accompanied by gross fracture.

Early in the course of these experiments avulsion of tendons was frequently noted, and Experiments 34, 35, and 36, in which avulsion of tendons alone was noted, were done by applying dislocation-producing force of a mild character. It would seem that avulsion of tendons, by changing the direction of their pull, aids the occurrence of dislocation.

In the ten other cases showing no luxation, fracture occurred, thus preventing the continuation of luxation-producing force and again demonstrating the superiority in tensile strength of the tendons and ligaments over bone. As previously noted, eight of the cases were fracture dislocations or fracture subluxations; though the same condition could have been and is occasionally produced by direct violence, these fractures, like the ten cases just mentioned, were produced

Dissection revealed the presence of the head of the humerus largely in a subglenoid position. Sprain-fracture of the greater tuberosity of the humerus at the insertion of the supraspinatus muscle was found. At the same site a slight rent of the capsule was found. Otherwise the capsule was undisturbed (see Fig. 2).

The inferior portion of the capsule was severed in dissection.

EXPERIMENT XLIII.—Following the method described by Allis, the pelvis was fixed and a posterior luxation of the right hip was attempted and produced clinically.

Dissection demonstrated a posterior luxation of the head of the femur, sprain-fracture of the head of the femur caused by a pulling of the ligamentum teres from the fovea, and a rent in the anterior and inferior part of the capsule extending from just below the acetabular rim anteriorly around the neck of the femur internally to the attachment of the capsule to the femur posteriorly. It was doubtful as to whether the rent in the capsule was due to a tear or a separation of the fibres; microscopic sections proved that it was a separation of the fibres. The reinforced portions of the capsule were undisturbed.

EXPERIMENT XLIV.—An attempt was made to produce an anterior luxation of the left hip according to the description of the mechanism given by Allis. In the attempt it was found impossible to produce more than a subluxation, as the head could not be sent forward from the site of the acetabulum. At the stage of the manipulation where extreme abduction of the leg was attempted it was noted that the left testicle left the scrotum and that there was a distinct dimpling of the skin between the head of the femur and the anterior rim of the acetabulum. Further manipulation revealed the fact that as the head of the femur left the acetabulum the left testis was drawn from the scrotum over into the acetabular cavity, presumably by the vacuum produced when the head left the cavity.

Dissection showed a longitudinal rent in the coverings of the spermatic cord posteriorly and just below the pubic spine, that had permitted the exit of the testis from the scrotum. At the joint, subluxation of the head of the femur, sprain-fractures of the anterior and inferior acetabular rim, sprain-fracture at the anterior edge of the junction of the great trochanter and femur through the agency of the ileofemoral ligament, and separation of the fibres of the pubofemoral ligament were found (see Fig. 3). Those sprain-fractures involving the anterior and inferior portions of the acetabular rim were produced through the agency of the cotyloid and capsular ligaments and seemingly independently. The largest sprain-fracture of the rim was just below the cotyloid notch.

EXPERIMENT XLV.—The lower right humerus was placed under a stationary iron bar, then the arm and forearm, in either hand, were pulled upward until what appeared to be a posterior luxation of the ulna was produced.

Dissection confirmed the posterior position of the ulna. A separation of the fibres of the flexor sublimus digitorum near the internal condyle,

through the agency of ligaments or tendons. Therefore the fractures forming part of the pathology of fracture dislocations are in reality sprain-fractures of enormous dimensions.

The twenty-five dislocation cases, seventeen of which were subluxations, all showed sprain-fracture.

These experiments suggest a mental moving picture of the phases though which the tissues concerned in a subluxation or luxation pass, from the beginning to the termination of the force producing the subluxation or luxation. These phases are: first, strain of the tendons or ligaments (the placing of tension on them); second, avulsion of the tendons and continuation of the strain; third, sprain-fracture or gross fracture, or both, produced through the agency of the ligaments alone, or of the ligaments and tendons; fourth, continuation of the force resulting in subluxation or luxation.

CADAVER EXPERIMENTS.

On taking up this work we were not unmindful of the fact that degeneration, and therefore weakness, especially of the soft tissues, begins immediately following death; however, we appreciated keenly that the cadaver offered larger structures more easily isolated, but, above all things, the same structures that concern us clinically. In addition, we wished to ascertain the seats of sprain-fracture in luxations occurring in human anatomy.

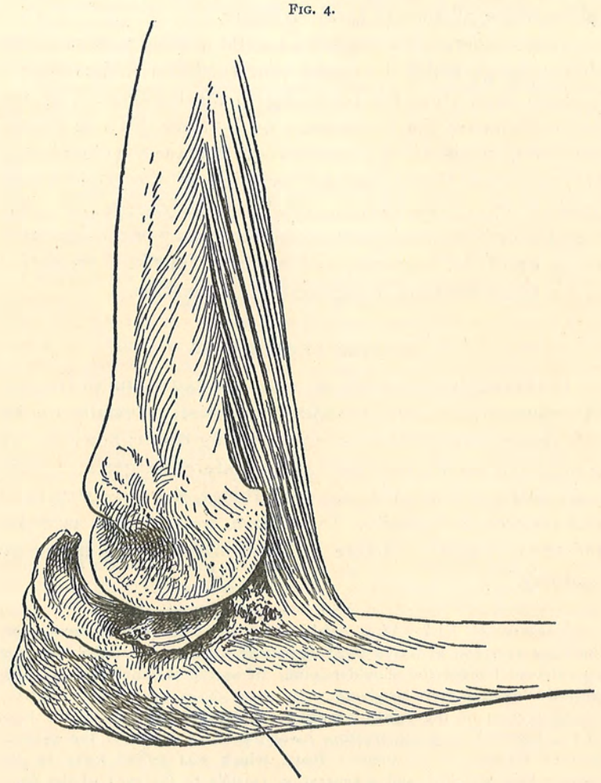
EXPERIMENT XLI.—After firmly fixing the right scapula and chest, the right arm was abducted until there was a giving way; then the arm was shoved toward the shoulder-joint. Thus the cardinal signs of subcoracoid luxation were produced.

Dissection of the joint showed a subcoracoid position of the head of the humerus, a sprain-fracture involving about 4 cm. of the anterior inferior margin of the glenoid fossa, which was pulled away by the capsule here attached, and a separation (visible to the eye) of the fibres of the capsule just above the site of the sprain-fracture (see Fig. 1).

EXPERIMENT XLII.—With the left scapula and chest firmly fixed, the left arm was abducted until most of the resistance offered was overcome; then the arm was shoved downward, making the head go from the glenoid cavity and thereby producing what was clinically a subglenoid subluxation (an erect luxation).

sprain-fracture of the internal condyle by some of these fibres and those of the internal lateral ligament, and separation of the fibres of the anterior capsule, proved by microscopic section, were demonstrated. Part of the orbicular ligament was severed to facilitate exploration of the joint tissues.

FIG. 4.



Effects of experimental subluxation backward at elbow.

EXPERIMENT XLVI.—By the use of the stationary iron bar and the same mechanism as in Experiment XLV, what seemed to be a subluxation of both bones of the left forearm backward from the humerus was produced. The forearm was then forcibly flexed on the arm.

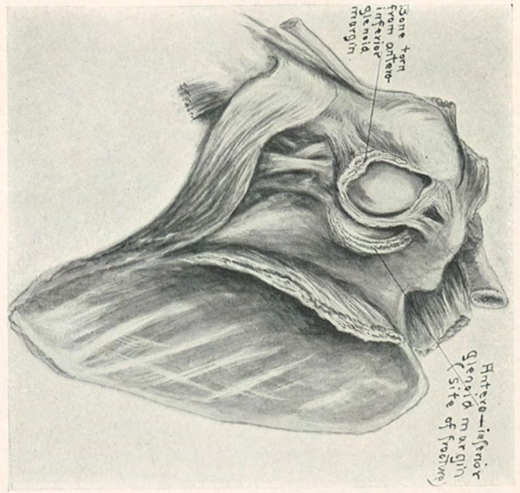


FIG. 1.

Effects of experimental attempt on the cadaver to produce a subcoracoid dislocation at the shoulder.

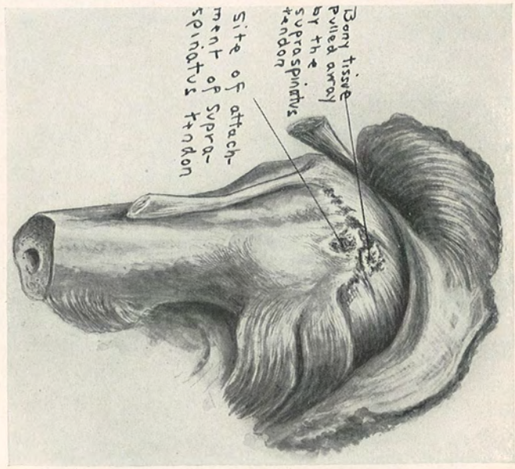


FIG. 2.

Effects of experimental subglenoid dislocation.

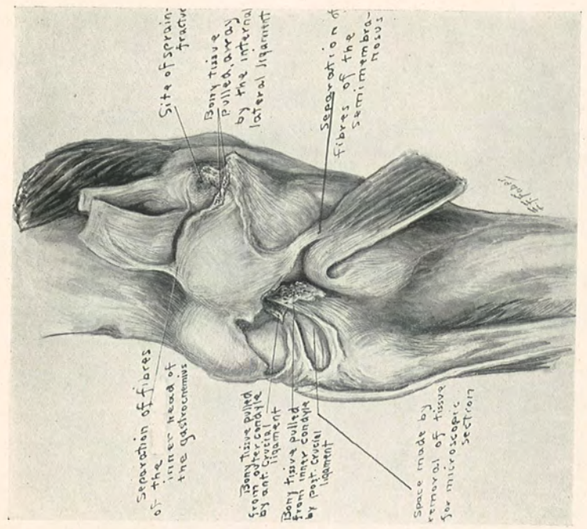


FIG. 5.

Effects of experimental subluxation backward at the knee-joint.

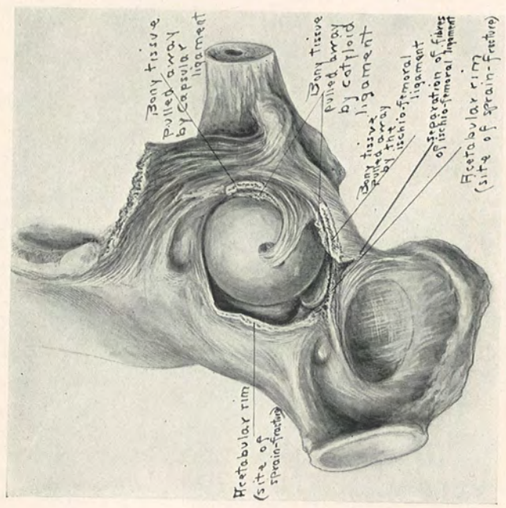


FIG. 3.

Effects of experimental attempt on the cadaver to produce an anterior dislocation of the hip-joint.

Dissection confirmed the position of the bones of the forearm and showed a horizontal rent in the anterior capsule. A piece of the outer anterior portion of the articulating surface of the ulna (part of the coronoid process), with a good part of the brachialis anticus muscle attached, was jammed backward toward the olecranon by the humerus (see Fig. 4), which in so doing caused crushing of some of the fibres of the brachialis anticus. This was obviously a sprain-fracture by direct violence. The horizontal rent in the anterior capsule extended entirely across the joint; macro- and microscopically, the fibres of the anterior capsule were proved to run horizontally. Therefore the rent in the capsule was due to a separation of fibres, and not a tear. The posterior capsule was torn in dissection for exploring purposes.

EXPERIMENT XLVII.—A subluxation of the right leg on the femur was produced by fixing the femur and pulling the leg outward.

Dissection revealed the presence of a subluxation of the leg externally on the femur, sprain-fracture of the internal condyle of the femur through the agency of the internal lateral ligament, sprain-fracture of the inner tuberosity of the tibia through the agency of the anterior crucial ligament, sprain-fracture of the inner condyle of the femur through the agency of the posterior crucial ligament, two rents in the internal aponeurotic expansion of the quadriceps extensor approaching each other at an acute angle and produced by an easily demonstrable separation of the fibres of the aponeurosis, rupture of some of the fibres of the aponeurosis at the point where the rents in it were nearest each other, and some separation of the fibres of the posterior capsule where the semimembranosus joined it. In the posterior capsule an opening was made in dissecting.

EXPERIMENT XLVIII.—By fixing the left femur and jerking the leg upward, a subluxation of the leg posteriorly on the femur was produced.

Dissection demonstrated the posterior subluxation of the leg, sprain-fracture of the inner and outer condyles through the agency of the posterior and anterior crucial ligaments respectively, sprain-fracture of the inner condyle through the agency of the internal lateral ligament, sprain-fracture of the posterior tibia between the tubercles, through the agency of the posterior capsule, separation of the fibres of the posterior capsule, proved by microscopic section, separation of the fibres of the semimembranosus at the seat of its expansion into the posterior capsule, and separation of some of the fibres of the inner head of the gastrocnemius. The two last-mentioned fibre separations were clearly visible to the unaided eye (see Fig. 5).

EXPERIMENT XLIX.—The right hand was bent (the arm being fixed) in all directions until a giving way was felt.

Dissection showed a slight subluxation of the fourth and fifth metacarpals on the uncinate bone, sprain-fracture of the hook-like process of the uncinate bone, sprain-fracture of the uncinate bone posteriorly at the articulation of the fourth and fifth metacarpals with the bone, and a diagonal fracture of the radius extending from without inward and downward into the radio-ulnar articulation. The capsule at the articulation of

the third metacarpal with the carpal bones was cut in attempting to demonstrate the bone lesions.

EXPERIMENT L.—This experiment was carried out on the left wrist in the same way as Experiment XLIX.

Dissection showed subluxation of the wrist-joint and sprain-fracture of the styloid process of the radius.

EXPERIMENT LI.—Holding the left leg in a vice, the foot, grasped at the toes, was turned inward until a giving way was detected.

Dissection showed a slight subluxation involving the articulation of the calcaneum with the cuboid and cuneiform bones, and sprain-fractures involving the superior articular surfaces of the anterior calcaneum, the cuboid, and the cuneiform bones. An opening in the external portion of the capsule uniting the calcaneum and astragalus was made to get additional exposure.

EXPERIMENT LII.—With the right leg held in a vice, the foot was bent outward, producing what was apparently a subluxation of the ankle-joint.

Dissection confirmed the presence of subluxation of the ankle-joint and showed the following sprain-fractures: the external malleolus, the internal malleolus, and the external articulating surface of the astragalus.

EXPERIMENTS LIII and LIV.—After a hand had been kept for one month, part of which time it was in cold storage and part of which time no particular attempt was made to preserve it, the middle phalanges of two fingers were luxated on their proximal phalanges by bending them backward on the proximal phalanges.

Dissection confirmed the presence of the luxations, but in neither instance gave distinct evidence of sprain-fracture, though there was slight roughening of the bones. Both anterior capsules were opened horizontally. Microscopic sections of the capsules showed these openings to be separations of fibres. The dislocations were complete.

In these experiments, as in those on dogs, quickly and slowly applied force was used, sprain-fracture resulting consistently wherever luxation occurred. Luxation or subluxation was produced in every one of the fourteen cadaver experiments; twelve of these experiments showed the production of sprain-fractures. In the two cases showing no sprain-fractures complete luxation was permitted through a separation of the fibres of the capsule. In these two cases abundant opportunity had been given for advanced degeneration of the softer tissues. Separation of the fibres of the capsule was encountered in nine cases (five were complete dislocations and four were subluxations). Where any doubt existed as to the direction in which the fibres ran, microscopic sections were made. These experiments have shown that, with a certain amount of capsular

relaxation, dislocation permitted by separation of the fibres of the capsule of the joint is a mechanical possibility, without the occurrence of sprain-fracture. Yet separation of the fibres of the capsule alone has been a rare occurrence, in our experience, seen only when tissue degeneration was present. Allis, in referring to the injuries to the ligaments of the hip joint in dislocation, noted that the ligamentum teres was usually torn from the head of the femur and that the capsule showed one of three conditions: tear from its acetabular or pelvic insertion (sometimes bringing periosteum with it), tear from its femoral attachment, and rent either between the attachments or running from one attachment to the other. From his descriptions we infer that the tears from the bone must have been sprain-fractures of small size and that the rents in the capsule must have been permitted by separation of the capsule fibres, as was the case in Experiment XLIII. It has been demonstrated to us in our work that separation of fibres takes place readily following a sprain-fracture that permits of abnormal motion of the elements of a joint. We have also found that occasionally the continuation of a force that first produces sprain-fracture may terminate with rupture of the fibres of the ligament or tendon involved, as in Hawkes's [3] case.

Though amazed at finding sprain-fracture so constantly in this cadaver work, for we had reckoned that degeneration of the soft parts would permit of no comparison of the relative strengths of bone and tendinous or ligamentous tissues, we were impressed with the fact that, though some degeneration of the soft tissues must have occurred at the time of the experiments, the relatively greater strength of them over bony tissue discounted this degeneration and permitted our results.

Knowing that Maisonneuve, about a century ago, in a memoir, described sprain-fractures of the external and internal malleoli and sprain-fracture of the styloid of the ulna in Colles's fracture of the radius, the fact that many men producing luxations in cadavers have not observed the occurrence of sprain-fracture recalls these points: first, sprain-fractures are often so minute as to be barely visible to the eye, though

easily palpated; second, extensive exploration of the joint cavities and surrounding tissues is often necessary before sprain-fracture can be demonstrated; third, advanced degeneration of soft tissues will not permit of the production of sprain-fracture; cadaver work, therefore, will not permit the drawing of comparisons as to the frequency of sprain-fracture in dislocation.

Thomas,[4] in speaking of his work on shoulder luxations, says: "I recall one cadaver specimen in which, in addition to the usual anterior capsule tear, there was an opening into the joint posteriorly, due to the tearing off of the greater tuberosity by the attached supra-spinatus and infra-spinatus and the underlying capsule. In connection with the earlier specimens, such a condition did not particularly interest me, but, so far as I can recall, this was the only one in which such a tearing off of bone was observed."

We find another group of observers who, when working on joints, have noted what we now believe must have been sprain-fractures, but they have been unable to offer tangible explanations of their findings. R. W. Smith,[5] in his work on luxations published in 1854, in speaking of an old case of fracture of the greater tuberosity of the humerus with subcoracoid luxation of the head, said, "The capsule had not been injured, but was thickened and enlarged, and bone had been deposited in its tissue." This so-called deposition of bone must have been an old sprain-fracture around which the tissues had united.

Marsh,[6] in 1868, reported a description in the Museum of the College of Surgeons Catalogue which read: "A knee-joint in which there are two small growths of apparently cartilaginous and osseous substance. The largest of them, attached to the crucial ligaments, has an oval outline, measures nearly an inch in its greatest diameter, is flat on its lower and very convex on its upper surface. By friction and constant pressure it had worn for itself a deep cavity, with hard grooved walls, in the posterior and lower part of the outer condyle of the femur, in which it lay imbedded and apparently

immovable. The second presents nodules of cartilage on its surface, is fixed to the synovial membrane just below the patella. The encrusting cartilage in this joint is much worn away, and the surface left by its removal is eburnated; but there does not appear to have been any inflammatory action as the result of the constant irritation which the pendulous cartilage must have produced." The first-named piece of osseo-cartilaginous tissue quite likely was the result of sprain-fracture; for we have found sprain-fractures, through the agency of the crucial ligaments, to be present fairly constantly in knee luxations, and, though no mention of luxation was made in this case, we know that spontaneous reduction of dislocations frequently takes place in joints similar in construction to the knee-joint. The second-named piece of tissue, along with some loose osseo-cartilaginous bodies in joints, described by Marsh and Brodie,[7] may or may not have been the result of sprain-fracture, though it seems quite likely that the bony tissue may have wandered from the ligaments producing the lesions, with the choice of becoming reattached elsewhere.

A third group of men has noted sprain-fracture in association with luxations. In 1847, Gibout,[8] Deville, and Malgaigne described what we now call sprain-fractures, and called them "fractures by tearing." Callender,[9] in 1866, reported a case of wrist-fracture. Part of his description reads, "The proximal portion of the shaft was also displaced upwards, carrying with it the ulna, the latter bone being torn away from its triangular ligament, to which the tip of the styloid process remained attached." Francke, Hildebrand, Kraske,[10] Sick,[11] and Sculler [12] all reported cases of anterior luxation of the shoulder-joint in which sprain-fractures involving the glenoid cavity were found; most of these involved the anterior margin of the glenoid cavity.

Joessel [13] described a tearing of the tendons of the supra-spinatus and infra-spinatus muscles from the greater tuberosity of the humerus, thereby causing a roughening, as the

chief predisposing cause of recurrences of anterior luxations of the shoulder.

Thomas [14] recently said: "Whenever there is a fracture of the greater tuberosity of the humerus there has been a dislocation of the shoulder, and in those cases in which there is no history of a dislocation the latter did occur at the moment of forced abduction, but was spontaneously reduced, as the arm fell to the side of the body immediately afterward."

DISLOCATION FROM THE X-RAY VIEWPOINT.

In consulting the X-ray records of the German Hospital for the years 1909, 1910 and 1911, and the first three months of 1912, made available through the courtesy of Dr. A. G. Miller, skiagrapher to the hospital, we found that 92 luxations had been skiagraphed. Thirty-one, or about thirty-four per cent., showed fracture; three of the thirty-one fractures, or about three per cent. of the ninety-two cases, were sprain-fractures; the twenty-eight remaining cases, about thirty per cent. of the total number, were fracture dislocations.

Of the ninety-two luxations, all but twenty-six were taken in but one plane; these twenty-six cases were taken in two planes; eleven, or about forty-two per cent. of them, showed the occurrence of fracture or sprain-fracture.

Many luxations are not properly studied, for two reasons: first, because of spontaneous reduction; second, because the surgeon who has reduced the luxation has failed to report the fact to the skiagrapher. So it is apparent that a consideration of all luxations is impossible, but consideration from the skiagrapher's findings gives the nearest approach to accuracy. We have perhaps sacrificed more striking conclusions concerning sprain-fracture by including among the others the congenital luxations, which, as we know, have uncertain etiology and primarily concern cartilaginous tissue. However, the ninety-two cases afford opportunity for making some very interesting observations. The fact that twenty-eight, or about thirty per cent. of these luxations, showed fracture is significant. Many of us had looked upon gross fracture in association with

luxation as a much more rare occurrence. Yet these fractures are really the result of the tendons and ligaments pulling off bigger bites than are pulled off when we diagnose sprain-fracture. However, it is easily understood; for are not all fractures, whether they be sprain-fractures in association with luxations, or uncomplicated fractures, if caused by indirect violence, permitted on account of the fact that tendons and ligaments retain their integrity longer in time of stress than bone? These things being true, we must consider these fractures occurring with luxations to be sprain-fractures of great degree, or, better, sprain-fractures and more; going beyond the mere occurrence of sprain-fracture.

Since it would be unlikely for fracture to occur following dislocation, unless by direct violence, we consider that the thirty-one cases of luxation showing fracture or sprain-fracture were permitted to occur by the primary occurrence of fracture or sprain-fracture.

Bissell evolved a theory as to the probable causation of fracture in association with dislocation; namely, that the bone was fractured by the force used in trying to reduce the dislocation. He reasoned: if luxation occurs first, how is there force enough left to cause fracture?—and if fracture occurs first, how is it possible for there to remain leverage enough to luxate the joint surfaces?

We believe the primary occurrence of fracture permits sufficient giving way of the capsule to allow easy separation of the joint surfaces with the use of little or no leverage. Further, our X-ray pictures have shown fractures before reduction was attempted.

It is interesting to find that Allis, in speaking of a fracture dislocation, said: "The fracture occurred prior to the dislocation. It could not have taken place after it; in other words, the dislocation was the result of the fracture."

Why have approximately sixty-six per cent. of these cases failed to show evidence of sprain-fracture or fracture, if we would substantiate our experimental findings? We know that sprain-fractures comprise about fifteen per cent. of all

fractures, but here, being three in thirty-one, they comprise but about eleven per cent. of the fractures. These figures show a discrepancy of four per cent., but our belief (for we believe sprain-fracture occurred in all of the cases that did not show gross fracture) makes the discrepancy eighty-nine per cent. In this series of cases exposure was not made in a number of planes sufficient to convince us that sprain-fracture or fracture had not occurred. Gross fractures are, as a rule, easy of demonstration by X-ray, and exposure in one plane is often sufficient for the demonstration. On the other hand, it is most often the case that sprain-fracture cannot be demonstrated unless the X-ray picture is taken in a plane that is on the line of a tangent to the circumference of the bone, originating from the site of the lesion, with nothing intervening (Ross and Stewart). This would, of course, necessitate, at times, many exposures, in order that the right plane might be gotten. On the twenty-six cases that exposures were taken in two planes encouraging results were encountered, for eleven, or about forty-two per cent. of them, in contradistinction to twenty, or about thirty per cent., of the remaining (or one-exposure) cases, showed fracture. We must remember at the same time that many sprain-fractures are too minute for X-ray demonstration.

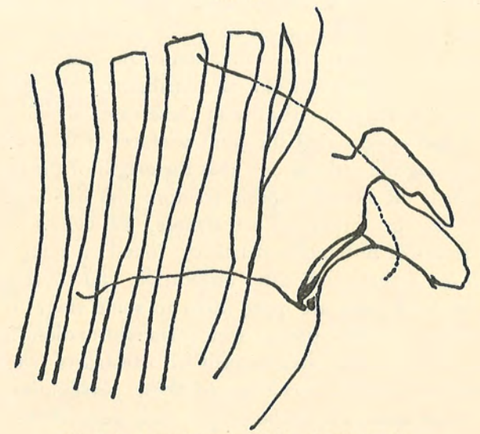
As a result of the study of these cases we concluded that there were two, and possibly three, reasons why all of the cases did not show sprain-fracture or gross fracture on the X-ray plate: first, the plates did not happen to be taken in a plane that would permit of the demonstration of the presence of sprain-fracture or gross fracture; second, in some few cases the sprain-fractures may have been so small that they could not be demonstrated by X-ray plates; third, it is possible that in rare instances luxation might have been permitted by a separation of the fibres of the joint capsule.

DISLOCATIONS FROM THE CLINICAL VIEWPOINT.

In the luxations encountered by us since drawing these conclusions, we have persistently skiagraphed the involved

joints in different planes and have in them all been rewarded by the demonstration of sprain-fracture or fracture. Though the number of cases so far observed is too small to be of value for detailed presentation, we cannot refrain from citing one of the most interesting of them.

FIG. 6.



Sprain-fracture of anterior inferior glenoid margin.

A. A. was admitted to the Germantown Hospital following an injury to the left shoulder. X-ray (2/5/1912), one exposure, showed a subluxation. Five more exposures in different planes were made (2/9/1912). One of these showed distinctly a sprain-fracture of the anterior inferior glenoid margin (see Fig. 6). Several of the other plates showed a sprain-fracture of the greater tuberosity of the humerus. The use of these plates was made possible by the courtesy of Dr. Paul Austin, skiagrapher to the Germantown Hospital.

The clinical diagnosis of luxation commands no attention here; the clinical diagnosis of sprain-fracture in connection with dislocation, made easier by first reducing the dislocation, is reached in the same way as is the clinical diagnosis of

sprain-fracture alone; furthermore, as is the case with sprain-fractures alone, sprain-fracture occurring in dislocation can be diagnosed without X-ray findings.

PRACTICAL CONSIDERATIONS.

To revert to the discussion of the X-ray findings in the ninety-two cases of luxation, one of these was a luxation of the femur showing an excess of callus around the head and neck, and another was an old luxation of the humerus upward and forward showing an old osteo-arthritis. We have been led to believe, from our studies in these cases showing osteo-arthritis and covering of the joint surfaces with osseous tissue, following old dislocations, that the origin of the new bone formation is the site of a sprain-fracture that had occurred at the time of the injury. Furthermore, we believe that the softer tissues of different consistency, found on joint surfaces exposed but a short time after dislocation, and covering them in whole or in part, are quite often in some stage of transformation into bony tissue, which transformation is being brought about by the advancement of osteoblasts from a site of sprain-fracture. Knowledge of these possibilities should attract more attention to the proper treatment of these cases when they are new, for such conditions as bony ankylosis can be avoided. However, when neglected cases become old this same knowledge should be of service in searching the joint surfaces for lesions that would give ideas concerning treatment and prognosis.

The great difficulty of demonstrating sprain-fracture without complete exposure of a joint was constantly demonstrated in our dissections. In operative procedures free dissection most often is not practical, and many sprain-fractures, no doubt, escape the detection of operators. Study of a very large number of cases from the clinical, the experimental, and the X-ray viewpoint would give us information in reference to the most frequent site of sprain-fractures in certain dislocations of each joint that the number of cases here studied does not afford. A study of this sort would enable the surgeon in

the non-operative treatment of dislocations to place the injured parts in position favorable to union of the severed bones, and it would enable the operator to expose his joints at the most frequent sites of sprain-fracture, providing their senses and X-rays gave them no information. We lay emphasis on the statement already made that X-ray does not demonstrate all sprain-fractures, and add that all dislocations should be treated as if sprain-fracture had occurred, meaning that a luxation should be at rest absolutely for three weeks following reduction, dressed in a position favoring reposition of fragments; in other words, it should be accorded the same treatment as fracture dislocations. We believe in reference to most recurrent luxations of all joints the same as Joessel believed in reference to recurrent anterior shoulder dislocations; namely, that they are permitted by the non-union of sprain-fractures. However, union in faulty position may permit the same occurrence. Therefore, we consider it rational, where operative procedure is undertaken in these cases, to approach the site of sprain-fracture and repair it with either catgut or phosphor-bronze wire, as recommended by Murphy [15] for fastening tendons to bones. This applies to cases where but little bone is pulled away. Where there is pulling away of bone of sufficient size, the use of ivory screws, as suggested by Magnuson [16] in his work on the lengthening of bones of the leg or the use of wire nails, is indicated for repair of the sprain-fracture. Ivory screws used in experimental bone work by Dr. Stewart have been most satisfactory, being capable of withstanding great strain and having the additional advantage of being absorbed. This form of procedure is not indicated in all luxations coming to operation; in a posterior luxation of the head of the radius recently operated on by Dr. Ross small pieces of bone, probably the result of sprain-fracture, were demonstrated, a fragment of the head of the radius was removed, and a transverse fracture of the olecranon was wired; no attempt was made at further exploration to verify the presence of sprain-fracture with a view of repairing it, as it was found that the above-described procedure, including suture of the

capsule where incised, seemed to be sufficient to maintain the joint's integrity. Moreover, operation for recurrent dislocation is often made successful by taking a reef in an enlarged capsule or by suturing together separated capsular fibres.

It is interesting to note that Thomas, in quoting the statement of Stimson that "clinically it is known that after a few days or weeks marked by gradually diminishing tenderness and swelling the joint can be freely used without pain," says, "It is obvious that when a joint can be freely used in a few days without pain there is no fracture." Our experience has been that a large proportion of sprain-fractures cause no pain on free use of the joint within a few days after the injury, but, if not properly treated, pain on use of the joint appears after sufficient time has elapsed for the development of arthritis or excessive callus.

CONCLUSIONS.

1. Practically all, if not all, dislocations are permitted by the primary occurrence of strain of tendons and ligaments, followed by avulsion of tendons, and then sprain-fracture or gross fracture.

2. It is possible that some dislocations are permitted to occur by separation of the fibres of the capsule in place of by sprain-fracture or gross fracture.

3. All dislocations should be skiagraphed and, if evidence of fracture is not found at first, pictures should be taken in many planes.

4. All dislocations should be treated as if fracture had occurred, even in the event of negative X-ray evidence.

5. Some sprain-fractures are too small to be shown by X-ray pictures.

6. Often there is spontaneous reduction of dislocations, and sprain-fracture or gross fracture is the only evidence left that can be detected by X-ray.

7. The sites of sprain-fractures or gross fractures provide the foci from which the osteoblasts issue, in those cases showing excessive callus or covering of joint surfaces with osseous tissue; moreover, the softer tissues found in joint cavities

within a short time after the occurrence of dislocations are often in some stage of transformation into bony tissue.

8. Sprain-fracture or fractures occurring consistently in experimental dislocations on cadavers afford the most positive proof of the fact that dislocations are permitted to occur in this way; but failure to demonstrate sprain-fractures or fractures consistently in experimental dislocations on cadavers means nothing, since the stage to which degeneration has advanced determines whether the greater tensile strength remains in the tendons and ligaments or not.

9. Whether the force be suddenly or slowly applied, sprain-fracture or fracture precedes the occurrence of practically all, if not all, dislocations.

Finally, we wish to acknowledge our indebtedness to Dr. J. E. Sweet, who placed the facilities of the Laboratories of Surgical Research of the University of Pennsylvania at our disposal.

BIBLIOGRAPHY.

[1] Ross and Stewart: A Study of Sprain-Fracture, ANNALS OF SURGERY, Jan., 1912.
[2] Allis: The Hip (Gross Prize, 1896).
[3] Hawkes: Transactions of New York Surg. Soc., ANNALS OF SURGERY, March, 1912, 443.
[4] Thomas: Habitual or Recurrent Anterior Dislocation of the Shoulder, American Journal of the Medical Sciences, March, 1909.
[5] Smith, R. W.: Fractures, 1854.
[6] Marsh: St. Bartholomew's Hospital Reports, vol. iv, p. 255.
[7] Brodie: loc. cit., Reimarus, "De Fungo Articulorum"; square, loc. cit., Virchow.
[8] Gibout: Bull. Soc. Anat. de Paris, 1847, xxii, 27–33.
[9] Callender: Transactions of the Pathological Society, London, xvii, 221, 1886.
[10] Kraske: Ibid., p. 113.
[11] Sick: Jahrb. d. Hamburgischen Stattskrankanstalten.
[12] Schuller: Berl. med. Woch., 1890, xxvii, 760.
[13] Joessel: Deut. Ztschr. f. Chir., 1880, 167.
[14] Thomas: Transactions of Phila. Academy of Surgery, ANNALS OF SURGERY, Jan., 1912.
[15] Murphy: A contribution to the Surgery of Bones, Joints, and Tendons, Journal of American Med. Assn., April 6, 1912.
[16] Magnuson: Lengthening Shortened Bones of the Leg by Operation, U. of Pa. Med. Bulletin, May, 1908.

Dr. B. A. Thomas protested against the use of the term "sprain fracture," saying that inasmuch as there are so many cases of severe contusion in which the same pathology exists we will soon have the term "contusion fracture" and "dislocation fracture," etc. He therefore entered a plea that these fractures associated with sprains and contusions be called *molecular* fractures, this term being much more scientific.

Dr. G. G. Davis said that in the making of a good many lesions on the cadaver for teaching purposes the so-called sprain fracture was very frequent. It bears out the experience of the writers of the paper. Recently he had a case of luxation of the shoulder in a living person and it was distinctly seen in the skiagraph that the supraspinatus was ripped up with a distinct line of fracture at its point of attachment.

THE RECOGNITION AND TREATMENT OF LESIONS OF THE RIGHT ILIAC FOSSA OTHER THAN APPENDICITIS.

BY CHARLES H. FRAZIER, M.D.,

OF PHILADELPHIA,

Professor of Clinical Surgery in the University of Pennsylvania.

Ever since Fitz's memorable paper in 1888, the right iliac fossa has been of great surgical interest. The frequency of appendicitis in this country has contributed to a thorough study of its varied pathology, and while for many years the treatment was the subject of great controversy, we now seem unanimously of the opinion that every case of acute appendicitis should be operated on at the earliest possible moment, except that most surgeons, probably the great majority, postpone operation for a time in the presence of spreading peritonitis. The experienced surgeon alone, however, can decide the question in each case. As a general rule we operate in every case of chronic appendicitis whether local pain alone is experienced or whether certain referred symptoms, often popularly called appendiceal dyspepsia, are present.

Ewald in 1899 stimulated the study of chronic appendicitis by a description of the type called appendicitis larvata and for a time much operating was done, usually with beneficial results but sometimes without relief of the symptoms complained of. We went through an era of more or less indiscriminate removal of the appendix in operations for other lesions in the pelvis and here again much good and some harm was done. We did learn, however, something more of the pathology of the presumably normal appendix and our microscopists often startled us with their diagnoses when symptoms of appendicitis had apparently never existed. Many surgeons made the so-called buttonhole incision, reached in, felt and removed the appendix but saw nothing more of the state of the viscera.

It is interesting to note how few studies have been published until recently regarding the end results in chronic appendicitis, although many loose statements are scattered through the literature regarding this matter. Graham and Guthrie in 1910 (*Jour. A.M.A.*, 1910, 54, p. 960) reported a series of cases of chronic appendicitis of the dyspeptic type which were traced a year or more after the operation, with the result that approximately 85 per cent. were cured or improved, 10 per cent. suffered from an occasional return of symptoms, and 5 per cent. were not cured by the operation. Stanton in 1911 (*N. Y. State Journ. of Med.*, 1911, vol. xi, p. 479) also studied 100 cases operated under the clinical diagnosis of chronic appendicitis, 64 of which were cured, while in 36 the end results were either unsatisfactory or other lesions were found to be the cause of the symptoms. Wilms, before the Fortieth Congress of German Surgeons, expressed the opinion that the diagnosis of appendicitis was often made too lightly, and he estimated that at least 30 per cent. of so-called cases of chronic appendicitis are cases of chronic constipation with a movable, dilated, and prolapsed cæcum. Klemm, Hausmann, Stierlin, and others have made similar statements. On the other hand, recently Scudder and Goodall (*Boston Med. and Surg. Jour.*, 1911, clxv, p. 6), reviewing the returns from 640 cases of appendicitis operated upon in the Massachusetts General Hospital, found that 94.6 per cent. of the cases were in good health and were relieved by the operation, and that 4.6 per cent. had poor health due to some definite pathologic reason. The paper is impressive, but the results are somewhat vitiated by the fact that only 640 returns were received from more than 3000 appendectomies.

I do not wish to be understood as opposing operation for chronic appendicitis, but wish to emphasize the necessity for a more individual study of each patient in order to avoid the removal by operation of a normal appendix without further investigation of the right iliac fossa, with the result that the patient will be left in as bad if not worse condition than before.

These patients exhibit attacks of pain, usually at McBurney's point, a sensation of dragging in the right iliac fossa, sometimes a tenseness or distention in the same locality, and irregularity of the bowels, usually constipation. Certain referred symptoms, of which "dyspepsia" is the most common, are also often present.

Now, given a series of these symptoms, what is the common practice? With or without a fairly accurate history of an acute attack in the past, with pain in the right lower quadrant. at times with reflex stomach symptoms, the practitioner or surgeon palpates the appendiceal region and finds a little tenderness to deep, *hard* prodding, and without further parleying diagnoses chronic appendicitis and may advise operation. As a matter of fact he is right in the majority of cases, and this confirms his estimate of his diagnostic acumen, but a certain percentage of the patients operated on will *not* be relieved by operation and then adhesions are discussed and perhaps a second operation advised.

The difficulty seems to be in that group of cases where symptoms suggesting chronic appendicitis are present *without the history of a definite acute attack*. These are the cases that must be studied anew. When once a principle is established, further progress is mostly along refinements in the diagnosis of the affliction and a study of group statistics. This has led to the recognition of one or more sub-groups, curiously alike symptomatically, but with a pathology differing from the central group, designated at the present time as Jackson's membrane, Lane's kink, and cæcum mobile. There is field for controversy here and the subject must be fully considered before we can establish a definite entity for any one of them. There must be more than one etiologic factor concerned in their production and we must learn to distinguish between the adhesions acquired as the result of infection (peritonitis) and those produced by abnormalities in the development of the gut tube and of its rotation or those acquired as a result of splanchnoptosis (traction adhesions of Lane).

The development of the intestinal tract from the primitive gut has been studied anew of late years and seems to offer

a better explanation of the formation of membranes and kinks than any other, except where a definite previous peritonitis has produced bands and adhesions. It will be remembered that the cæcum descends from beneath the liver to the right iliac fossa, and that its posterior peritoneal surface fuses with the parietal peritoneum; the ascending colon thus acquires an extraperitoneal surface, which originally was intraperitoneal. The lower portion remains free and the extent of the line of reflection varies markedly in different individuals; the colon and cæcum may be entirely free with a distinct mesocolon and may hang far down in the pelvis, or the entire posterior surface of the colon and cæcum and even the termination of the ileum may be extraperitoneal. Somewhere between the two extremes the normal is found.

Jackson's Membrane.—In 1909 Jackson, under the title of membraneous pericolitis, described a lesion of the cæcum and ascending colon, consisting of a thin vascular veil binding the colon to the abdominal wall and resembling the œdematous arachnoid seen in the wet brain of a dead alcoholic. Jackson remarks: "The colon seems placed in a diaphanous bag, slightly too short to contain it without wrinkling." The membrane does not resemble the ordinary adhesions in that it does not enter into a close organic union with the peritoneum of the gut and abdominal wall; instead, it may be stripped off as a veil, after which the serous coat of the bowel appears. The literature upon intra-abdominal adhesions is very great and it is difficult to isolate the articles bearing directly upon this subject. Virchow wrote of the lesion, and certain German surgeons, notably Credé, Lauenstein, and Riedel, advocated operation for severe continued abdominal colic and the removal of adhesions; Lane had discussed a similar, perhaps the same, condition under the term of traction adhesions, but the lesion under consideration, in the sense of a pannus, seems first to have been described accurately and adequately by Jackson (*Surg., Gyn. and Obs.*, 1909, ix, p. 278) in both its pathologic and clinical aspects. Binnie in 1905 described a similar condition.

The etiology of this condition has not yet been cleared up,

there being two conflicting opinions, viz., that it is due to certain congenital anomalies during the rotation of the large intestine or that it is the result of infection. Blake (ANNALS OF SURGERY, 1912, lv, 767) has recently stated that the so-called Jackson membrane was present always and was in fact a normal structure. But such an opinion in view of the observations of many reliable observers must be erroneous. Gerster (ANNALS OF SURGERY, 1911, liv, 325) in an excellent paper ascribed the lesion to a chronic colitis as the starting point of an infection which causes a reaction of the peritoneum. Pilcher (ANNALS OF SURGERY, 1912, lv, p. 1) in an excellent paper on membraneous pericolitis believes it to be the result of long-continued or oft-repeated mild infections of the peritoneal covering of the cæcum and appendix, transmitted through the intestinal wall. The congenital factor may have a predisposing influence. It is interesting to recall that Hofmeister found the *Tricocephalus dispar* in a number of his cases. On the other hand, Mayo (*Surg., Gyn. and Obs.*, 1911, xii, 227) believes that "this condition is undoubtedly due to the late rotation of the bowel and descent of the cæcum from its hepatic position after the formation of the parietal portion of the peritoneal cavity in the infant. The cæcum burrows its way into position, as it were, through the peritoneum."

The symptoms of membranous pericolitis, as formulated by Jackson, are pain and tenderness, constipation, gaseous distention most marked over the cæcum, mucous discharge from the bowels, loss of weight and tone, various forms of gastric indigestion, and neurasthenic manifestations. This group of symptoms will be seen to correspond pretty closely to those described for many years as being caused by visceroptosis; they are dependent upon the stagnation of the fecal content of the bowel and their absorption. Pilcher described the pathologic complex as (*a*) defective peristalsis from the mechanical action of the veil or adhesions; (*b*) real obstruction from bands; (*c*) enterospasm from persistent irritation, and (*d*) auto-intoxication.

Jackson recommends that the membrane should be entirely

dissected off the colon, and reports seven cases in which this was done with gratifying results and only awaits the lapse of time to see if the results remain permanent. After the operation it is important to revive the sluggish peristalsis by regular habits, antifermentative diet, occasional catharsis, and abdominal gymnastics and massage. Connell (*Surg., Gyn. and Obs.*, 1911, vol. xiii, p. 485) twists the membrane into a cord and fastens it to the abdominal muscles, thus keeping the cæcum up and out of the pelvis.

Lane Kink.—The kink is manifested by an acute bend of the ileum about six inches from its termination, due to a thickening or contraction of the mesentery at that point or to an adhesion of adjacent arms of the angle or of the bowel to its mesentery. It may be congenital or acquired, the former being the result of a change in the position of the viscera, especially the cæcum, or an abnormal disposition of the small bowel. As a result there develops on the under surface of the mesentery of the last few inches of the small intestine a new band which at first forms part of the under surface of the mesentery. Later, a distinct ligament forms which subsequently contracts, drags on the ileum and produces kinking, especially when the patient is in the erect position. The symptoms of the Lane kink as described by Franklin Martin (*Surg., Gyn. and Obs.*, 1911, vol. xii, p. 33) and Mayo (*Surg., Gyn. and Obs.*, 1911, vol. xii, p. 227) differ but little from the familiar symptoms ascribed to visceroptosis in general, except that the region of the kink is often tender, the area extending from the umbilicus downward to the right, and the pain is increased by peristaltic activity, especially when caused by the activity of the individual. "The intestinal and gastric symptoms are often most marked at fairly regular periods after eating, and frequently there is a distention of the small intestine in evidence when the individual is fatigued" (Mayo). Malaise, headache, backache, anorexia, nausea, and all the other symptoms that are characteristic of gastro-intestinal stasis may be present, together with toxæmia from the coexisting chronic constipation. Most cases will be diagnosed as chronic constipation, some will

be operated on with the knowledge that a dilated cæcum exists, but we may surmise that a kink is present and confirm the diagnosis by an inspection at the time of operation. Jordan (*Lancet*, 1911, clxxxi, and *Brit. Med. Jour.*, 1912, i, 1225) emphasizes the importance of accurate X-ray studies, and publishes some excellent illustrations of the Lane kink.

The acquired variety of the kink is mostly caused by appendicitis or pelvic infections which by producing an adhesive peritonitis cause an angulation of the ileum at the point of contact. It is beautifully shown in the case of intestinal obstruction following an appendicitis with operation where drainage is employed, the ileum knuckles at its point of adhesion to the tract. The treatment of the Lane kink consists simply in the separation of the adhesions and bands by the knife or scissors or by sponge dissection. The ileum should be drawn taut to reveal the adhesions, and in all cases the cæcum should be so elevated that it does not make traction upon the insertion of the ileum; in rare cases in which all of the anomalies coexist and extreme degrees of ptosis with kinking at all the flexures exist, it may be necessary to perform the more serious operations of exclusion of the colon or of excision of the entire colon. If operation is not performed the patient should be treated with belts, exercise, diet, and all the other measures recommended in the treatment of visceroptosis.

I have observed the Lane kink in a number of cases since my attention was first called to its existence, and make it a practice when operating for any abdominal lesion to examine the ileum, cæcum, and colon, when feasible, for abnormalities. In two of the cases, a movable and dilated cæcum was also present, for which condition I performed Wilms's fixation operation; the histories of these cases will be given later. In the following case I found both a Lane kink and a chronic interstitial appendicitis and it was therefore difficult to determine which condition was the cause of the symptoms:

This patient, a man, age 39 (R. M. G., No. 10,202), commenced to be troubled with his stomach about six or seven years

before, starting with pain in the epigastrium, distention and eructation of gas. The pain came on some time after meals, but he at no time had acute attacks suggesting biliary colic. He occasionally eructed some bitter material. The pain was dull in character rather than sharp, and was occasionally relieved by vomiting. He was constantly constipated. Physical examination was negative except for slight tenderness over the appendiceal region. There was a moderate anæmia.

Operation (December 6, 1911).—Through a McBurney incision the appendix was exposed on the inner and under surface of the cæcum. It was hard and infiltrated, evidently of the chronic interstitial type. Further exploration revealed a well-developed band in the mesentery of the ileum (Lane kink), which was removed and the raw surface covered by a continuous suture in the peritoneal folds on either side. Owing to the fact that the patient had many symptoms pointing to a gall-bladder lesion, an incision was made in the right rectus, but the findings were negative.

In another case the patient had symptoms of appendicitis and the appendix was removed in another hospital about nine months before I first saw him. This patient (W. B. P., 10,017) was 21 years of age and a tailor by occupation. His previous history was negative. No drainage was employed in the previous operation, but since then he has complained of pain and a sensation of heat in the right lower abdomen. The pain is constant and dull, as a rule, but is occasionally sharp and short in character. It is not associated with eating nor with the state of the bowels; he is usually constipated and complains of some dizziness. Operation was performed on September 5, 1911, and the omentum found adherent to the scar of the old wound, but in addition there was a well-marked Lane kink of the ileum.

That a Lane kink may be acquired as the result of appendicitis is illustrated by the following case:

E. V. W. (index No. 10,985), age 38. About 18 years ago the patient had an attack of abdominal pain lasting three days and necessitating medical attention. The attack recurred one week later and also lasted for three days. Since these attacks he has had indigestion in the form of epigastric pain about one hour after taking food. Sometimes the pain would immediately follow

eating; it was then severe, sharp, and burning in character. When the pain comes on an hour after meals it increases gradually in intensity and is aching in character. One year ago patient suffered from a severe attack of pain in the epigastrium, with vomiting, which lasted for about one week; the symptoms were increased by eating, and were not relieved by taking soda. The attack became less severe and wore off in 1½ months, but he lost 13 pounds in weight. In December, 1911, he had a severe attack of colicky general abdominal pain, localized after a time in the right iliac fossa and lasting for four or five days, with a residual soreness in the lower abdomen for a number of days. With the attack vomiting occurred and was quite frequent during the first day.

The present attack began on March 16, 1912, with severe colicky pain in the midline and just above the umbilicus; there was nausea but no vomiting, and toward evening pain became much less, but the taking of food increased the pain. During the three days before admission the pain practically disappeared and never localized itself in the right iliac fossa, but coughing caused pain in the hypogastrium, and eating or drinking caused pain in the epigastrium. Patient suffers from gaseous distention and belching, but is not constipated. Physical examination reveals a scaphoid abdomen with no rigidity nor mass. The entire right iliac fossa is quite tender, most marked a little to the right of the median line below the umbilicus.

Operation (March 19, 1912).—The appendix was found surrounded by adhesions and pointing downward and inward toward the pelvis. The adhesions were readily separated and the appendix delivered without the abdominal wound, where it was found to be in places completely necrotic. There was no free exudate, but the first two or three inches of the mesentery of the ileum was the seat of an organized inflammatory exudate, simulating, in its position and relations to the ileum, a Lane band. In fact, there was one point in the ileum, about three inches from the ileocecal valve, where there was an evident constriction of the lumen of the bowel. There is no doubt but that the last attack was one superimposed upon the many preceding attacks of appendicitis. The findings of the operation were interesting in connection with the fact that a Lane kink was suspected before the operation was undertaken. Several ligatures were applied to the bleeding

points on the mesentery until hæmostasis was complete. The wound was closed in the usual way.

The report from the Laboratory of Surgical Pathology (No. 3995) revealed the appendix to be in a state of necrosis, the mucosa being entirely replaced by inflammatory and necrotic material, and the coats showing an intense leucocytic infiltration. There were two areas, one near the tip and the other about the centre of the organ, which were greenish-black in color, evidently in a state of gangrene.

Cæcum Mobile.—It is easily understood how anomalies in the descent of the colon may produce undue mobility of the cæcum, and many investigations have been undertaken to determine the frequency with which a movable cæcum exists, and there appears to be much difference of opinion among these observers. The statistics of Wandel (*Mitt. a. d. Grenz. geb. d. Med. u. Chir.*, Bd. xi, S. 39) are perhaps the most often quoted. He found 66 cases of movable cæcum in 640 autopsies. Treves (*Brit. Med. Jour.*, 1885, p. 474) gives approximately the same figures. Recently, Dreyer (ANNALS OF SURGERY, 1912, lv, 164) states that out of a large number of autopsies he has found in 67 per cent. a movable cæcum; in the autopsy room only 11 per cent. of women were found to be free from cæcum mobile.

The term "cæcum mobile" was first employed by Haussman (*Berlin klin. Woch.*, 1904, 44, 1153) in 1904, but it was not until Wilms (*Deutsche med. Woch.*, 1908, 1756) reported, in 1908, that he had operated upon 40 cases that the clinical aspects were appreciated. There is an abundant literature upon this subject at the present time, mostly from the German clinics, and the recognition of a dilated and displaced cæcum is much easier, clinically, than the other conditions I have discussed. It should be understood that mobility alone does not imply that the patient must suffer from symptoms, extreme degrees being perfectly compatible with good health. But it is also certain that an overloaded and dilated cæcum may compress the ileum or drag upon its mesentery, which in time develops thickening and may produce a Lane kink. Lane

also teaches that as the result of excessive mobility traction adhesions develop which endeavor to fix the bowel and prevent its further descent; occasionally, they merely serve the purpose of constricting the lumen of the colon. Finally, the drag upon the meso-appendix interferes with the blood supply and lumen of the appendix, inducing its degeneration and disease. Torsion of the elongated cæcum may occur, Klose (*Münch. med. Woch.*, Feb. 15, 1911) believing this to be the chief factor in the production of symptoms.

On the other hand, Fischler (*Mitt. a. d. Grenz. geb. d. Med. u. Chir.*, 1909, xx, 663) states that he has encountered cases of actual dilatation and atony of the cæcum without appendicitis and the cæcum not necessarily unduly mobile or displaced. Klemm (*Archiv. f. klin. Chir.*, 1909, xcv) also refers to atony of the cæcum, but described a different etiology. He believes that as a result of appendicitis the serosa of the cæcum is affected and the elasticity of the bowel wall impaired; it stretches, and atony follows as a result of fecal stagnation. It also seems probable that any obstruction at the hepatic flexure, as from ptosis, adhesions, or membranes, may produce atony of the cæcum with symptoms. I have observed this in the case of a girl (E. C.), eight years of age, who was admitted to the Episcopal Hospital with the diagnosis of appendicitis. She had complained of symptoms referable to the right iliac fossa and with deep tenderness. A radiograph revealed dilatation of the ascending colon just below the hepatic flexure, that part of the bowel which makes up the flexure being ptosed forward and downward.

The chief symptoms of movable cæcum are, first, colicky pain in the right iliac fossa, mostly without fever, and often accompanied by continuous pain or a sense of soreness in the interval between the attacks; secondly, constipation with occasional short attacks of diarrhœa, especially at the conclusion of the attack of colic; thirdly, in the region of the cæcum a local distention may be palpated which gives a sense of elastic resistance and which upon gliding palpation reveals gurgling or splashing sensations; fourthly, bismuth radiographs made with

the patient in the erect, recumbent, and Trendelenburg positions will reveal the position and size and shape of the organ.

Gastric disturbance (appendiceal dyspepsia, etc.) is not a marked feature of the attack in uncomplicated cases. If it does exist it may be due to chronic appendicitis, to associated gastroptosis, or to some other pelvic or upper abdominal complication. Stanton showed this very clearly in the analysis of his cases of chronic appendicitis. Of the 64 patients cured by appendectomy he noted that in 96 per cent. there was a history of epigastric or mid-abdominal pain or distress; whereas of the 36 in which the end results were unsatisfactory the patients complained almost without exception of pain in the right lower quadrant as their chief symptom, and the occurrence of gas was very noticeable in the case histories. Lardennois (*Presse Médicale,* June 4, 1910) describes the following pathognomonic signs: When the contents of the transverse and ascending colon are pushed back toward the cæcum, pain in the right pelvic region is produced; while the pain disappears if the contents of the prolapsed cæcum are gently pushed from below upward toward the colon. He believes that disturbances from movable cæcum have frequently been erroneously ascribed to wandering kidney, ovarian cysts, varicocele of the broad ligament, displacements of the uterus, and various neuralgias or neuropathies.

The treatment of cæcum mobile at the present time has not been placed upon a rational basis. We must remember that the cæcum is normally movable, and it is only when it becomes dilated by reason of obstruction in the colon or excessively mobile by reason of congenital anomalies that serious symptoms result. The work of Wilms has been accepted by many German surgeons: Haussman, Klose, Stierlin, Rehn, Wolker, and others regard surgery as the only satisfactory remedy. But Sonnenburg [1] believes that a patient is better with a

[1] Since the above was written, Bevan, at the 1912 meeting of the A. M. A., stated that the mere movability of the cæcum can of itself alone give rise to trouble no more than can a normal ileum or a normal sigmoid, both of which are much more movable than the so-called mobile cæcum.

cæcum mobile than with a fixed cæcum, and he has not seen much benefit derived from the operation.

Fischler advises a restricted diet with the avoidance of carbohydrate, fat, or albumin; light massage; gymnastic exercises; the avoidance of purgation, and the administration of bismuth, magnesia, and rhubarb. He applies moist heat to the cæcal region by compresses worn during the night, although in very severe attacks the application of cold and minute doses of morphine may be necessary. He believes that atony, with stagnation of the contents and local meteorism, is responsible for the trouble and that operation will not be successful. One thing we must remember: it is exceedingly dangerous, unless the diagnosis is perfectly clear, to teach a non-operative method of treatment for attacks of pain in the right iliac fossa.

As to the method of operating, there may be said to be three methods in technique. Klose sutures the cæcum throughout its entire length to the lateral abdominal wall, the suture taking up only the serosa of the bowel and fastening it as far back as possible. Wilms makes a vertical incision in the parietal peritoneum about one inch from the peritoneal reflection and sutures the upper edge of the cut peritoneum over and onto the cæcum, thus pushing the cæcum into a retroperitoneal pocket. Klemm (*Archiv. für klin. Chir.,* July, 1911, p. 588) refers to plication in the unusually redundant form, and Blake (Annals of Surgery, 1912, lv, 767) plicated the wall of the cæcum by a continuous Cushing suture of linen, commencing at the site of the appendix and uniting the ventral and lateral tæniæ or striæ musculares together aborally along the ascending colon for a sufficient distance, usually 4 or 5 inches, to produce the desired effect. As the continuous suture is introduced and drawn tight, the length, and therefore the pendulousness, of the cæcum is diminished, as well as its calibre. The appendix is removed at the same time. As to the result of operation, no definite conclusions can yet be drawn. Stierlin, in reporting from Wilms's Clinic (*Deutsch. Zeit. fur Chir.,* 1910, 106, 407), refers to 61 cases, with a cure in 75 per cent., improvement in 16 per cent., and no improvement in 9 per cent.

Klose (ANNALS OF SURGERY, 1912, lv, 163) reports 154 cases operated on since 1904, with a complete cure in 89 per cent.

The two following cases, gathered from my recent experiences, are quoted as illustrative of cases of mobile cæcum in which the Wilms operation seemed indicated:

CASE I.—E. K. (10,399), age 24; was admitted to the University Hospital with a history of having suffered since the onset of menstruation with attacks of pain in the right iliac fossa. Two years ago the attacks became more severe and began a few days before the onset of menstruation and rendered her unable to occupy any regular position in business. Between periods she frequently suffered from bilious attacks independent of the quality or quantity of the food taken, although at times she suffered from a "dragging sensation" in the right iliac fossa which turns into a "sweeping pain" which moves up toward the epigastrium. Vomiting frequently occurs with the pain and sometimes relieves it. She has no pain regularly following the taking of food. She is frequently distended with gas. The bowels are constipated and require almost daily the taking of mild cathartics. Backache and headache are common.

Operation (January 7, 1912).—Appendectomy and fixation of the cæcum: Through an oblique incision over McBurney's point extended in either direction so as to give a more adequate exposure, the structures of the right iliac fossa were explored. An elongated and mobile cæcum was revealed, and to its outer side the appendix, seven or eight inches long, sharply flexed at about the junction of the middle and lower thirds, at which point a firm band of adhesion anchored it to the posterior wall of the abdomen. The appendix was removed. About 3 inches from the ileocecal valve Lane's kink was discovered. The band was divided and the raw surface of the peritoneum closed with continuous suture. To fix the cæcum, an incision was made in the parietal peritoneum, the edges of which were bluntly dissected both up and down, thus forming a pocket into which the cæcum was introduced and secured in place by a continuous linen suture between the longitudinal band of the cæcum and the upper margin of the peritoneal incision. The pelvic organs were examined, with negative results. The abdominal wound was closed and

the operation concluded with a dilatation of the cervix, with curettement.

Pathological Report of Appendix.—Specimen consists of an appendix measuring 14 cm. in length, with a diameter varying from .8 cm. at the base to 4 cm. at the tip. The surface is rather pale and shows practically no congestion, but there are many fine adhesions, especially near the tip. On section the coats appear normal.

On microscopic sections many of the glands are seen to be somewhat dilated and filled with secretion. There is marked congestion of the small blood-vessels in the mucosa and here and there quite considerable areas of hemorrhage in the lymphoid tissue. The other coats are not involved. Pathological diagnosis: acute catarrhal appendicitis.

CASE II.—E. B. (10,557), age 54, is a well-nourished adult female without any of the stigmata of visceroptosis. She has been married for 33 years and has had one child. She is generally constipated, requiring the frequent use of cathartics, but is not obstinately so, nor is the constipation worse at the time of her attacks. Her digestion is generally good, although gaseous distention and eructations are common. She passed the menopause four years ago, and had no trouble previously with menstruation. She suffers from attacks of pain in the right iliac fossa lasting 12 to 24 hours and occurring every month for nearly four years. She often gets nauseated, but rarely vomits during the attack. The pain sometimes radiates over the abdomen, but is usually confined to the right iliac fossa. The attacks are followed by great soreness, necessitating a stay in bed of from one to three days. There seems to be no cause for the attacks, the quality and quantity of food making no difference.

Upon admission to the University Hospital, we elicited nothing further except that the cæcum seemed to be large and gurgled on pressure. Pressure neither over McBurney's point nor on the opposite side caused any pain. She was thought to be suffering from chronic appendicitis.

Operation (February 14, 1912).—Appendectomy; fixation of cæcum: Through a McBurney incision, the cæcum and appendix were exposed and the former found to be redundant and atonic and the latter bound down to the posterior wall of the abdomen, occupying a position behind the cæcum. There had

evidently been a number of previous attacks of appendicitis, as the appendix itself was very brittle and the meso-appendix tremendously infiltrated. After the appendix was removed, a vertical incision was made in the lateral wall of the abdominal cavity and a pocket made for the cæcum by dissecting the peritoneum off a distance of an inch above and below the line of incision. The cæcum was then secured in place by a continuous suture of linen introduced through the superior margin of the peritoneal incision above described and the longitudinal band of the cæcum. There was, in addition, a moderately well developed Lane band, about three inches from the ileocecal valve; the band was divided and the raw peritoneum closed with continuous suture. The appendix (Lab. No. 3928) showed microscopically a marked thickening of the submucous and muscular coats with fibrous tissue overgrowth and a general appearance of progressive atrophy, as would be expected in a woman of this age. Patient made an uninterrupted recovery from operation.

It is impossible as yet to formulate any definite conclusions of the three conditions which I have just discussed. It will be necessary to obtain statistical information before the Lane kink will be accepted as a definite cause for symptoms referable to the right iliac fossa. I refer, of course, to the congenital type, and not to that acquired from adhesions, the result of a peritonitis, either arising from diseases of the appendix or other organs. While it is possible for a mobile cæcum to exist as a result of abnormalities in the descent of this portion of the bowel, it is probable that in most cases a dilated and atonic cæcum has resulted from some obstruction in the shape of membranes or bands wrapped around the ascending colon or kinks or adhesions at the hepatic flexure.

As to the symptoms, there seems to be no way of distinguishing the type of lesion with any degree of accuracy, except through the agency of the X-ray. Pictures made with the patient in the erect, recumbent, lateral and Trendelenburg positions will show the degree of mobility of the cæcum, the presence of adhesions, kinks, etc. The mere retention of the bismuth meal in the cæcum for a prolonged period of time does

not necessarily imply obstruction to peristalsis; the physiology of the colon is not as yet definitely understood, although Cannon, Holzknecht, Hertz, and others have done a great deal recently toward the elucidation of its physiology. It is possible in some cases to palpate the distended cæcum, but the symptoms of the Lane kink, of Jackson's membrane, and of cæcum mobile are singularly alike, and in many cases indistinguishable from those which we have been taught are indicative of chronic appendicitis. A statistical study of carefully-taken histories, a comparison of X-ray pictures and a careful recording of the findings of the operating table, the living pathology, as it were, are necessary in order to determine for the future what these conditions really mean to the patient. At the present time it suffices to say that the buttonhole incision for chronic appendicitis should be discarded; the incision should be large enough in all cases to inspect the surrounding viscera and to be able to correct any malformations or diseases thereof. The treatment of the Lane kink, of the Jackson's membrane, and of the cæcum mobile has been described, my own preference for cæcum mobile being the Wilms operation. Occasionally one will encounter extreme degrees of mobile cæcum with marked dilatation and atony; in such cases the operation of Lane should be performed, the ileum being transplanted into the sigmoid.

Dr. John B. Roberts said that he had had occasion to operate that day on a case of intestinal obstruction which had been operated on by another surgeon for appendicitis eight or ten months ago. An abscess had then been emptied in which it was necessary to put a drain. The patient still had the pains of which he complained long before he had the operation for appendicitis. He found a distinct Lane kink and other evidences of old adhesions, which may have been present before the appendix operation, for he declared his symptoms of pain were not relieved by the removal of the appendix. He found a constricting cord around his ileum, which caused the obstruction. Whether this was the remains of the omphalomesenteric duct or not he did not know.

SILK TENDON (LANGE) REMOVED TWO YEARS AFTER INTRODUCTION.

Dr. A. Bruce Gill said that the purposes of operative treatment of paralysis, aside from simple correction of deformity, are as follows:

1. The restoration of complete muscular power and normal function. The anastomosis of nerves is an attempt to secure this; but, while this would be the ideal procedure were it successful, it is at present a most uncertain operation.

2. The restoration of muscle balance with subnormal power. This is attempted (1) by tenotomy or tendon lengthening of the stronger muscles; (2) by tendon shortening of the weakened muscles; (3) by transplantation either of an opposing strong muscle or of a distant neutral muscle, using silk, if necessary, to lengthen the tendon; (4) by a moving of the joint itself in order to lengthen the arm of the lever on which the weakened muscles operate and to shorten correspondingly the arm on which the stronger muscles exert their power; and (5) by the implantation of silk check ligaments or by the Jones's skin plastic operation, which prevents the over-stretching of the weakened muscles and permits them to operate to greater advantage.

3. The restoration of stability of a limb without muscular power or the fixation of a flail joint in the best position for function. This may be secured (1) by arthrodesis, (2) by the implantation of silk ligaments, and (3) by the Jones's plastic method.

Professor Lange of Munich, by experiments begun in 1899, introduced and established the use of silk ligaments and tendons, although artificial tendon had been used as early as 1875. He states that silk prepared by boiling in sterile water may remain uninfected in the human tissues indefinitely; but that it may become infected from the blood years after its implantation, as it offers a favorable culture medium for micro-organisms. If the silk be boiled in corrosive sublimate solution, it remains forever antiseptic, as the silk and the sublimate enter into a chemical union; but the irritation of the sublimate produces a collection of sterile pus about the silk. But sublimate silk coated with paraffin is both antiseptic and non-irritative. He further states that such silk implanted in human tissues causes a formation of fibrous

or tendinous tissue around the silk and within its meshes, and that this tendon becomes as thick as a lead-pencil or even a little finger.

On April 26, 1910, Lange operated on a ten-year-old boy in the Widener Memorial Home for Crippled Children. The patient had quadriceps paralysis. He transplanted the semitendinosus muscle to the anterior surface of the tibia, using a heavy silk cord to lengthen the tendon. At the same time two similar cords were carried subcutaneously from the tendon or fascia below the tensor fasciæ femoris to the same point in the tibia, an inch below the tibial tubercle. Here several of the silk cords were sewed firmly to the periosteum and the ends of all tied together, with the knee in full extension. The limb was fixed in plaster for three months, at the end of which time the knee was maintained in extension when the thigh was raised from the table. A protective brace was worn subsequently. At the end of another three months it was noted that the knee was flexed to 110 degrees and that the patient had no power to extend it or hold it in extension. At the end of a year the leg could be completely flexed on the thigh and there was no voluntary power of extension. The thickened artificial tendons could be rolled loosely beneath the fingers and could be traced to just below the patella.

On March 28 of this year, Dr. E. B. Hodge, by whose courtesy this case was now reported, explored the site of the former operation. A fibrous or tendinous cord as large as a lead-pencil was found firmly attached to the tibia. Above the patella it divided to go to its two points of origin. All the silk cords were pulled loose from the tibia and lay within the fibrous sheath with their ends about two inches above the point of their original tibial attachment. The artificial tendons were relaxed even when the knee was fully flexed.

Two new silk cords were quilted into the artificial tendons. Two holes were then drilled through the crest of the tibia just below the former point of insertion. The silk cords were passed through the holes, some through one and the rest through the other. They were sutured to the periosteum and their ends tied together. A piece of the old silk was accidentally pulled out of its sheath and the semitendinosus tendon. It apparently was not attached to its sheath at any point, as it was pulled out of it

almost as easily as a string is pulled out of water. It is apparent that the silk is not at all penetrated by the fibrous tissue.

This case was considered to be worth reporting because it shows the results of one of Lange's own operations, in part substantiating his claims and in part refuting them. It also indicates that a periosteal attachment of the silk cords is not always strong enough to withstand the strain upon it.

RESULTS OF PLASTIC TO RELIEVE CICATRICIAL CONTRACTION.

Dr. J. M. Spellissy exhibited photographs illustrating results obtained from plastic flap transplantation in two cases of cicatricial burn contracture, and presented the second patient.

Case I.—L. F., aged five, admitted to the Methodist Hospital February 1, 1905, exhibited the condition in which the mucous membrane of the lower lip was pulled down below the sternal notch; and the whole front of the chest and arm down to the level of the elbow, to be a continuous cicatrix obliterating the profile outlines of the neck and drawing the angles of the mouth down to the lower borders of the clavicles.

First operation (February 24, 1905): At the suggestion and with the assistance of Dr. John B. Roberts a straight flap about two and a half inches in breadth, having its base at the neck, was dissected off the left side of the back from the ninth rib upward, swung into the space and sutured to the edges of an incision made at the base of the neck, separating the much thickened scar tissue down to the muscles, from a vertical line passing through the right ear to a similar position on the other side. The end of the flap reached but to the middle line of the neck. Marked improvement resulted from this operation, the mucous membrane of the lower lip having permanently come up as far as the border of the chin and the profile of the neck and chest being much better.

Second operation: On April 14, 1905, a similar flap, but longer, with an L-shaped end, was dissected from the left back and side, and sutured into the gap made by again incising the cicatrix in front and at the left side of the neck. The blood supply of the L-piece was defective and the latter sloughed away, so that while still further improvement was achieved in the full face and

profile appearances of the neck and chest and of the eversion of the lower lip, yet the sloughing of the end of the flap lost the closure of the lower lip as obtained on the operating table.

Third operation: As all skin for flap transplantation from the patient had been used, a third flap, on June 7, 1905, volunteered by her brother, a boy of about 14 years, was dissected from the under surface of his left arm. The base of the flap was at the internal margin of the arm, of about three and a half inches in breadth and of about the same length backward. It was dissected from the internal and posterior surfaces of the arm and reflected forward. The cicatrix of the sister's neck was again incised and freed until the lower lip easily remained closed. For a week prior to the operation patient and brother were daily trained in immobilization on two mattresses that had been sewn together, the hips and shoulders of the patient and her brother being strapped to the mattresses, his mattress having a slightly higher level than hers. The patient and the flap-donor lay on their backs with their heads in opposite directions. Their chins faced each other, so that when his left arm was placed across her upper chest, from her left side, with his elbow and forearm flexed at right angles with his arm and resting on a sand bag at the right of her head as shown in the diagram, his arm did not rest upon her chest but just touched it at the base of the neck. In this position the flap from the brother's arm was sutured into the gap in the sister's neck, promising permanent closure of her lower lip without contracture, when at a later stage the transplanted flap would be separated from the donor. Unfortunately, several minutes after the introduction of the last suture the patient suddenly suffered respiratory failure, and despite immediate cutting of the sutures, separation from her brother, the use of artificial respiration, and all restorative aids, she died. Throughout this operation the ether had been better borne than in the two preceding ones. The dense cicatrices enveloping her chest and in the second and third operations her back, because of the flap scars, completely surrounded her thorax and seriously and at last fatally embarrassed respiratory action.

Case II.—E. G., aged eleven, admitted to St. Joseph's Hospital on August 2, 1910, and transferred on October 1, 1910, to the service of Dr. Spellissy. She exhibited sulphuric acid burns

upon her face, right leg, forearm, elbow, and arm. By January 15, 1911, cicatrization of the burn involving the lower arm, elbow, and arm was complete. The resulting contracture did not permit extension beyond a right angle, as shown in Fig. 1.

First operation: On January 31, 1911, the cicatrix at the right elbow was incised across its anterior surface until the arm could be fully extended. The denuded space was some five inches in length. The extended arm was brought close to the right side of the patient and a flap equal to the length of the denuded surface dissected from her right side. Its breadth was about three inches, and it was reflected forward, the base being anterior and in line with the axillary fold. Longitudinal flaps were next dissected from above and below the area of the denuded side. They were slid together and sutured to each other and to the skin at each side, leaving no bare space. The under side of the reflected flap was then marginally sutured to the denuded space in the patient's extended arm except where the flap was continuous with the skin of the abdomen.

Second operation: On February 27, 1911, the plaster jacket which had enveloped the affected arm and chest of the patient since the first procedure, and the flap uniting the patient's arm to her abdomen, were cut and the margins of her wound freshened and sutured. A new cast was applied to the patient's arm still in extension but free from her body. The cast was removed and the patient presented to the Academy, exhibiting perfect function, as shown in Figs. 2 and 3.

DIVERTICULITIS OF THE SIGMOID.

Dr. Geo. Erety Shoemaker showed a specimen removed by resection from a woman aged 61 years. Within the last five years attacks began which were characterized by pain and soreness in the median and left abdomen, generally accompanied by constipation. An attack occurred three months before and another within two weeks of the operation, both attended by Dr. Brumm. No mucus nor blood in the stools, no diarrhœa, nor vomiting, but soreness with fever. Loss of weight ten pounds in a year. A watery, bloody, and brownish discharge from the vagina had occurred daily for several weeks and gave rise to a suspicion of carcinoma of the body of the uterus, but vaginal examination

showed no other indications of this. A mass, however, was felt behind to the left and close to the uterus, elongated and tender, too high to be felt by the rectum or seen by the sigmoidoscope, the latter causing too much pain for high introduction. The rectum was normal. The mass appeared to be along the intestinal wall.

Operation: Median incision. Uterus, tubes, and ovaries small and not obviously diseased though adherent on the left. Mass found to involve the sigmoid, which was contracted and made rigid from a point about three inches above the recto-uterine fold. Fat and epiploic appendages through this area were inflamed, red, and adherent. The hardness was not stony, and except at one point was not like carcinoma. Being unable to make a satisfactory end-to-end or side-to-side anastomosis of the large bowel after excision of the mass, on account of surrounding fat and inflamed tissue, the small intestine at a point six inches from the ileocæcal valve was united by lateral anastomosis to the front of the rectum, using clamps, and linen suture. Drainage slight, no leakage at any time. Tube out in 48 hours, pulse fair. Third day upper abdomen flat, some distention low, nausea. Fourth day flatus and five liquid stools. Fifth day many loose stools, epigastric distress, no distention above navel. Stomach irritable. In the night of the seventh day there were signs of acute cardiac dilatation and death occurred. There was no general peritonitis, the temperature range was low and improving, the wound was clean. There was much complaint of intestinal griping pain. As far as could be determined the colon did not distend.

The specimen shows inflamed intestinal wall with fifteen to twenty inflamed diverticula, some of which extend through the muscular wall into diverticula and some do not.

Dr. Shoemaker added that even with the abdomen open the diagnosis may be difficult, especially in those cases where pus has formed. It may be that some of the obscure, diffused, sluggish suppurations of the abdomen extending up along the large bowel have been really instances of diverticulitis, though supposed to have originated in the fallopian tube or elsewhere. Such a case is now recovering in the hospital after drainage only, the pus had a fecal odor and the patient was toxic, but in the absence of resection the origin remains unproven.

NEPHRECTOMY FOR PYONEPHROSIS WITH SACCULATION OF THE KIDNEY DUE TO VALVE ACTION.

Dr. Geo. Erety Shoemaker presented a woman, 24 years old, who complained of more or less constant pain in the right side, increasing to paroxysms, accompanied by fever, and these followed by a flow of dark urine with relief. An enlargement over the right kidney in front had been noted at intervals. Weight shows decided loss. She dates right-sided distress from a fall 13 years before when the clavicle was broken. On admission to the Presbyterian Hospital examination showed the right kidney not freely movable, the size varying. At intervals it was difficult to make out, another day a rounded, tender, elongated mass appeared about three times the size of a normal kidney. The left kidney was rather inaccessible, but the X-ray later showed it to be slightly enlarged.

The urine, drawn in a sterile flask, showed a pure and abundant growth of the *Staphylococcus albus*. Hæmoglobin 66; white blood-cells 6050; red blood-cells 3,500,000. There were no gonococci.

Cystoscopy was done by Dr. Geo. M. Laws. Bladder normal. Right ureteral opening pouted and œdematous. Indigo-carmine intramuscular injection, 20 c.c. of a 4 per cent. solution. On the right it appeared as a trace in nine minutes but did not increase. On the left there was no movement of the ureteral orifice for 18 minutes, then heavy voluminous spurts appeared and continued. The right kidney therefore appeared functionally inefficient, while the left was acting well for both.

Radiograph by Dr. Newcomet. About 45 c.c. of a 12.5 per cent. solution of collargol was previously injected into the right kidney and ureter by Dr. Laws. The radiograph shows with the greatest clearness some dilatation of the ureter except near the kidney pelvis, where it is decidedly narrowed (explainable by valve action). Dilated calyces in a kidney over seven inches long were distinctly shown, separated by partitions of kidney structure, the cortex being a shell.

Operation: Incision parallel to and close below twelfth rib readily exposed the lower dark blue pole of the kidney, the organ being long and thin. The upper portion, elongated and sacculated, was with some difficulty reached high under the ribs. Careful dissection freed the ureter, which was tied between catgut ligatures, and the vessels were secured by fine silk. There was no bleeding and no soiling of the field. Closure with fine tube superficial drain, no shock. Aseptic recovery. Urinary output from the other kidney was ample from the first. Relief from right-sided distress was immediate and permanent.

The specimen shows the sacculation due to long-continued back pressure. Shrinkage has occurred, but the X-ray plate shows the size. The ureter leaves the pelvis obliquely and continues parallel to its wall, closely attached by connective tissue, which has since been dissected away. This resulted in valve action, when the pelvis filled. Doubtless this action was disturbed in turn by distention and descent of the lower pole of the kidney, the upper end being firmly fixed. Intermittent discharge would thus be accomplished. Slow dilatation at the expense of the structure followed this intermittent back pressure. Chronic infection was later added.

STATED MEETING, HELD OCTOBER 7, 1912

Dr. Gwilym G. Davis, President, in the Chair.

SPRAIN-FRACTURES.

Dr. Penn G. Skillern, Jr., presented skiagraphs of cases of sprain-fracture as follows:

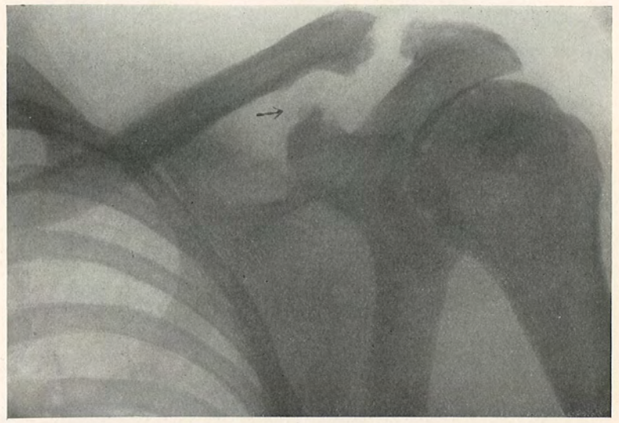
Case I.—*Sprain-fracture of coracoid process of scapula.* A football player, aged 20, fell upon his right shoulder, causing luxation at acromioclavicular joint. Skiagram (Fig. 1) showed a scale of bone torn off from the coracoid, probably from traction upon the coracoclavicular ligaments. Fractures of the coracoid process are rare, their line usually involving the base. The frequency of combination of this sprain-fracture with luxation at this point has not been established.

Case II.—*Sprain-fracture of wrist.* This skiagram (Fig. 2) of an ordinary "sprained wrist" showed avulsion of a scale of bone from the dorsum of the carpus, probably from the os magnum. This scale was not palpable on account of the swelling, but there was distinct localized tenderness over it. A skiagram should be made of every "sprained wrist" and the treatment should be immobilization.

Case III.—*Sprain-fracture of anterior superior spine of ilium.* Male, aged 16, during a foot race felt something snap in upper part of left thigh, but finished race (five yards). Pain aggravated by flexion of thigh. Skiagram (Fig. 3) showed avulsion of a shell of bone from the anterior superior spine and its immediate vicinity, evidently from action of the sartorius muscle.

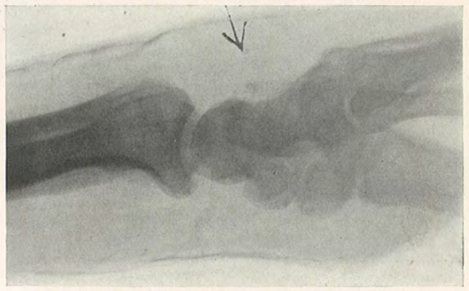
Case IV.—*Sprain-fracture of cuboid.* S. K., male, aged 23. Twisted left foot inward and heard something crack, immediately after which swelling appeared at external tarsometatarsal joint. No previous injury here. Examination showed swelling and ecchymosis between external malleolus and this joint, and definitely localized tenderness at antero-external corner of cuboid, suggesting sprain-fracture of same. Skiagram (Fig. 4) showed chipping off of a sliver of bone from antero-external corner of

Fig. 1.



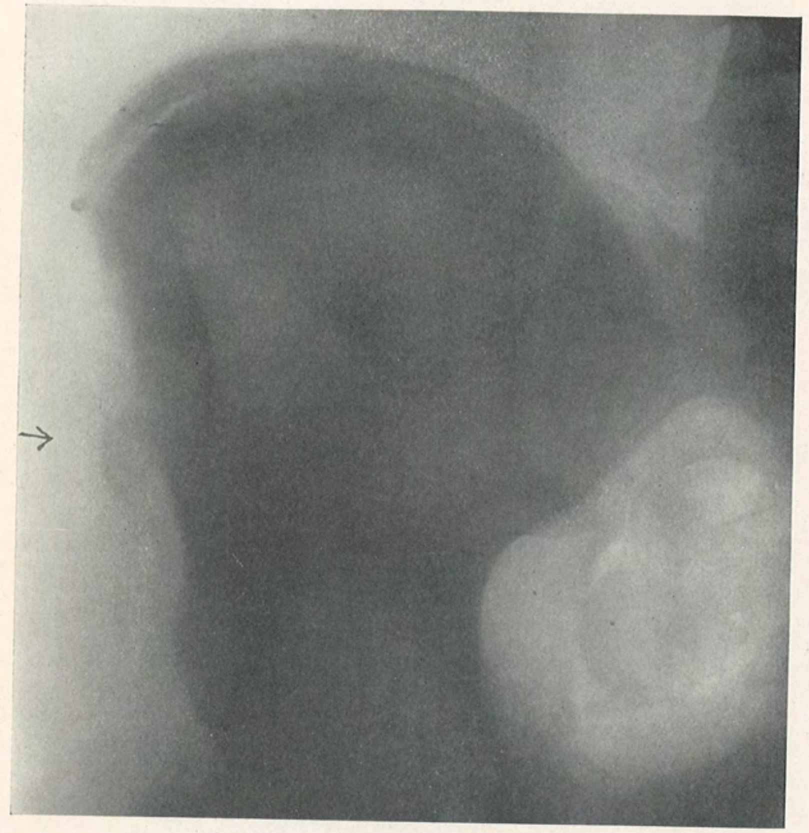
Fracture of coracoid process scapula.

Fig. 2.



Sprain. Fracture of wrist.

Fig. 3.

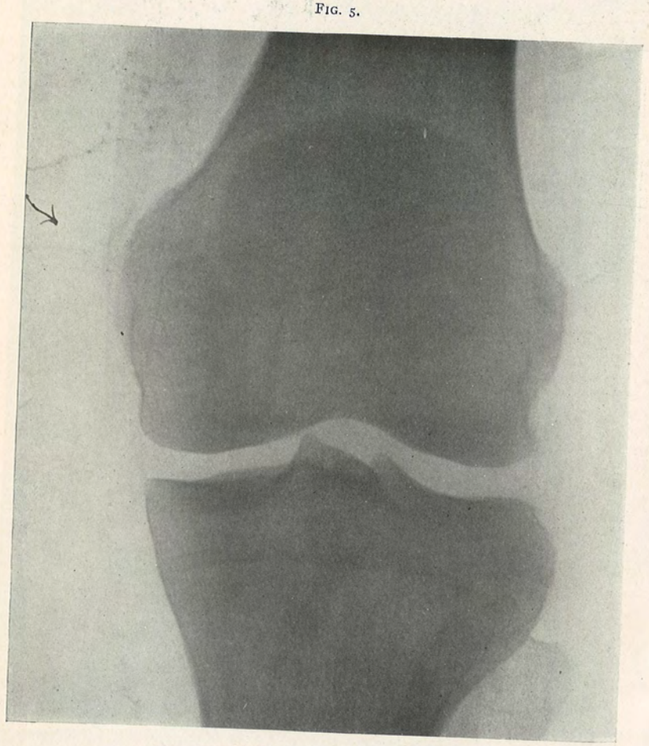


Sprain. Fracture of anterior superior spine of ilium.

Fig. 4.

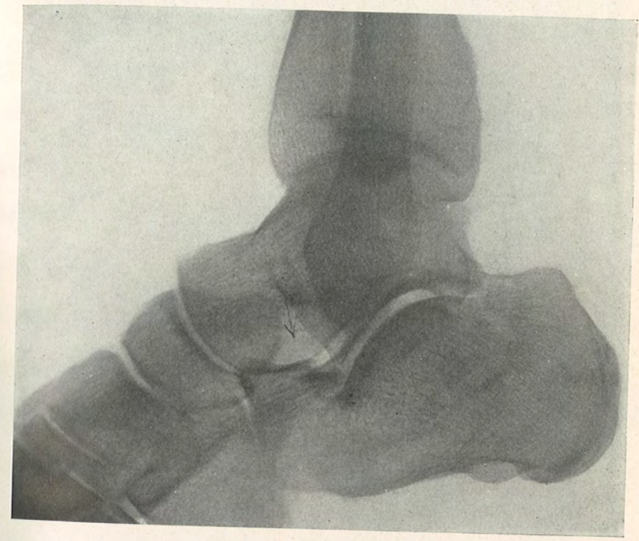
Sprain fracture of tarsal cuboid.

FIG. 5.



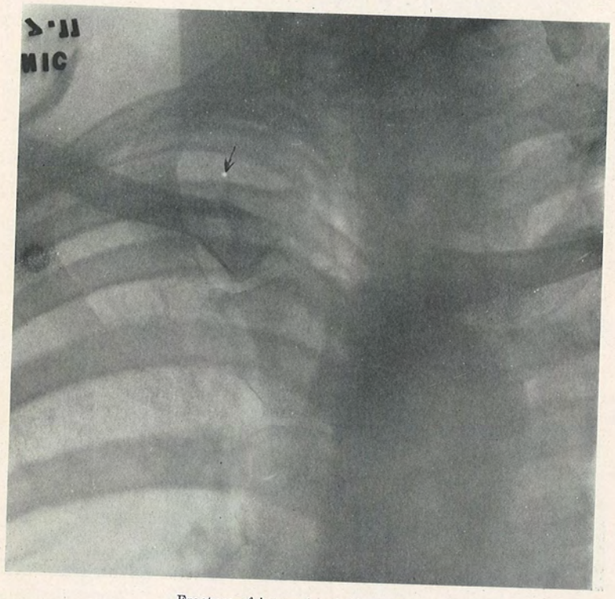
Separation of adductor tubercle of the femur.

FIG. 6.



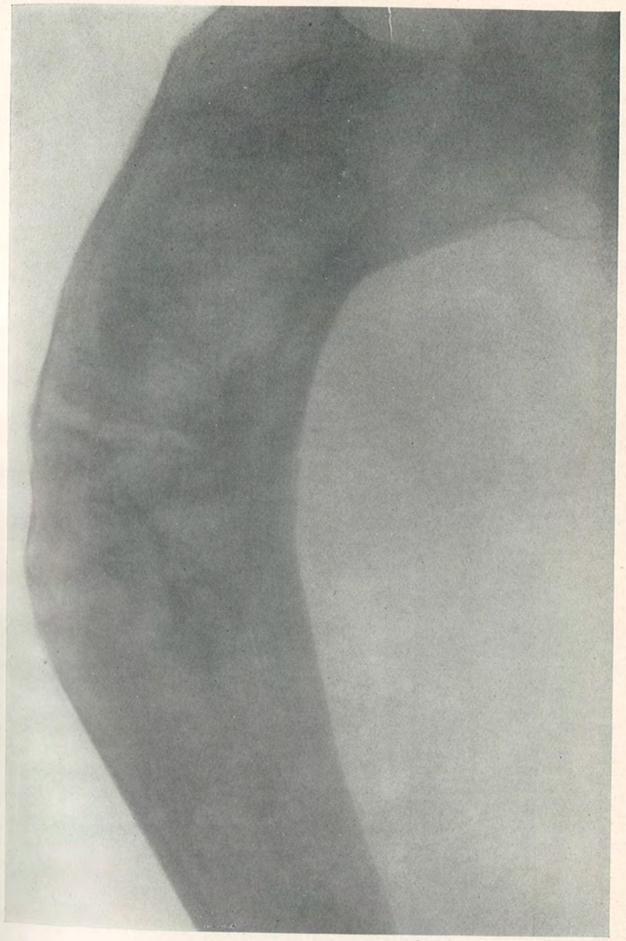
Fracture of sustentaculum tali.

FIG. 7.



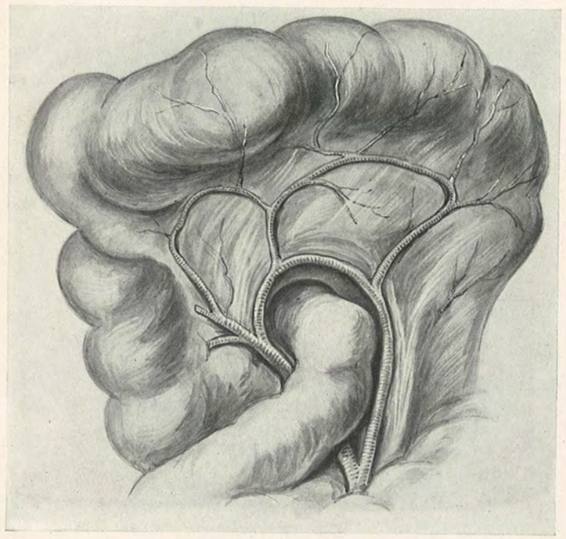
Fracture of internal end of clavicle.

FIG. 8.



Hereditary syphilis of femur.

FIG. 9.



Mesocolic fossa of extraordinary depth.

cuboid, evidently from overstretching of the dorsal tarsometatarsal ligament at this site. Foot strapped in over-abduction with relief of pain.

CASE V.—*Fracture of adductor tubercle of femur.* Boilermaker, aged 20, received a blow upon the lower part of the left thigh. There was localized tenderness just above internal condyle. Skiagram (Fig. 5) showed separation of adductor tubercle, and the tendon of the adductor magnus leads to it as a shadow.

CASE VI.—*Fracture of sustentaculum tali.* Male, aged 35, fell from a height of 10 feet, landing on feet. Skiagram (Fig. 6) showed an impaction of the sustentaculum into the body of the os calcis.

CASE VII.—*Fracture of clavicle, sternal end.* Male, aged 40, was struck by a heavy object upon the right clavicle. Examination revealed a dense and tender swelling over the clavicle near the sternum, which to inspection resembled a neoplasm and a luxation at the sternoclavicular joint. Skiagram (Fig. 7) revealed a line of fracture within an inch of the sternoclavicular joint. In the literature this fracture is very infrequently met with.

CASE VIII.—*Syphilis hereditaria tarda of femur.* Male, aged 22, farmer. Except for lesion in left thigh is robust and healthy. Three years previous to admission had what was diagnosed and treated as a fracture of the femur. For several years before that had had trouble with left femur, giving rise to a perceptible limp. Examination revealed marked bowing of left thigh, the point of greatest convexity being 13 cm. below the anterior superior iliac spine. Left thigh 6.5 cm. shorter than right. On palpation the upper part of the femur was of great uniform diameter, markedly roughened, but not tender. No inflammatory manifestations, no areas of softening, no sinuses. There was no history of tuberculosis, malignancy, or syphilis in the family. Diagnosis of late hereditary syphilis of femur made. Skiagram (Fig. 8) revealed marked increase in diameter of upper half of femur; obliteration of medullary cavity; alternating areas of osteoporosis and osteosclerosis; and the line of an incomplete fracture at the point of greatest convexity of the femur. Wassermann reaction positive (Ivy). Mercury and iodide treatment was instituted and an orthopædic splint adjusted by Dr. Willard so as to transfer weight supported by left lower limb from ground to pelvis as a base of support. After 8 months, while the

patient had better use of and less inconvenience with the limb, yet skiagrams indicated but little change in the condition of the bone, and quite recently a dose of neo-salvarsan was administered.

CASE IX.—*Mesocolic fossa of extraordinary depth.* Found in a female body in the angle between the duodenojejunal flexure and mesocolon, this fossa measured 3.5 cm. in width, and 4 cm. in depth (Fig. 9). The mouth of the fossa was bounded on the left by the left colic branch of the inferior mesenteric artery and vein; in front by an arterial arch which connects the middle colic artery with the left colic. Leaving this arch at its middle and behind it is the inferior mesenteric vein, while attached to the arch and enclosing it is the posterior lamella of the mesocolon. On the right the mouth is bounded by the middle colic artery and the trunk of the superior mesenteric. Posteriorly is the third portion of the duodenum and the renal artery.

The anterior wall of the pouch is bounded by the pancreas; the posterior wall by the duodenojejunal flexure; the right by the superior mesenteric vessels; and the left by the descending colon and anterior half of the left kidney.

This fossa offers an excellent site for lodgment of an internal abdominal hernia.

DR. W. G. ELMER remarked that one should be careful not to be led into error by examination of a late X-ray picture. If the ligament tears away the osteogenetic layer from the bone, it is open to supposition that a small island of bone may be formed in the vicinity of the bone from which it was supposed to have been torn away.

DR. ASTLEY P. C. ASHHURST said that it seemed to him that there was no need to exaggerate the frequency of sprain-fractures, when it was possible to explain the lesions in other ways. Drs. Ross and Stewart (ANNALS OF SURGERY, 1912, ii, 599, Fig. 4) included in their series of sprain fractures an experimental fracture of the coronoid process of the ulna which was quite clearly caused by direct violence and not by ligamentous distraction. So in the case reported by Dr. Skillern, it seemed to Dr. Ashhurst that the fracture might very well have been caused by direct violence.

THE REDUCTION OF OLD UNREDUCED DISLOCATIONS OF THE SHOULDER.

BY T. TURNER THOMAS, M.D.,

OF PHILADELPHIA.

Associate Professor of Applied Anatomy and Associate in Surgery in the University of Pennsylvania; Surgeon to the Philadelphia General Hospital; Assistant Surgeon to the University Hospital.

THE best treatment for the old unreduced dislocations of the shoulder is still undecided, although there is probably no question concerning traumatic conditions of the shoulder that has been the subject of more prolonged and earnest discussion. The most definite result that has been attained is the general tendency toward earlier operative interference, the chief advantage of which is that the severe force necessary for the reduction can be applied with less danger of fracture of the humerus and with greater safety to the surrounding important vessels and nerves. But the results of such operations are far from satisfactory, in many cases the reduction still remaining impossible and the operation frequently ending in an excision of the head of the humerus. That nearly all dislocations become practically irreducible after three months, and that they often become very difficult of reduction in as many weeks, is generally conceded. As a medical student I was taught that attempts at reduction should be made up to three months, and that even after that, operation was not of necessity indicated. There was a considerable difference in the views of teachers then as now. Although Kocher [1] operated as early as five and seven weeks in some cases, his record of non-operative reductions has probably never been equalled. He reported 25 successful reductions out of 28 cases, after 5 months and 22 days in the longest and 5 weeks in the shortest. The position taken by Lund [2] 15 years ago probably represents the present general tendency among surgeons as

well as any. According to Lund, "after more than six weeks have elapsed, such changes have usually taken place as to render success, with such manipulative methods as it is safe to employ without danger of fracture of the humerus or rupture of the axillary artery, improbable. If reduction is to be accomplished at all, it is to be accomplished by arthrotomy, with or without resection of the head of the humerus." He refers to the "remarkable case of Burrell" in which the reduction was accomplished without operation after eight months. Cavaillon,[3] in his report of a case reduced after six months by Jaboulay, says that Koenig reduced one after eight years and Sedillot one after one year without operation. The opinion of the profession generally, at the present time, is probably expressed in the statement of Forque and Reclus, quoted by Cavaillon, to the effect that success by manipulative methods in such old cases made them pernicious examples, evidently, because they encouraged too daring and dangerous attempts by others. The axillary vessels have been ruptured in rare instances and the humerus fractured many times. Kocher fractured the humerus in the three cases in which he failed to reduce the dislocation, and likewise in one of his operated cases in the efforts to reduce by his method before operation, resecting the fractured head in the operation. In another of the operated cases the upper end of the humerus was fractured in attempts at reduction before the patient came to the hospital.

It would be generally admitted that the average functional result following a non-operative reduction is better than that following an operative reduction. Jonas,[4] in supporting the operative method, says: "The division of muscles, especially the deltoid and the subscapularis, has often been extensive and the separation of fibrous and capsular structures extended over a wide area, before reposition became possible." I doubt if as much damage is done to normal structures in the usual reduction by manipulation, so that the return of function should be more rapid and more complete. It is very likely, however, that complete return of motion and function is rare

even after the non-operative reduction, except perhaps in cases of two or three weeks' duration. The increased tendency toward operative reduction is to be explained by the almost insurmountable obstacles to reduction in many cases, and the present-day well-developed technic for operations in general. Yet, notwithstanding the very large number of operations which have been done by the best surgeons, we have no reason to be particularly proud, even when the reduction has been accomplished. The mortality of operation has been considerable, while the non-operative reductions have a much better record in this respect. Kocher, for instance, had one death from sepsis in his eight operative cases, but none in his 25 successful and three unsuccessful non-operative cases. In another operative case, a sinus was still present nearly seven years after operation.

One is apt to underestimate the difficulties until he has attempted the reduction in one of these cases. The humeral head is not far removed from its normal place in the socket. The anterior glenoid margin, in the subcoracoid variety, is in contact with the cartilaginous portion of the head, above and posteriorly, just anterior to the anatomical neck, so that the greater tuberosity is still in the glenoid cavity or directly over it, and only the rounded portion of the head is anterior to the glenoid margin. Yet to bring the whole of the head back into the socket, after a few weeks, is often very difficult. The particular obstacle to reduction has never been satisfactorily demonstrated.

During the last four or five years I have had considerable interest in the results of traumatic conditions about the shoulder, many of which are very obscure. I began early to pay attention to the old unreduced dislocations and to theorize, on the basis of the cadaver dislocations, as to the cause of the difficulties in reduction. The first fact to attract my attention was that the reduction, which is usually very easy under full anæsthesia at the time of the accident, becomes very difficult in two or three weeks, and that without regard to whether the X-ray shows a concomitant fracture or not.

To my mind that meant that the obstruction was in the soft tissues. My first conclusion was that it was due to a shortening of the muscles and that it was somewhat of the same nature as that encountered in an old ununited fracture. In the meantime I had been trying to work out the solution of the problem of other conditions in this region, as the recurrent dislocations, stiff and painful shoulders, and some traumatic brachial paralyses. I ultimately concluded that these conditions were all the results of dislocations and their analogous but milder conditions, the sprains of the shoulder, and that the essential lesion in all was the laceration of the axillary portion of the capsule. I have satisfied myself that the capsule of the shoulder-joint is not the negligible structure that it is generally thought to be, and that the best treatment of these cases is that directed to the cicatricial changes which have occurred at the site of the capsule tear. I then concluded to study, so far as my limited opportunities would permit, the possibility or probability that the chief resistance to reduction in old unreduced dislocations came from the same cicatricial changes, which tend to fix the head in its dislocated position. These changes could advance far enough in two or three weeks to offer a considerable resistance to reduction, and the longer the dislocation remained the greater would be the contraction and resistance of the cicatricial tissue. I had not at that time, but have since studied Kocher's paper in which his conception as to the obstacles was based upon his previous cadaver observations and upon his experience with 36 cases, eight operative, and upon an autopsy on a case in which he had not attempted reduction. Although he had attached considerable importance to irregular bone formation and fragments, he says that his main contention, which he justified by his operative cases, was that the reduction was obstructed not by adhesions between the humeral head and scapula, but by the contraction in the region of the old capsule tear between the margins of the glenoid and the anatomical neck of the humerus. These closed the capsule tear, he says, and hindered the raising of the capsule from

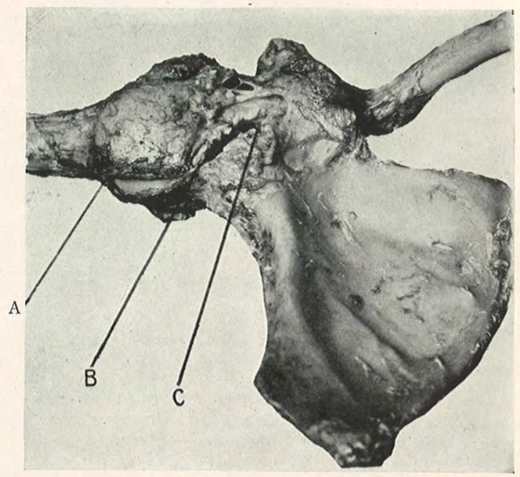
the glenoid so that the head could not enter. In other words the margins of the rent in the capsule, which he believed offered a considerable resistance to reduction in the recent condition, now became thickened and contracted by cicatricial tissue and thus accounted for the increased difficulty. In his post-mortem dissection, however, he "found no capsule tear anywhere" but where it was originally, "a closed fibrous tissue covering passed over the head everywhere."

His conception of the rent in the capsule was obtained from his study of the dislocation on the cadaver.[5] But in producing it he followed Malgaigne's method of first dividing the capsule by an incision in the axilla, from the lower border of the subscapularis to the origin of the triceps. As I understand it, he made a longitudinal incision from the glenoid to the humeral attachment, in the lowest part of the joint. He then produced the dislocation by raising the arm to the vertical position "with force" and pushed it outward. On dropping the arm he found that he had a complete subcoracoid dislocation. If the head escaped through the opening in the capsule which he made with the knife and which was longitudinal, the margins would probably close about the neck of the humerus and offer a considerable resistance to reduction. On the basis of observations made upon capsule specimens dissected after a dislocation had been made by forced abduction and upon intact capsule specimens, I concluded that such a result is impossible. I have since produced a dislocation on the cadaver after making such an incision in the capsule as Kocher describes and am still more convinced that the head cannot escape from the socket through such an opening (Fig. 1, AB). As the arm is carried into abduction, the axillary portion of the capsule becomes tense and limits the abduction (Fig. 2). The effect upon the longitudinal opening is to bring its margins together so that the dislocation cannot occur until the abducting force has made a more or less extensive new tear in the capsule at an angle with the longitudinal opening (Fig. 1, BC). The presence of the incised opening probably influences somewhat the direc-

tion and extent of the tearing, but before the dislocation could occur there would be a more or less transverse rent that, added to the incised opening, would present a very large opening into the joint, in the axillary or anterio-inferior portion (Fig. 3). Without such an incision, the tearing usually takes place from the glenoid or humeral attachment. Since the capsule conditions which Kocher emphasized in his description of the cadaver dislocation tallies almost if not exactly with what I have seen repeatedly in my cadaver work, I believe that his longitudinal incision had only little influence upon the size of the transverse rent which permitted or was caused by the dislocation. As I have seen the laceration of the capsule, its margins cannot become constricted about the neck of the humerus in a recent dislocation. It is too extensive and its transverse direction will not permit it (Fig. 4). This view is not original since Professor G. G. Davis taught his classes in applied anatomy at the University of Pennsylvania for more than ten years that the margins of the rent in the capsule would not prevent reduction of a recent dislocation.

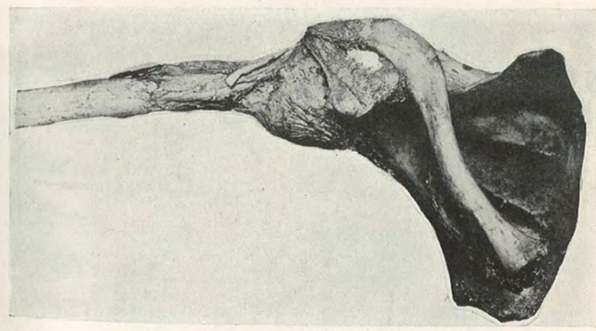
On the other hand I find that the conclusions which I had reached concerning the cicatricial changes in the capsule and upon which I had based my efforts at reduction in my first four shoulders (three patients), did not differ greatly from those which Kocher had reached. The one difference which I regard as important, *i.e.*, as to the importance of the margins of the rent in resisting reduction by constriction about the neck, has led me to reject the Kocher method of reduction and to employ the old method of abduction, or one of the abduction methods, and because of the good results which I have obtained with it have concluded to report the results of my observations and to support the method which I think is best. While Kocher says that his main contention which concerned the cicatricial changes at the site of the tear in the capsule was based upon his operative cases, it is evident that his interpretation of the effect of these changes was based primarily upon the conditions found in the cadaver dislocations. He assumed, therefore, that the subcoracoid dis-

FIG. 1.



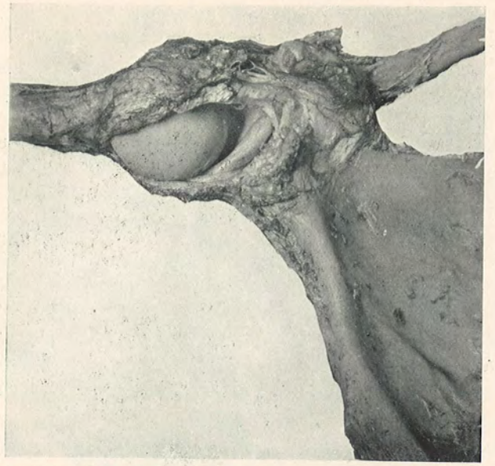
Capsule preparation from cadaver dislocation produced by Malgaigne method which was employed by Kocher. View from below and anteriorly. *A*, *B*, opening made in lower part of capsule by incision; *B*, *C*, increase in capsule opening made in producing dislocation by abduction after incision was made. At *B* the capsule margins were approximated by a suture, to indicate the junction of the incised and tear portions of the capsule opening necessary for the occurrence of the dislocation.

FIG. 2.



Limit of abduction with scapula fixed in normal position (when arm is hanging at side). Axillary portion of capsule tense and humeral head held firmly against glenoid surface. Further abduction will tear axillary portion of capsule.

FIG. 3.



Same preparation as in Fig. 1, showing size of capsule opening produced by the combination of incision and tearing, and necessary for the occurrence of the dislocation.

FIG. 4.

Capsule specimen of subcoracoid dislocation produced by forced abduction without incision. Upper margin of capsule tear carried forward with head under coracoid process. Humeral head has not passed through the rent, the margins of which do not constrict the neck. Therefore, in a recent dislocation they will not obstruct the reduction. The gap in which a portion of the head presents will later be filled in by cicatricial tissue, which, in an old dislocation, will offer the chief obstacle to reduction.

location in the cadaver produced by forced abduction, since that is how he produced it, represents the same condition as the subcoracoid dislocation in life. The work which I have already done on traumatic conditions of the shoulder is based upon the same assumption, with the further conclusion that all anterior dislocations are essentially the same. The cadaver dislocation, therefore, makes an excellent basis upon which to build up the probable results in life of the later cicatricial changes. In this way I determined to my own satisfaction the pathology of the recurrent dislocation, and upon this basis have now operated on 12 cases and have assisted in another, with only one recurrence of the dislocations. I believe that there is very little difference between the capsule conditions developing in the recurrent and the old unreduced, except that in the latter the continuance of the dislocated position has permitted the capsule about the humeral head to become firmly fixed in its abnormal position. In both conditions the capsule is completely repaired, but to meet abnormal conditions, *i.e.*, to permit the humeral head to occupy the dislocated position. Kocher "found no capsule tear anywhere" in his autopsy but "a closed fibrous tissue covering passed over the head everywhere." No one has yet reported that he found the tear unhealed in an operation on a recurrent dislocation.

In my effort to locate the obstructing portion of the changed capsule, I have taken for the type, as did Kocher, the dislocation without fracture, in which the upper and posterior portion of the capsule was not torn. With the head in the abnormal position, the lacerated capsule would, of necessity, adapt itself to the altered relations of the articulating surfaces and this rearrangement can be observed on the cadaver (Fig. 4). When the tear is from the glenoid margin, which is probably the most common variety, the torn portion of capsule attached to the humerus maintains about its normal relation to the head as does the capsule to the neck and head of the femur in the corresponding condition in the hip (as shown by Allis[6]). The head of the humerus protruding at the site of the rent, but not completely through it, separates

the upper torn edge of capsule from its normal place at the glenoid margin, so that later when the gap has been filled in by new cicatricial capsule this portion of the repaired capsule is longer than normal by the width of the gap. Therefore, the obstruction cannot come from this portion of the repaired capsule. The posterior portion, which is dragged tensely over the glenoid cavity by the head in its dislocated position, will be kept continuously at its normal length so that, because of its length and the fact that it is not put under tension in the reduction, it will not resist the return of the head to the socket, unless it becomes adherent to the glenoid surface as Kocher found in one of his operated cases. Even if it does, the traction on the humerus in abduction might separate it during the reduction. But in the regions between these two portions the capsule conditions are not so favorable to reduction. The undamaged portions at the upper and lower limits of the rent pass forward and inward with the head, so that instead of having a vertical direction as in the normal condition they now are about transverse, and as Kocher showed for the upper portion are rolled somewhat into a cord (Fig. 5). Cicatricial tissue fixes them to the corresponding portions of the scapula, the upper portion near the base of the coracoid process and the lower portion near the bottom of the glenoid cavity. I believe that these two portions of the capsule must be torn more or less before the head can be brought back to the socket, and that it will require considerable force to tear them.

I had determined that traction on the humerus at about a right angle with the trunk, firm fixation of the scapula, and traction or direct pressure on the head toward the socket was the safest and best method of breaking this resistance, but was still concerned about the risk to the axillary vessels and nerves. I knew that severe force had been applied by a variety of methods in a large number of cases, and that vessel rupture, at least, was very rare. A study of the normal relations and those of the dislocation on the cadaver gave some interesting results in connection with this phase of the

subject. Normally, the capsule is practically completely covered by the short rotators. With the exception of the circumflex, none of the large vessels and nerves lies directly in contact with the capsule, the circumflex nerve and posterior circumflex vessels being in contact with a small portion of it near its humeral attachment. In an anterior dislocation, the humeral head passes downward and forward, and overlaps for a short distance the glenoid margin but still remains under the subscapularis, which continues to separate it from the large vessels and nerves. These are adherent to the upper surface of the muscle, and do not move with the head when it is being luxated, so that they come to occupy a position anterior to the dislocated head, and in my opinion are not in danger from direct pressure on the head toward the socket, if that pressure is made over the most prominent portion of the head and from a position somewhat posterior. Kocher emphasized the danger to these structures from the heel in the axilla in the Cooper method, which seems to have been the most popular one in recent dislocations up to that time, and it is this danger which was probably the most important factor in obtaining for the Kocher method the rapid and extensive recognition which it received. While they should always be respected, I believe that the danger to the vessels and nerves has been over-rated, especially when the arm is in abduction. I have now operated on two cases of recurrent dislocation of the shoulder through an axillary incision behind the large vessels and nerves, reaching the capsule in the space between the lower border of the subscapularis and the adjacent border of the latissimus dorsi. With a little traction upward on the subscapularis I came directly upon the most prominent portion of the head. This was maintained in the dislocated position to bring it nearer to the surface. The large vessels and nerves did not come into view at any time. The circumflex nerve and vessels were below the most prominent portion of the head in both cases, but in one the subscapular branches of the axillary vessels lay almost directly over the prominence. Although much direct pressure was made on the

head in the reduction, in all my cases, in some of them very severe, not one complained of any disturbance that would indicate any damage to vessels or nerves. If the subscapular vessels came in the line of pressure, either they could tolerate very much pressure without suffering or they moved away as the pressure increased, as could easily happen, since the comparatively thick subscapularis muscle intervenes between the vessels and the humeral head. In view of these observations, the large number of reductions and attempts at reduction in old dislocations with severe force and the infrequency of nerve or vessel rupture, I believe that usually dangerous involvement of the nerves and vessels in the cicatricial tissues does not occur. Guibe [7] studied the lesions of the axillary vessels complicating dislocations of the shoulder, with special reference to the treatment of these complications. He says that it is difficult to determine their relative frequency, that they are very rare but not exceptional. Hennequin did not mention them in his treatise on dislocations, which shows, Guibe thinks, that he had no personal experience with them, although he probably saw and reduced more dislocations of the shoulder than any other man in France, at least old dislocations. Of the 78 cases collected from the literature by Guibe, it appears that in only 31 were the axillary vessels ruptured during attempts at reduction of old dislocations, and most of these were of six weeks' duration or less. In the remaining cases the complication occurred at the time of the dislocation or of the reduction immediately afterward. With the abduction method which I have employed there should be the least danger, because by it the head is dragged back to the socket by the shortest and most direct route. Kocher in describing the findings in his autopsy case said that the nerve cords and vessels were somewhat removed from the head. I searched several museum collections for a wet specimen of an old dislocation but failed to find one.

To formulate a theory is one thing, to apply it in the presence of danger is quite another. I was prepared, however, to test it when the opportunity came. I wish to acknowledge

here that I was further prepared by a statement made by Professor Edward Martin, based upon his operative experience, to the effect that in his opinion the chief obstacle to reduction was ligamentous. This was the main point in my observations. Soon afterward I again took advantage of his rich experience. In one case after the usual efforts to reduce by non-operative methods, he exposed the joint, and after dividing such obstructing tissues as could be located and after failing to bring the head into the socket by the Kocher and other methods, under protection of the field of operation, he placed one foot against the axillary border of the scapula and pulled strongly outward on the arm in abduction, with immediate reduction of the dislocation. While the head had been considerably mobilized by the operation, to my mind, it was of much importance that the abduction method succeeded after the Kocher and other methods had failed. I valued this encouragement the more when I found that in my first case the dislocation had existed for eight months, and that an unsuccessful effort at reduction under ether had been made at the end of three months. I succeeded in the reduction only after the use of much force, but the after-course was quite uneventful.

I realize that the superiority of the Kocher method over all others in old as well as recent dislocations has become so firmly established that it will not be an easy matter to obtain consideration for any other. The abduction method, however, is an older one and has done good service in the past. Kocher's success with his method seems to have been greater than any one else has had with it in old dislocations, probably because in addition to knowing it better than any one else he risked more force than most surgeons would employ. His only failures were in those cases in which he could not employ more force by his method after fracturing the humerus. Such success as I have had with the abduction method is to be explained by the fact that I could use enough force to reduce the dislocation in every case without fracturing the humerus. The one failure was not due to inability to

reduce but to keep it reduced. It is my belief that it is distinctly superior to the Kocher method in old dislocations, and I have hoped that I could show that it was. In this connection the suggestion of Dr. A. C. Wood is most valuable. He said that the principle of the abduction method was exactly the same as that which Allis [6] established for dislocations of the hip. By reversing the steps of the mechanism of the dislocation, Allis merely drags the femoral head back to the acetabulum through the same path by which it reached its dislocated position. Some years ago Dr. Allis gave me the following brief and simple illustration of the principle of his method: "If a boy after diving into the water were to come back feet first, he would be doing what I try to do in dislocations of the hip." Kocher considered that the effectiveness of his method depended upon the same principle as that of the Bigelow or circumduction method, and that the coracohumeral ligament of the shoulder is analogous to the Y ligament of the hip.

In the Bigelow method the Y ligament is depended upon to stand the chief strain in bringing the head back into the socket. This is accomplished by a series of movements calculated by twisting to shorten it and by using it as a fulcrum to pry the head into place. While the coracohumeral ligament may be the analogue of the Y ligament, as Kocher suggests, it is not nearly as strong as the latter, actually or relatively. Its upper single limb arises from the outer edge of the horizontal portion of the coracoid process, and soon fusing with the capsule runs without very distinct borders to both tuberosities, crossing the bicipital groove (Piersol). Kocher in his first paper, in which he introduced his method and in which he referred only to recent dislocations, stated that the rotating mechanism was destroyed and the method was rendered ineffective when the greater tuberosity was broken off or almost the whole capsule torn away. I have found the latter condition several times in my cadaver work. He found the greater tuberosity broken off in seven of his eight operative cases. He had no means of determining the frequency of this condition in his non-operative cases, except by the finding of crepitus which is a very uncertain sign. The X-ray has shown that this fracture is much more frequent than was formerly thought. In the presence of this fracture, I think, that the conditions are made relatively more unfavorable for reduction in old dislocations. Reunion may have taken place but in such a case it is likely to be faulty. But even if the coracohumeral ligament which is attached to the greater tuberosity remains intact, it becomes involved in the cicatricial tissue, because it is at the upper limit of the rent and is carried forward and upward to the site of the greatest cicatricial shortening of the repaired capsule. It would be difficult to calculate what its influence is under such circumstances, but it is fair to assume that it cannot be as effective in old as in recent dislocations. In reduction by the Allis principle, the capsule plays no part, except in so far as it must be torn to permit the reduction. We depend upon the strength of the humerus and, with firm fixation of the scapula, the force is applied through it to the shortened portions of the capsule. The traction is made in its long axis, and at the upper end the force, driving the head toward the socket, is applied almost directly to the bone. In the Kocher method the main force is applied to the lower end of the humerus, which represents a long lever, the fulcrum being at the attachment of the capsule to the anatomical neck. Of the four fractures produced by Kocher, three were at the upper end of the humerus. He recognized that the external rotation was the dangerous movement. This is eliminated in the abduction method.

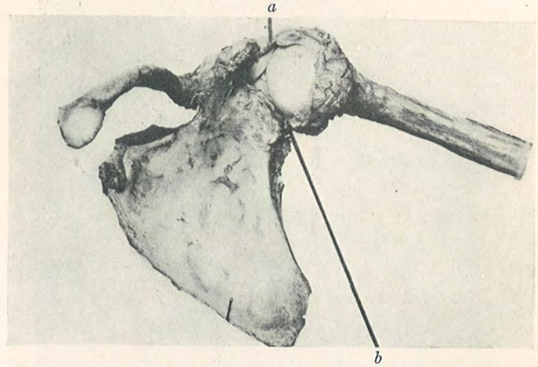
It is generally recognized that the humeral head leaves the socket while the arm is in abduction. In the normal condition, when the scapula is fixed in its position of rest, *i.e.*, the position it occupies when the arm is hanging at the side of the body, the humerus reaches the limit of abduction at about a right angle with the body (Fig. 2). In the dislocation when the arm is in abduction, the head is anterior to and on a slightly higher level than the socket. Therefore, to reduce, the head must first be brought down to the level of

the socket so that it can be made to ride over the anterior margin of the socket, outward and backward. The traction on the abducted arm must be strong enough to overcome the resistance of the holding portions of the repaired capsule, and the traction or direct pressure outward and backward on the upper end of the humerus should not begin until the head is thought to be low enough. I know of no exact method of determining this point, but I have an assistant place the finger or thumb of one hand on the head so that he and I can observe approximately its degree of downward movement when the traction is made on the arm and the scapula is firmly fixed. I think it should move about a full inch. The head ascends to a somewhat higher level in old than in recent dislocations, because of the groove made in the head by the pressure against it of the anterior glenoid margin in the dislocated position. The longer the dislocation persists the deeper will the groove probably be. This groove will at least partly explain the fact that the elbow can usually be brought to the side of the body in old dislocations, while in the recent condition it springs away from the side. Since the resistance is in the fibrous connection between the humerus and scapula, if the scapula is firmly fixed, all the force applied in traction is being exerted on the short or holding portions of the capsule, *i.e.*, exactly where it can produce the best results and the least harm, the resistance offered by these portions of the capsule being the best possible protection against damage to the surrounding structures during the application of the force.

The following is a brief description of the method as I apply it:

Under full ether anæsthesia, I first try to tear some of the resisting capsule fibres by manipulation. The patient is then transferred from the operating table or litter to the floor with several blankets underneath and a pillow for the head. The Allis apparatus, which permits all the traction to be applied to the arm and thus to prevent danger to the elbow and wrist,

FIG. 5.

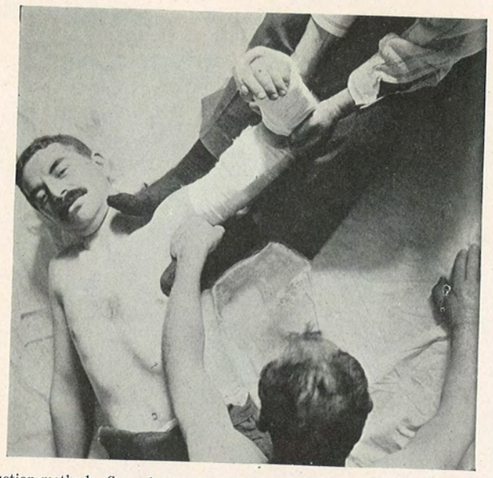


Showing the upper (*a*) and lower (*b*) margins of the rent carried forward and inward by dislocated head, which is rolled outward to show them.

FIG. 6.

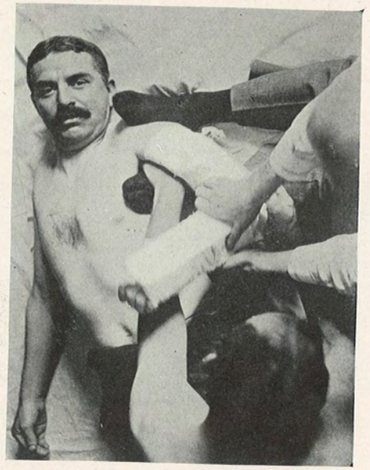
Abduction method with aid of two internal angular splints and wet gauze bandages. First step: Fixation of scapula by surgeon's feet while he makes traction on arm held somewhat beyond a right angle. Thumb of assistant's left hand marking position of humeral head, the rest of his body being kept as much as possible out of the illustration.

FIG. 7.



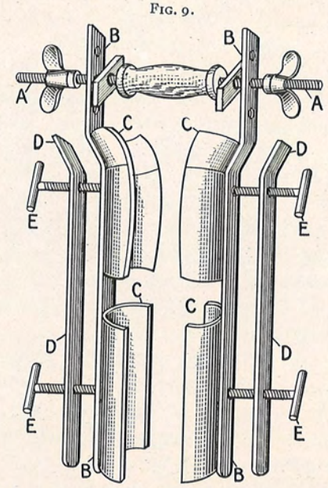
Abduction method. Second step: Head drawn down to level of socket and assistant pushing it toward socket. Folded sheet and second assistant may be employed to aid in this step.

FIG. 8.



Abduction method. Third step: Assistant, while he is still pushing on head toward socket and surgeon is maintaining traction, with his right hand pulls the lower end of the humerus to the side of the body.

FIG. 9.



Allis's instrument for assisting in the reduction of dislocations of the hip. AA, handle with four nuts to secure handle to upright bars, BBBB. CCCC, iron plates riveted to BBBB, and shaped to fit humerus or femur above condyle. DDDD, movable bars that can be approximated to or separated from BBBB. In using, the bars DDDD are first screwed down to BBBB. The bandage is then applied around them and tightened by means of the handles EEEE. Previous to applying the apparatus, a wet bandage should be applied to the limb. It serves a double purpose, in that it protects the part from violence, and prevents it from slipping.

is then applied. (Two internal angular splints are always available, Figs. 6, 7, and 8.) I then take a sitting position on the floor in such a way that I can brace one stockinged foot against the axillary border of the scapula and the other against the upper border, while pulling on the arm in abduction. An assistant kneels alongside the patient below the arm with the thumb or finger of one hand on the dislocated head of the humerus (Fig. 6). Another assistant may, with a folded sheet, assist the first in forcing the head toward the socket. My first pulls, gradually increasing in force, test the downward movement of the head. When I think it comes down far enough I maintain the traction and ask the assistant to push strongly outward and backward on the head (Fig. 7), and when it seems to pass out far enough I ask him to pull in on the elbow with the other hand (Fig. 8). I have found that because of my position it is rather difficult to move the elbow inward myself. I have not tried the method without narcosis and I have found it difficult to apply the necessary force by grasping the arm above the elbow with my hands. Dr. Allis's apparatus made for applying traction to the thigh in dislocations of the hip, was an excellent aid in the dislocation of the shoulder (Fig. 9). I have seen Dr. A. C. Wood, however, reduce a dislocation of about three weeks' duration by grasping the arm above the elbow, placing one foot against the axillary border of the scapula, without taking the patient off the litter on which he was lying, without the aid of pressure or traction on the upper end of the humerus, and without giving an anæsthetic. The reduction was made with the first pull, and the patient merely made a slight outcry and then laughed when he found the shoulder in place. I am satisfied that there would have been more pain if the dislocation had been a recent one.

After the dislocation has existed two or three months, I believe that no non-operative method can succeed without the employment of a considerable degree of force, and in many cases very severe force will be necessary. With the abduction method I have described, I believe that a sufficient degree of force can be safely applied to place the head in the socket in most cases. What time limit or other contraindication the

method has, I do not know. In the attempt which I made after four years, I was satisfied that the failure was not due to the duration of the dislocation but to the contents of the glenoid cavity, as the movements of the head were quite sufficient to accomplish the reduction. Kocher found this condition in only two of his operative cases, all of which he regarded as irreducible by non-operative methods. In supporting the non-operative method I have drawn upon the experience and suggestions of those with whom I have been associated. In conclusion I wish to acknowledge an indebtedness that is none the less definite because it is based upon memory. For about fifteen years I had the privilege of seeing or assisting Professor J. William White reduce a considerable number of these old dislocations. I have always believed that he was unusually successful, and after considerable reading on the subject I have been more convinced of it. His rule was to attempt reduction if the dislocation was not more than three months old, and his failures were very few. In my opinion, his success was due to the fact that he persisted, first with one method, usually the Kocher, and then with another, having assistants make traction with a folded sheet and direct pressure in the axilla on the upper end of the humerus toward the socket, and if the various methods failed after the first trial, going back to one or the other, until finally he brought the head into the glenoid cavity. I believe that every failure brought him a step nearer to success by breaking still more the resistance that must be overcome in every case before the reduction can be accomplished, and that he succeeded because he persisted. I am certain that his success was an important factor in bringing me to the conviction that the solution of the problem in this condition was not in early operation on every case, but that in most cases only the proper method and persistency would be necessary to accomplish the reduction.

The effect of the fractures commonly associated with anterior dislocations of the shoulder is still little understood. They are usually the fractures of the greater tuberosity and

the anterior glenoid margin. The tendency has been to regard them as leading to insuperable obstacles to reduction without operation and this was rather encouraged by Kocher. My experience with them is small, but it leads me to believe that in most cases we shall be able to overcome by operation any obstacles arising from them, sometimes with, but often without, operation. Two years after reducing my case of four months' standing I operated and found evidences of both fractures. Codman[8] recently found small fragments of the tuberosity adherent to the glenoid cavity, interfering with the reduction, and he has suggested that in operating on these cases the incision should be made posteriorly. This is undoubtedly true, because by the anterior incision one cannot obtain a good exposure of the glenoid cavity, since the humeral head is in the way. I believe, however, that the capsule resistance should first be broken by traction in abduction, so that when the glenoid cavity is emptied the head can be brought easily into the socket. It might be possible to divide the obstructing portions of the capsule through the wound, but I think it unlikely that it can be done as effectively as by traction on the humerus and fixation of the scapula.

CASES.

CASE I.—Woman, fifty years of age. Dislocation of right shoulder, reduced 8 months after accident. Unsuccessful attempt made at end of three months.

Mrs. M., September 3, 1909, fell headlong down a flight of steps, injuring her right shoulder. Physician diagnosed a sprain. Immobilization for a time and later given electrical treatments and massage. Dislocation recognized three months after accident, and attempt made at reduction under ether. Some months later she came into the hands of Dr. J. Bernard Mencke, who referred her to me April 21, 1910. On April 29, she was admitted to the Philadelphia Hospital on the service of Dr. A. C. Wood, and on May 2, which was one week short of eight months after the accident, she was etherized and after breaking up some of the axillary resistance by manipulations,

I had her placed on the floor on blankets with a pillow under her head. The scapula was fixed by two long strips of adhesive plaster about three inches wide, one passing over the upper and the other over the axillary border of the scapula, and the ends of each strip held by an assistant. One of these assistants placed his stockinged heel against the head of the humerus. I sat on the floor in such a position that I could pull on the forearm just above the wrist with the arm at slightly more than a right angle with the body. After pulling as hard as I could several times to bring the head down to the level of the glenoid, the assistant pushed with his heel on the head toward the socket and I brought the arm to the side, maintaining my traction in the meantime. After three failures to lodge the head in the socket in this way, I asked another interne to assist me in pulling on the wrist, when the reduction was accomplished. The arm was bandaged in the Velpeau position for three weeks and then released entirely. Notwithstanding the fact that I had been prepared to use much force, I was concerned particularly about the pressure of the heel of the assistant in the axilla, until on the following day the patient showed little or no discomfort and no signs of injury about the shoulder. At the present time abduction can be carried to about 140 degrees, while external rotation is still somewhat limited. She has no pain and can do most of her housework.

CASE II.—Woman aged sixty years. Dislocation of the right shoulder of 4 years and 3 months, and of left shoulder of 4 months' standing. Reduction on left side, failure on right side. Joint on left side opened 22 months after reduction.

Mrs. R., in the latter part of April, 1906, fell down a flight of stairs and injured her right shoulder. Did not seek professional advice until two weeks later. She then visited a hospital where a dislocation was recognized. She was given an anæsthetic and an attempt made at reduction. The arm was bound to the side and patient kept in the hospital two weeks, when she was discharged and told that everything would come out all right. About the first week in May, 1910, she slipped on a banana peel and fell striking on her left shoulder. About a week later she sent for a physician who diagnosed a dislocation of the left shoulder. With his heel in the axilla he pulled

on the arm, after which he said that the dislocation was reduced. The arm was bound to the side for two weeks, but during that time the bandage was removed every few days and the shoulder massaged. Dr. Mencke, at the German Hospital, in the service of Dr. G. G. Ross, who saw her some time later, referred her to me, August 8, 1910, with the diagnosis of a double subcoracoid dislocation, which was readily confirmed on examination and by the X-ray. She could abduct to about 120 degrees on the right side and the usefulness of the limb was very good considering the presence of the dislocation. On the left side she could abduct to about 50 degrees. She was admitted to the University Hospital August 9, 1910, on the service of Professor J. William White, and on August 10 was given ether for the attempt at reduction. She wished me to try to reduce the right shoulder if I succeeded with the left. After placing her on the floor as in the preceding case, a folded sheet was passed around the body transversely so that it covered the axillary border of the scapula and could be held at both ends by an assistant on the opposite side of the body. Another folded sheet was similarly placed but with its middle over the upper border of the scapula and its two ends passing obliquely downward and to the opposite side of the body where it could be held by a second assistant. In my stockinged feet I sat on the floor in the same position as in the preceding case, but placed one foot against the upper and the other against the axillary border of the scapula, and again grasped the patient's left forearm just above the wrist, an assistant taking hold of the arm just above the elbow. We two then pulled on the arm while the scapula was fixed by my feet and the sheets, until a slight tearing sensation was felt—it was also heard—and the head moved downward to what I thought was the level of the anterior glenoid margin. The assistant holding the sheet passing obliquely downward from the upper border of the scapula then placed one stockinged foot against the upper end of the humerus and pushed the head toward the socket. When it seemed to be in the socket the arm under traction was brought to the side of the body. After two such trials the dislocation was reduced on this, the left side, after having existed for four months.

The right shoulder was treated in the same way but after

four or five trials the dislocation was not reduced. There was distinct crepitus, and the X-ray, according to Dr. Pancoast, the skiagrapher, showed a fracture of the greater tuberosity. The head was carried repeatedly over the anterior glenoid margin well up into its normal position, but as soon as the traction and pressure were released it jumped back again into the dislocated position. I am satisfied that the posterior portion of the capsule was adherent to the glenoid surface, probably with a detached fragment of the greater tuberosity so that the cup was filled and the head could not remain in the socket. Kocher called attention to this condition, and other writers, as Lund, have emphasized it. Before the head can be placed in its normal position, the glenoid cavity must be cleared of these structures.

While the force employed in the attempt at reduction in the right shoulder of this patient was greater than in either of the two other shoulders, the left in this case and that of the first case, which were successfully reduced (or in any of the three successful reductions which followed), it seemed to me that the glenoid conditions and not the prolonged period during which the dislocation had lasted were chiefly responsible for the failure. I would infer, therefore, that while the duration of the dislocation is of importance, the adhesion of the posterior portion of the capsule, especially if it has been detached with a fragment of the greater tuberosity, is of far more importance. After failing to reduce the right shoulder, I bandaged both arms to the side of the body and supported both wrists in slings from the neck. On the following day I removed the bandages and asked the patient to abduct the right arm as far as she could and found that she could do so to about 90 degrees. I asked her if she had much pain in this shoulder and her answer was, "not much." During the night she had had considerable pain in the left shoulder which was reduced, but this had largely disappeared. I had expected to find considerable disturbance, especially in the right shoulder, but there was no noticeable swelling or pain and she permitted me to handle both shoulders, but the right particularly, with considerable freedom.

She left the hospital August 15, and received massage and passive motion at the German Hospital, under Dr. Ross's direction, over a prolonged period. I saw her again for

the first time about a year after her discharge. I was surprised to hear her refer to the arm of the side on which I had reduced the dislocation as her "bad arm." The motion was not as good as on the right side where the dislocation remained unreduced, and she had some pain in the left when she tried to move it upward. She was very anxious to increase the movement on the left side. I at first counselled against operation, but as she was a widow and could keep out of the almshouse only by earning her own living, and was anxious to have something done, I concluded to open the joint. The X-ray showed irregularity at the site of the greater tuberosity, and I thought I might find a loose fragment or irregularity, the removal of which would warrant an operation.

She was admitted to the Philadelphia Hospital on the service of Dr. A. C. Wood, and on June 15, 1912, with the patient under ether, I made an incision over the greater tuberosity downward and forward from the anterior margin of the acromion in the line of the fibres of the deltoid. The site of the subacromial bursa was exposed thoroughly but it had been obliterated. In its place was a layer of fibrous tissue about one-half inch thick, firmly adherent to the greater tuberosity but not to the under surface of the acromion, as was shown by the fact that the tuberosity and the layer of fibrous tissue moved freely under the acromion. In this case, at least, the obliteration of the bursa by adhesions was not responsible for the scapulohumeral limitation of motion. With the finger in the joint later it seemed evident that the limited abduction was due to the tightening up of a contracted axillary portion of the capsule. An incision was made into the joint between the supraspinatus and subscapularis tendons, careful search being made for the long tendon of the biceps, which is in this situation. It was found to have been torn from its attachment at the upper margin of the glenoid, and its torn end was adherent in the lower part of the bicipital groove, the upper end of the groove being obliterated by callus. There were two small bony projections on the upper surface of the greater tuberosity, evidently the result of an old fracture which had reunited. There were no loose pieces of bone here. The bony projections were smoothed off by a chisel. The finger in the joint found a deep

groove in the cartilaginous portion of the head just below and internal to the greater tuberosity. The anterior glenoid margin, including about the anterior third of the cup, had been worn away. Imbedded in the anterior portion of the capsule was a small fragment of bone, evidently torn from the anterior glenoid margin at the time of the dislocation. The groove in the head had rested on the worn portion of the glenoid margin during the four months in which the dislocation had remained unreduced, and the wearing away in both bones was the result of the pressure induced by the contact. By manipulations during the operation it seemed evident that the absence of the anterior part of the cup and the groove in the head permitted an abnormal range of movement out of the cup anteriorly, and that the rubbing of the rough portion of the head on the anterior glenoid margin in this abnormal movement was responsible for much of the pain which the patient had experienced. The condition found in the joint explains in a measure why it is so difficult to obtain full function after the reduction of an old dislocation. The operation, however, did not improve the condition of the patient materially, and she is compelled to remain in the almshouse because of the condition of her two shoulders. The pain, however, on movement of the joint is not as severe as before the operation, and the patient is still improving in that respect as well as in the range of motion.

CASE III.—Young man. Fracture lower third of right humerus and dislocation of same shoulder, of eight weeks' duration. Weak union and refracture of humerus. Reduction of dislocation. Death of patient three months later from lung disease.

Mr. D., referred by Dr. W. S. Cornell. November 9, 1910, while at work in a lumber yard, a pile of boards fell on him. He was taken to a hospital where a fracture of the humerus was diagnosed and the arm immobilized with splints. He was admitted to the University Hospital January 3, 1911, on the service of Professor Edward Martin, when I saw him for the first time and recognized a dislocation which Dr. Cornell had already found. He was etherized January 5 for an attempt at reduction. I was anxious about the character of the union at the seat of fracture, because Dr. Cornell reported that the patient had come to him with a very indifferently applied bandage and a very small internal splint and with no fixation of the elbow or shoulder.

I gently rotated the arm externally and on the first movement a refracture occurred. I concluded, however, to try to reduce the dislocation. It would have been impossible with the Kocher method. I first applied to the forearm a wet gauze bandage, following a suggestion of Dr. Allis. I then padded with cotton and covered with a gauze bandage two ordinary right-angled internal splints, which I applied to the forearm and arm with another wet gauze bandage after soaking the splints in water. One splint was on the inner and the other on the outer side with the padded side of each splint facing the limb. The upper edges of the splints were left free of bandage just on the forearm side of the elbow. The object was to devise an apparatus with which I could make a strong pull that would be confined as much as possible to and in the axis of the humerus, beside providing some immobilization for the fracture. I had found that by grasping the arm above the elbow with my hands, I could not apply the necessary force, and in the preceding cases I had been concerned lest the traction on the forearm would do some damage to the elbow and wrist. I learned later that Dr. Allis had devised an excellent apparatus for a similar purpose in hip dislocations that is quite as effective at the shoulder and that I used in the last of my cases. With the patient on the floor under ether I took the same position as in the preceding cases, placed one stockinged foot against the axillary border and the other against the upper border of the scapula, and grasped the splints one in each hand where they were free of bandage. A folded sheet was passed around the upper end of the humerus and the two ends grasped by an assistant who placed one foot against the upper border of the scapula. A second assistant placed his hand against the head of the humerus in the axilla. When after pulling on the humerus and watching the hand of the assistant on the humeral head descend as far as I thought necessary, I asked the assistant with the folded sheet to pull and the other to push outward on the humerus toward the socket while I maintained the traction on the humerus. When the head seemed to be going out satisfactorily, I asked the assistant with his hand in the axilla to grasp the elbow

with his other hand and pull it toward the side. The first try failed but the second succeeded. The fracture of the humerus was immobilized by an internal angular splint and a shoulder cap, and the arm bandaged to the side of the body.

The ease with which the humerus was refractured eight weeks after the accident gave little hope of firm reunion, so that on January 30, the site of fracture was exposed by an intermuscular incision on the outer side of the arm. The musculospiral nerve was turned aside, the fibrous covering of the fragments curetted away, and the fracture splinted with a Lane plate, a small rubber dam drain being left in the lower angle of the wound. A dressing was applied and an internal angular splint used to reinforce the plate. The shoulder was then exposed for the removal of two small fragments of the greater tuberosity which were loose. The long tendon of the biceps retained its normal attachment, and the supraspinatus tendon from which the fragments were detached was sutured to the fibrous covering of the humerus. A small opening was made in the posterior part of the joint for drainage of the oozing that could not be controlled. The wound was closed and a dressing applied. A triangular splint was fixed in the axilla and kept the arm at nearly a right angle with the body. Both drains were removed on the third day. Healing occurred by first intention. The patient developed a severe cough after the operation. He gradually improved and left the hospital March 7. The shoulder was in good position and the motion improving. He visited me at my office several times but about a month after leaving the hospital I lost sight of him. He was much pleased with his progress at that time but his cough was still severe. I learned later that he died about three months after the operation. Before operation he had a pale sallow complexion, but he had not complained of being sick and examination did not develop any lung or other lesion. He did not show lung disturbances after the etherization and reduction. I think, however, that he must have had a latent tuberculous lesion in the lung, and that the ether and shock of the operation made it acute.

CASE IV.—Woman, aged fifty-eight years. Dislocation of right shoulder, 16 days old. Reduction.

Mrs. B., on August 20, 1911, fell down three steps, striking on her right shoulder. A dislocation was not recognized until

15 days later. She was admitted to the University Hospital, September 5, on the service of Professor Edward Martin. On that day, an interne made a vigorous effort to reduce by the Kocher method under nitrous oxide anæsthesia, without success. On the following day under ether anæsthesia, I reduced the dislocation easily, with the abduction method, probably because the resistance had been largely broken up by the interne's efforts. The X-ray showed a large fragment of the greater tuberosity widely separated from the head, a condition which, according to Kocher, renders the dislocation irreducible by his method. This probably accounted for the interne's failure. I feared that this fragment would give trouble later from faulty apposition, which fear was not removed by the skiagraph. On September 13, I exposed the greater tuberosity by a three-inch incision downward from the acromion and found that the fragment had fallen so nicely into place that I could find the line of fracture only on one side and could not detect any irregularity at the site of the tuberosity. The wound healed by first intention and the patient left the hospital on the seventh day after the operation. She now does all of her work as a housekeeper and there is now very little limitation of movement. Her only complaint is that she cannot button her dress in the back quite as well as with the other hand.

CASE V.—Woman, aged fifty-six years. Dislocation of right shoulder 25 days old. Reduction.

Mrs. B., on January 1, 1912, tripped over a piece of carpet to the floor, injuring her right shoulder. The physician who was called thought she was suffering from a fracture and said it was a hospital case. I saw her first January 23, and on January 26 I reduced the dislocation under ether at the University Hospital, on the service of Professor Edward Martin, by the abduction method as in the preceding cases. In this case I employed the apparatus devised by Dr. Allis for applying traction to the hip in dislocations of the hip. It worked perfectly at the shoulder, and permitted all the force to be applied directly to the upper arm. The handles allowed an excellent grip with both hands and easy manipulation of the arm. I did not use a folded sheet, but had an assistant make direct pressure on the head toward the socket, and when it had been forced outward

far enough he pulled the lower end of the arm to the side of the body with his other hand. The reduction was accomplished on the second attempt. The arm was bound in the Velpeau position and the patient sent home the same day. I did not see her again for four weeks because she had been ill at home. With the permission of Professor G. G. Davis, she received passive exercises and massage in the gymnasium of the Orthopædic Department of the University Hospital. She now raises her arm above her head and is well pleased with the use she has of it. She reported by letter, recently, that she was enjoying very good use of the arm.

CONCLUSIONS

The mortality is lower and the average functional result following a non-operative reduction is better than following an operative reduction, but the frequently insurmountable obstacles and the great force necessary to a successful reduction have led to an increasing tendency toward operation.

The particular obstacle to reduction has never been satisfactorily demonstrated. While Kocher emphasizes other obstacles, as irregular bone formation, his main contention was that the chief resistance to reduction came from the contraction of the margins of the old capsule tear, which had closed about the head and thus prevented the raising of the capsule from the glenoid so that the head could not enter. On the basis of cadaver studies supported by clinical evidence, I believe that the chief obstacle is to be found in the cicatricial tissue at the site of the capsule tear and the shortening of the latter in certain portions, which must be more or less torn before the head can be brought back into the glenoid cavity. The rent in the capsule *per se* is probably never an obstacle to reduction by constricting the neck of the humerus and thus preventing the return of the head.

The Allis principle of reduction is a safer and more effective one than that of Bigelow. According to the former the humeral head is dragged back to the socket in almost a direct line, while by the latter the head is returned by leverage.

Kocher, out of 28 cases in which he attempted reduction by his method, reduced 25 and failed in 3, in each of which a fracture of the humerus prevented further efforts. The longest duration of the dislocation was 5 months and 22 days. Of 6 dislocations in 5 patients, 5 were reduced by the abduction method, one of them after 8 months. The humerus was not fractured by the efforts at reduction in any case. While a fracture of the humerus renders an old dislocation irreducible by the Kocher method, one dislocation was reduced after 8 weeks by the abduction method in the presence of a complete fracture of the humerus at the junction of the lower and middle thirds. In the one case in which the abduction method failed, the dislocation had existed for 4 years and 3 months, and there was probably an adhesion in the glenoid cavity of the posterior portion of the capsule with a fragment of the greater tuberosity, a condition which Kocher considered an insuperable obstacle to reduction without operation. Probably the best method of accomplishing reduction in such a case is first to break the fibrous resistance to reduction by the abduction method and then through a posterior incision to raise the fragment and capsule from the glenoid, when the head can be brought into the socket and the fragment replaced in its normal position, or it may be removed and the remaining capsule sutured in its normal position.

Because of the pressure and other changes in the humeral head and glenoid cavity from the long existence of the dislocation, it will sometimes be best to allow the dislocation to remain unreduced, especially if the limb is fairly useful and without troublesome pain, as in the shoulder in which the abduction method failed. While there was no mortality in Kocher's 28 cases in which no operation was done, in his 8 operative cases there was one death from sepsis. In the 5 cases in which the abduction method was employed without operation, there was no death, but in the case in which there was a poorly united fracture 8 weeks after the occurrence of the dislocation, the fracture was splinted 15 days after the

reduction. A latent lung infection, not recognized at the time, was much aggravated by the operation, and the patient died in consequence of it three months after the operation. The indications and contraindications for the abduction method can be determined only by further experience.

REFERENCES.

[1] Deut. zschr. Chir., xliv, 1911, pp. 581 and 916.
[2] Bost. Med. and Surg. Jour., 1897, cxxxvi, p. 397.
[3] Lyon Medical, ci, 1903, p. 304.
[4] Annals of Surgery, 1903, xxxvii, p. 756.
[5] Berlin. klin. Wochenschr., vii, 1870, p. 101.
[6] Samuel D. Gross Prize Essay, Philadelphia, 1896, The Hip.
[7] Rev. d. Chir., xliv, 1911, pp. 581 and 916.
[8] Bost. Med. and Surg. Journ. clxv, 1911, p. 115.

Dr. Oscar H. Allis said that he possibly stood alone in one respect, he does not think any one gets a perfect result in dislocation of the shoulder. The mechanism of the shoulder is very peculiar in some respects; as all know, muscle has the function of stretching within prescribed limits. When the head of the humerus is thrown suddenly into the axilla the short muscles of the scapula, its normal retainers, are apt to be torn in two or stretched with interstitial tearing of the muscle-fibres, so that after restoration there will be a later atrophy and tendency to a second dislocation. A tendency to a second dislocation is not necessarily because the capsule does not unite, but because it has no longer these little muscles to hold it in position. He was inclined to think that no one ever gets the full amount of motion after one of these dislocations. In a paper read before the College of Physicians on one occasion he stated the theory that the dislocation takes place through muscular action when the arm is thrown away from the body. He had seen a number of such cases. A person going downstairs makes a misstep and throws the arm out, producing a dislocation, although the individual does not fall. When Dr. Thomas said that he does not believe that the opening or laceration in the capsule is ever so small that the head cannot be replaced, he was sure experimental work bore that out. The old theory of a slit in the capsule cannot be held by any one that has done any experimentation.

Dr. D. L. Despard said that traction prolonged over a number of days possesses some advantages over the method of applying a great force only at the time when reduction is being attempted. The former method of traction was successfully used recently in the dislocation of the shoulder of an exceedingly muscular man. The injury had existed for over six weeks and he had anticipated a great deal of difficulty in effecting a reduction. By means of Buck's extension apparatus, traction was started with 6 pounds, which was gradually increased to 10 pounds and continued over a period of 8 or 9 days. The patient was then anæsthetized and reduction effected by the Kocher method upon the first attempt.

Dr. John H. Jopson said that he had always found Dupuytren's modification of Mothe's method easier than the Kocher method. It consists in drawing the arm directly upward fully extended in a broad sweep while counter-pressure is made by an assistant's fist in the axilla.

Dr. A. P. C. Ashhurst remarked that all methods of reducing dislocations might be classified, either as *direct* or *indirect*. Dr. Thomas advocates one of the direct methods; it is the same as Stimson's or Sir Astley Cooper's, only it is applied differently. Stimson puts the patient in a sort of sling and lets the arm hang through a hole in this sling, attaching a weight to the hand. Cooper pulled the arm away from the chest, using the foot for counter-pressure. When the head of the humerus is brought away from the side of the chest and opposite the glenoid process of the scapula, then it is pushed or pulled into the socket, either by manual pressure as in Stimson's and Thomas's methods, or by leverage over the foot, as in Astley Cooper's method. All of these are direct methods, similar in principle to Allis's method for reduction of dislocations of the hip. In this sense there was nothing new in Dr. Thomas's application of this principle to the shoulder. Henry H. Smith's, Kocher's, and other methods of the kind are so-called indirect methods, like Bigelow's.

It was interesting, Dr. Ashhurst thought, to recall that anæsthesia not only made reduction much easier, but that it demonstrated that it was not only the muscles which interfered with reduction. Though Kocher was the first to recognize that the ligaments were the main obstacle to reduction in dislocations of the shoulder, as Moses Gunn had been the first to recognize their action at the hip, Kocher's claim that the coracohumeral ligament acted at the shoulder as did the iliofemoral at the hip

was demonstrated to be false by Farabeuf, who showed that the essential structure was the posterior part of the capsule.

The end results of dislocations of the shoulder formed an interesting subject. Though the reports of consecutive series of cases are meagre, it appeared that two out of three patients have been found to present persistent debility. Out of more than 20 patients under the speaker's own care, it had been possible so far to ascertain the end results only in five cases. In only two of these was perfect function regained; the three other patients were quite satisfied with their condition, though two of these had had the same shoulder dislocated twice or more subsequently, and the third had distinct limitation of motion, though subjectively he claimed his shoulder was "all right."

Dr. Gwilym G. Davis remarked that this discussion had broadened out into recent as well as old dislocations. Etherization eliminates the consideration of muscle resistance, but as regards the difficulty of replacing luxations if no anæsthetic is given, then the muscles play an important part as a hindrance to replacement; in shoulder luxations it is often thought unnecessary to give an anæsthetic. Then the elimination of the muscles must be undertaken by other means, hence it is that use is made of the methods of Stimson, Astley Cooper, and others, by direct traction, etc., all with the idea of overcoming the muscle resistance. When this is overcome by an anæsthetic then the bones and ligaments only are to be dealt with, and the reason that the luxation cannot at times be reduced under these circumstances is because, as Dr. Allis has shown in the hip, the arm is not placed in the correct position. Thus, when Stimson puts the arm through the sling he lets the weight swing and the arm swings round until the capsule is opened and the head slips in. The same thing occurs in the Astley Cooper method,—when the arm is rotated it opens the rent and in goes the head, and it is the same with all the direct methods. In the old method of hanging the patient over the top of a door, the arm rotates until the capsule is open to its greatest size, when the head will slip in. If traction is made in abduction and backward, absolutely eliminating the muscles by anæsthesia, then the only thing to do is to rotate until the capsule is open, and push the head in. If it does not go in, then there is an irregularity in the condition; it is not a true simple luxation but one complicated with a fracture, etc. When it comes to the method, the speaker agreed with Dr. Thomas that this is the proper method of reducing luxations of the shoulder. He had had several cases in which he had put the foot against the bedstead and pulled outward and backward and rotated; the longest time taken for reduction was fifteen minutes, while in others it was effected in three minutes. Kocher's method is unnecessary although effective if it is desired to reduce without an anæsthetic. Reduction does not depend solely upon the coracohumeral ligament. This ligament goes from the coracoid process, which is to the inner side, outward and in front. It has near it the long tendon of the biceps and the glenohumeral ligament. Above is that part of the capsule which frequently remains untorn in the cases in which the Kocher method is effective. One can determine on the cadaver that when the upper and posterior parts are intact one can rotate the humerus, and the head will move out from the chest toward the glenoid cavity. But if that portion of the capsule is torn, the head will bore between the glenoid process and the side of the chest, and in order to reduce such a luxation all that is necessary is to proceed with the direct method as the capsule is all torn. In such cases the Kocher method is ineffective. In the old cases in which that part of the capsule is intact then the Kocher method is effective because one can wind the remaining portion of the capsule around the upper portion of the head of the bone and push it outward, and it pushes in the old cases the supraspinatus, infraspinatus, and teres minor off of the glenoid process and cavity. The Kocher is the most dangerous method, because if the external rotation is made when the arm is down by the side, as is so often taught, then the coracobrachial is stretched so firmly over the head of the humerus that the lesser tuberosity catches on it and prevents it being rotated outward, and not infrequently the head of the humerus is jammed so tightly between the glenoid process of the scapula and the side of the chest that if one persists in rotating outward one will fracture the bone. It is far safer to do a wide abduction and traction.

Dr. T. Turner Thomas (in closing) said that he did not mean to infer that the abduction method was new. It is much older than the Kocher method, but what he had tried to show was that one of the older methods is more effective than the new, or Kocher method, which has been the prevailing method almost

from its introduction. In regard to the Stimson method for recent dislocations, the underlying principle is the same as that which he had been applying in old dislocations. With regard to the disabling limitation of movement after the reduction of old dislocations, if the dislocation has existed for many months before reduction, the chances for a complete return of function are small. He would not say that it is impossible to get it. The return of function will be more rapid and will more nearly approach the normal after a non-operative reduction than after an operative reduction, as a rule. The underlying cause of the difficulty is essentially the same as for the corresponding condition found after the reduction of recent dislocations, *i.e.*, the stiff and painful shoulder of which so much has been written in recent years. The cicatricial contraction at the site of the capsule tear in the axilla will be more unyielding after the reduction of the old dislocations than after the reduction of the recent. He had, in a considerable number of cases of the latter variety, broken up this resistance by forcible manipulations under ether, without trouble and with very satisfactory results.

He had had very little experience with recent dislocations, since these are usually reduced by the family physician or the hospital interne, so that in discussing the abduction method he had confined himself to the old dislocations.

The superiority of the abduction method should be more evident in the reduction of dislocations of the shoulder associated with fracture of the surgical neck of the humerus, just as the Allis method is superior to the Bigelow method in the corresponding condition at the hip. The Kocher method may have the advantage in the reduction of recent dislocations, without an anæsthetic, in very powerful individuals. Such patients can resist more effectively the simple, direct pull in abduction than a series of more or less complicated movements as in the Kocher method, although the general spasm may effectively resist all these.

STATED MEETING, HELD NOVEMBER 4, 1912

Dr. Gwilym G. Davis, President, in the Chair.

STAB-WOUND OF THE HEART; RECOVERY AFTER SUTURE.

Dr. Charles F. Mitchell presented a colored man, 59 years of age, who was brought to the Pennsylvania Hospital by the patrol at 5 P.M., July 30, 1912, having received a stab-wound of the left chest a short while before. He had been drinking heavily, and there was a marked odor of alcohol on his breath. His previous history was negative, except that he always used alcohol to excess. He was admitted to the service of Dr. Richard H. Harte, in whose absence Dr. Mitchell was called upon.

On admission temperature was normal, pulse 90 to the minute, while breathing was rapid and rather labored. There was no sweating, lips and conjunctiva blanched, heart sounds regular, but rather faint. Arteries atheromatous, marked arcus senilus. Area of cardiac dulness not increased. Right chest normal, but signs of pneumothorax over whole left chest. There was some dulness of left chest posteriorly. In sixth left interspace in anterior axillary line was a stab-wound, about 1½ inches in length, from which bright red blood was flowing.

From above symptoms and physical examination a penetrating wound of the chest was diagnosed with probable injury to the heart. At 6.24 P.M., 1 hour and 24 minutes after admission, the patient was given ether preceded by ethyl chloride. The field of operation was sterilized with 3 per cent. iodine solution and wound in interspace enlarged. Left lung was found collapsed. The sixth rib was then divided and retracted, and immediately a large opening was found in the pericardium. The edges were rough and the wound appeared to be more like a tear than a clean cut. There were a number of clots found in the pericardium, which when removed showed a transverse cut in the heart, from which at each systole there flowed bright red blood. The cut in the heart was about one inch in length, apparently in the left ventricle about an inch above the apex. A

curved intestinal needle, threaded with fine Pagenstecher thread, was then passed through the cardiac muscle and tied, the ends being left long and used as a tractor in the introduction of the second stitch. When the second stitch was tied, it was found that the wound was completely closed and the hemorrhage from the heart stopped. The pericardium was then partially closed, after its cavity had been washed out with normal hot solution. A small gauze drain was left in the wound and the retractor holding the rib withdrawn, and the wound closed with silk-worm-gut sutures. There was no hemorrhage from the chest or pericardium, and no ligatures were used during the operation.

Previous to the operation the patient was so well stimulated by the alcohol already imbibed, that he did not require any stimulation, either before, during, or after the operation. He apparently left the operating table without any symptoms of shock, his temperature being 96.4°, pulse 88, respiration 32. Time of operation 22 minutes. During the night he was given a sixth of morphine hypodermically, but this is all the medication he received. The following morning his temperature rose to 101°, pulse remained about the same (92), respiration 36.

On August 2, three days after admission, he developed delirium tremens, and was irrational for a couple of days. On August 5 a to-and-fro friction rub synchronous with a heart-beat was noted to the right of the sternum at level of the third rib. This disappeared in three days. There apparently was no increase of cardiac dulness or other signs of cardial effusion. Temperature at this time was 100°, pulse 100, respiration 28. Drain was removed on August 17. Patient sat up in bed at this time. On August 21 dulness in the left chest posteriorly, with distant breath sounds, was noted over this area. Temperature 102.3°, pulse 124, respiration 28. On August 26 chest was aspirated and about eight ounces of a dark reddish, clear fluid evacuated. Upon culture this was found to be sterile. On September 14 chest was again aspirated, but only a small quantity of the same sort of fluid obtained. From this time on, patient rapidly improved. Signs of fluid in left chest diminished and when patient left the hospital on October 19 there was but slight dulness over left chest posteriorly, probably due to a thickening of the pleura. The heart at this time seemed to be

slightly pulled to the left, apex beat being in sixth interspace one inch to the left of the nipple line. There were no murmurs present, sounds regular but a trifle rapid. Dr. Mitchell added that so much has been written of late as to the treatment of heart wounds that it does not seem necessary at this time to go very deeply into this subject.

Konig[1] in his article on "Technic for Access to Suture of the Heart," gives a full discussion on this subject, and Poole,[2] gives a most exhaustive study of the technic, as well as the bibliography of recorded cases up to the year 1912. He has succeeded in tabulating 77 cases of heart suture, which added to those already tabulated in 1909 by Peck totals 236.

Ranzi[3] gives Rehn the credit of publishing the first successful case of heart suture in 1896, and has collected 223 operative cases with a mortality of 53.3 per cent. He adds to this number three cases of stab-wound and also three of gun-shot wound of the heart, who were operated upon in Von Eiselsberg's Clinic at Vienna, but only one of which recovered. He mentions in the successful case, that five hours intervened between the time of injury and operation, and states in naming the time of the the operation that the anæmia was not very marked.

Bircher[4] reports a case of gun-shot wound of the heart which healed under conservative measures alone, and also reports a case of multiple stab-wounds of the heart requiring operative treatment, which case recovered. He goes on to say that only one stab-wound was found at the first operation and the second wound required suture twelve hours later. At the time of the second operation the wound first sutured showed that firm repair had already begun to take place. He states that conservative measures seemed more promising for gun-shot wounds, and intimates that operative procedures are necessary in all cases of stab-wound.

It is needless to say that all stab-wounds of the heart require surgical intervention, and that all wounds in the neighborhood

[1] Deutsche Zeitschrift für Chirurgie, vol. cxii, Nos. 4 and 6.
[2] ANNALS OF SURGERY, April, 1912.
[3] Weiner klinische Wochenschrift, Vienna, Dec. 14, vol. xxiv, No. 50.
[4] Archive für klinische Chirurgie, Berlin, vol. xcvii, No. 4, pages 831–1075; last indexed, April 27, page 1318.

of the heart should be explored, as this is the only positive method of determining the extent of the injury done.

When the symptoms of extreme shock accompany a wound of the chest in the cardiac region, the diagnosis is fairly sure of an injury to either the pleura, pericardium, or heart, but this cannot fully be determined without exploratory procedure; as in the case above cited, the symptoms were those of an injury to the pleura, whereas at operation we found not only the pleura injured, but the pericardium and heart as well.

As to the method of operating in these cases, I do not believe that any fixed rules can be laid down other than those of expediency. Usually the enlarging of the original wound (Peck) and the division of the costal cartilages, the retraction of which will allow a good exposure of the heart, is all that is required. Kocher and others suggest various flap methods. Kocher divides the fifth, fourth, and, if necessary, the third costal cartilages, while Wilms recommends the intercostal incision, as it can be much more quickly performed than the various flap methods. In the majority of heart wounds the pleura is injured. Sauerbruch says that 80 per cent. of the cases are so complicated.

As to the suture material, either well-vaselined silk, chromicized catgut, or Pagenstecher may be used. In our case Pagenstecher thread was the one selected. No doubt the use of the differential pressure apparatus is of great advantage in the administering of the anæsthetic, but when this apparatus is not available, ether, by the drop method, is the most efficient method.

The pericardium may or may not be completely closed. If there is much injury it is better to partially close it by interrupted sutures and carry a small drain down to the opening that is left so as to drain the excessive serous discharge which is apt to occur as a result of the traumatism. Drainage of the pleural cavity may or may not be done at the primary operation; it depends on the likelihood of infection. In doubtful cases it should always be performed. Poole says it is better to delay drainage until infection has occurred and then to perform a secondary thoracotomy.

Dr. Francis T. Stewart remarked that it was an error to give credit to Rehn, of Frankfort, for the first suture of the heart. Farina and Cappelen each operated in 1896, but the patients died. In 1897 Rehn published the first successful car-

diorrhaphy. So far as he was aware there had been 11 cases of suture of the heart in Philadelphia, one by Dr. Mitchell, two by Dr. Gibbon, one by Dr. Bradbury, one by Dr. Billings, one by Dr. Harte and five by himself, nine of these having been cared for at the Pennsylvania Hospital. As to the diagnosis, in the beginning it is often a matter of doubt. He had explored a number of thoraces for wounds and had found only five cases in which the heart was wounded, although in many a wound of the heart was suspected. Simply from the degree of shock no conclusion can be drawn. He remembered one case of stab-wound over the heart which appeared as if there must be a wound in this organ, but it was found on examination that the knife had not penetrated the thorax, the patient suffering only from emotional shock. In some of the cases in which the thorax is penetrated the heart is seriously disturbed because of so-called concussion of the heart, the heart being merely bruised. This is more frequent in gun-shot wounds. In several cases that he had explored the pericardium had been wounded but not the heart, but the symptoms were indicative of a wound of the heart. The most reliable symptoms, when they exist, are those of compression of the heart (cyanosis, distention of the veins from pressure on the auricles, etc.). These symptoms are not conclusive, however, because effusion of blood into the pericardium may result from wounds of the vessels of the pericardium or the great vessels at the base of the heart. The site of the wound is usually over the heart, although in some cases it is in the axilla or even in the abdomen. No conclusions can be drawn from external bleeding, because serious bleeding may proceed from a wound of the internal mammary artery or from the intercostals. The diagnosis can be assured only by exploration. His own custom in these cases has been to incise the skin; if the wound penetrates the muscles, to incise the muscles; if it penetrates the thorax, to enlarge the wound throughout its entire depth and to expose the pericardium; if a wound is found in the pericardium, to enlarge that wound, perhaps by resection of a rib above or below, or both. But if, on exploration, the symptoms of a wound of the heart being present, it is found that the pericardium has not been wounded, or no wound is discovered, then the pericardium should be punctured with a

needle, because, although one who has had no experience in this class of surgery may think it easy to determine whether or not blood is in the pericardium simply by inspection, it is not always an easy matter, as has been proved by several reported cases. If there is doubt after a needle has been put in the pericardium, this membrane should be incised in order to allow full exploration. As to the method of exposure, it is a matter of expediency. The size and shape of the incision or flap must be determined by the situation of the external wound and the situation of the stab in the heart. If a flap, consisting of one or more ribs, is turned inward, the pleural cavity will always be opened. If a flap is turned up or down double section of the intercostals is necessary. Whenever possible the flap should be turned outward, toward the arm. In this way, if need be, the pleura can be separated without injury, and the exposure made extrapleurally, as in one of his cases, a wound of the auricle, where he was able to make a large flap, to push off the pleura, which was not wounded by the knife, to expose the pericardium over a wide area, and to suture the wound in the heart without injury to the pleura; the patient made a rapid recovery. If the pleura is wounded infection usually follows. About one-half of the cases die of empyema of the pleural cavity or pericarditis or infective myocarditis, etc., so that if infection can be avoided the number of recoveries will be vastly increased. Of those that recover, about one-third do so in spite of infection. Of the five cases operated on by himself three recovered, two in spite of infection. As surgeons now recognize that wounds of the heart should be sutured and it has been demonstrated that the hemorrhage can be controlled, the greatest problem is to learn how to prevent the infection. He mentioned three things as being of some value in this direction. First, the rapid disinfection of the skin with iodine. In most of the cases he had operated on he used soap and water, alcohol, and bichloride of mercury, which takes a little too long, if done properly, and is not very sure if done hurriedly. With a 10 per cent. tincture of iodine solution the disinfection can be done rapidly and certainly. In the second place, if possible, drainage should be avoided; careful hæmostasis should be made and clots removed, as those which remain either form adhesions or encourage infection. If empyema arises later it can be drained. Third, that the presence of air in the pleural cavity must if possible be avoided, at least after operation. He did not know of any case having been operated on with the positive or negative pressure apparatus. In his last case he intended to use a home-made Auer-Meltzer apparatus, but the different parts could not be assembled quickly enough. The question arises, however, as to whether suction upon or distention of the lung may not increase the bleeding. If a positive or negative pressure apparatus is not at hand, the air in the pleural cavity should be removed by aspiration, after the wound in the chest is closed. A pleura full of air contains a large number of bacteria, which, after they have settled on the pleura give rise to infection. If the lung can be expanded the chances of infection will be less. In one case in which he opened the thorax for exploration, finding a wound of the lung and not of the heart, the patient was treated in this way and recovered without difficulty or infection.

Dr. W. Joseph Hearn said that a few years ago a colored woman was brought to the Jefferson Hospital one morning with evidence of puncture of the heart (stab-wound), and one of his medical delegates examined her carefully with the stethoscope and was satisfied there was leakage from the heart and suggested immediate operation, which he attempted. He made a U-shaped incision, turning the two bows of this flap toward the sternum, and avoided cutting the mammary vessels. He made an incision through which he could almost put his hand, and after washing out with salt solution, found an opening one inch long in the pericardium; the pericardial wound was enlarged sufficiently to see there was no wound of the heart, merely a scratch, which had been made by the point of the knife. It was simply a wound of the pericardium into which he put 2 or 3 sutures, closing the wound without drainage. The woman 2 years later died of phthisis. His method of exposure gave a good view of the heart without much hemorrhage. The only difficulty encountered in sewing up the pericardium was the heart movement.

PERIRENAL HÆMATOMA.

Dr. John Speese read a paper with this title.

Dr. Francis T. Stewart remarked that he had never seen a spontaneous perirenal hæmatoma, but when Dr. Speese read

his explanation of the tympanites it reminded him of the tympanites of other renal lesions, particularly of renal colic, which must be purely nervous in origin. On two occasions he had been asked to operate on a patient for intestinal obstruction who was found to be suffering from renal colic, and recently he had seen another case of the same character.

Dr. Charles H. Frazier was reminded of a case presented by him to the American Medical Association five or six years ago. This was a young man 25 years of age, who was brought to the hospital 36 hours after the onset of his illness, believed to be suffering from an acute abdominal lesion. Upon examination after admission there was found board-like rigidity of the right side, exquisite tenderness on pressure midway between the appendix and gall-bladder, and also tenderness, but not to the same degree over the right kidney. There was marked acceleration of the pulse, leucocytes were 25,000, and an elevated temperature was present. An exploratory incision was made in the right rectus, nothing was found in the peritoneal cavity and the wound was closed. An incision was then made over the right kidney. A very large perirenal hæmatoma was exposed. Drainage was introduced and the patient made an uneventful recovery. The hemorrhage was attributed to a cortical tubercular lesion. The patient had pulmonary tuberculosis.

AN APPROACH TO THE HYPOPHYSIS THROUGH THE ANTERIOR CRANIAL FOSSA.

BY CHARLES H. FRAZIER, M.D.,
OF PHILADELPHIA.
Professor of Clinical Surgery in the University of Pennsylvania.

Though the real advent of surgery of the hypophysis dates back little more than a half a decade—it being the last of the cerebral structures to come within the scope of surgical therapy—nevertheless in this short space of time rhinologists and surgeons have given much attention to this small and until recently very inaccessible organ, and have developed various methods of approach on the cadaver and the living subject with varying degrees of success. The hypophysis, situated as it is deep in the sella turcica and hemmed in by such important structures as the cavernous sinus, the optic tracts and chiasm, and the internal carotid artery, has for a long time been considered a *noli me tangere* by the surgeon. Indeed, in 1882, Hyrtl described even the sphenoidal sinus as being entirely beyond the reach of hand or instrument.

The incentive to surgical intervention in this particular field must be attributed to Pierre Marie, who in 1886, in a monograph on acromegaly, first suggested the etiologic relation between acromegaly and perverted function of the hypophysis. The constantly increasing number of experiments demonstrating the vital importance of this organ, and the many observations, notably Fröhlich's, of the various symptoms complex, caused by perverted function of the pituitary and amenable in only a transitory measure to internal remedies, including organotherapy, have added greatly to the impetus to surgical intervention. Like all other intricate procedures, the operation for exposure of the hypophysis is passing through various stages of evolution, becoming constantly less complex and at the same time less mutilating, until I think I may say with

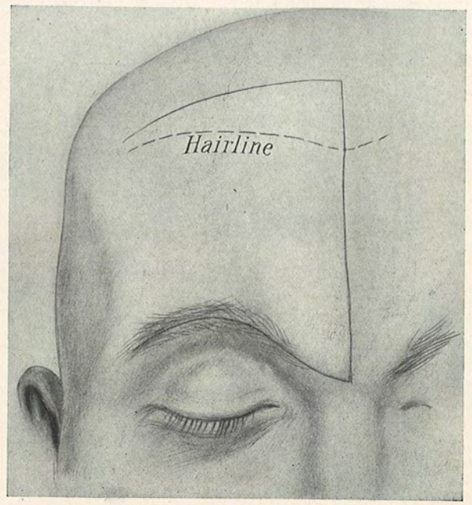
perfect accuracy that I found the operation, according to the technic which I am about to describe, as easy of performance and as devoid of difficulties, though somewhat more complicated, as that on the Gasserian ganglion.

There are two principal modes of attack: the intracranial and the extracranial, each having been modified to suit the needs and the convenience of the various operators. By means of the former, the hypophysis may be reached either through the middle or the anterior cranial fossa, and the operation may be performed extradurally or intradurally.

In 1893, Caton and Paul (*Brit. Med. Jour.*, 1893, p. 1421) conceived the idea of removing a hypophyseal growth through the middle cranial fossa by elevating the temporosphenoidal lobe, but as it happened the patient died before the operation was performed. Horsley (*Brit. Med. Jour.*, 1906, i, 323) later removed a cyst of the hypophysis by this method, and recommends early incision of the dura. Dahlgren is also reported to have operated successfully through the middle fossa, but no details of the operation are to be found. Paulesco, Cushing and Caselli have used a very similar method in their experimental work. In 1910, Silbermark (*Wien. klin. Wchnschr.*, 1910, xxiii, 467) developed a temporal intracranial method on the cadaver, consisting of a bilateral craniectomy—the counter-opening allowing dislocation of the temporal lobe without danger of compression. This operation, however, has never been performed on the living. While this method has proved very successful in canine and other experimental hypophysectomies, it seems scarcely adapted to man except in very rare instances, such, for example, as when a cyst or tumor of the pituitary extends into the infundibular region, and little attention has been given of late to this procedure.

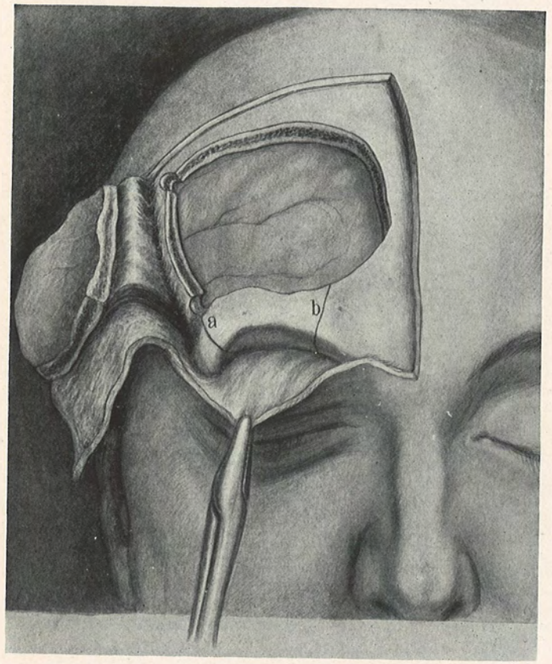
Krause (*Deu. Klin.*, 1905, viii, 1004) was the first to suggest approaching the hypophysis through the anterior cranial fossa, by resecting the frontal bone and proceeding extradurally until the lesser wing of the sphenoid is reached, at which juncture the dura is incised and the hypophysis

FIG. 1.



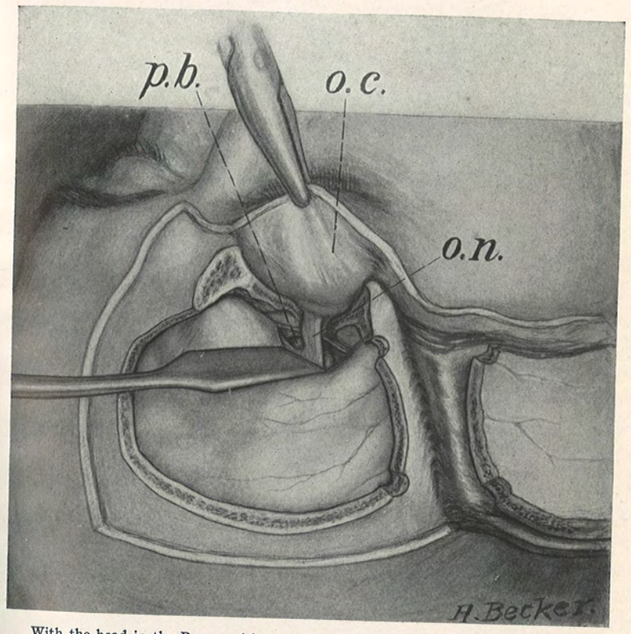
Drawing showing the relation of the incision to the eyebrow and the hair line.

FIG. 2.



Showing the reflection of the osteoplastic flap and between lines (*a*) and (*b*) the portions of the supra-orbital ridge to be resected.

FIG. 3.



With the head in the Rose position, after the supra-orbital ridge and what remains of the roof of the orbit have been removed, the frontal lobe is elevated with a retractor and the orbital contents are displaced downwards, exposing the optic nerve and immediately to the left of it, the pituitary body; *o.c.*, orbital contents; *p.b.*, pituitary body; *o.n.*, optic nerve.

easily exposed. Borchard (*Centralbl. f. Chir.*, 1908, lxvi, 332) tried to remove a hypophyseal tumor by the above method, but was obliged to abandon the operation because of hemorrhage. Kiliani (ANN. SURG., 1904, xl, 35) elaborated Krause's technic somewhat and advocates immediate incision of the dura. In 1908, McArthur performed an operation somewhat similar to Krause's with an unsuccessful outcome. He has since modified his technic, but has not to my knowledge practised it on the living subject. Last year Bogoiavlensky (*Jour. de Chir.*, 1912, viii, No. 4) performed the first successful operation through the anterior cranial fossa by a method very much like Krause's.

Most of the operations thus far have been by extracranial methods, and the surgery of the hypophysis is usually said to have its advent in 1907, when Schloffer performed his first fairly successful operation, approaching the hypophysis by the extracranial and transphenoidal route, though the experimental work of König, Löwe, and especially Giordano had paved the way for the development of Schloffer's technic. The latter, however, was somewhat crude and mutilating in character, and it has remained for others to alter and refine it. Thus, in chronological order, we find Kanavel (*Journal A.M.A.*, Nov. 20, 1909) and his intranasal operation, in which the nose is reflected upwards; Halstead (*Surg., Gyn.*, and Obstet., May, 1910) and his oronasal operation, in which the incision is made in the mucous membrane beneath the upper lip; and Hirsch (*Jour. A. M. A.*, vol. lv, p. 9) with his endonasal method. The latter is the operation of choice of all the transphenoidal methods, the conspicuous feature of which is the submucous resection of the septum and vomer, thus minimizing the danger of infection. During the past year Chiari (*Wien. klin. Wchschr.*, 1912, xxv, 1) performed two operations by a slightly different technic. He makes an incision from the inner edge of the orbit along the outer margin of the nasal bone down to the maxillary process. The eyeball is then drawn outward, the posterior part of the nasal septum and the sphenoidal septum are resected, and the hypophysis exposed. The disfigurement, Chiari claims, is slight,

as only a small portion of the nasal framework is removed. Still a different method has very recently been devised by Biehl (*Zentralb. f. Chir.*, 1912, Jan. 6) in experimental work, consisting in a suprahyoid pharyngotomy. By drawing aside the soft palate with the tenaculum, the base of the skull covering the nasopharynx up to the bifurcation of the septum is bare. The soft parts are pushed aside, under wall of the sphenoidal sinus opened, floor removed, and hypophysis readily exposed. This gives a broader approach than most extracranial methods, and has been found by Biehl very successful on the cadaver.

With one and all of these transphenoidal operations, however, there are two serious injections: One, the inevitable risk of infection from the mucous membrane. This has proven the determining factor in almost all of the 30 fatal cases. The second objection is the rather contracted avenue through which one must work to reach the sella turcica, and difficulty in securing an adequate exposure of the sella turcica and contents. The variation in size of the sphenoidal cells is a disturbing factor. When of comparatively large dimensions exposure is not so difficult; quite as often one will find cells of small dimension, through which exposure is correspondingly contracted.

I am very much in doubt whether eventually the transphenoidal route will be the operation of choice, and although there are some conditions in which this method will have to be resorted to, I believe in the future preference will be given to the intracranial route through the anterior cranial fossa. With this in mind, I have endeavored to elaborate a technic which will make the exposure of the hypophysis as feasible as the exposure of other basal structures, such as the Gasserian ganglion. The procedure, which I resorted to lately, seems to me the safest and most rational that has come to my notice. The operation consists essentially in the reflection of an osteoplastic flap from the right frontal region, in the removal *en bloc* of the supra-orbital ridge as suggested by McArthur with a portion of the roof of the orbit, later to be replaced, and in rongeuring away what remains of the roof of the orbit down to the optic foramen. With the elevation of the frontal lobe and

the depression of the orbital contents, a free and adequate exposure is secured, and there remains only to make a short incision in the dura to lay bare the cavity of the sella turcica.

In a case referred to me recently by Dr. Franklin E. Murphy, of Kansas City, the patient, a young man of twenty-three, had been a normal child up to the age of fourteen, when he was struck with a rock over the right temporal region. Two years later, he grew perceptibly weaker, his weight began constantly to increase, and he was gradually losing the sight of his right eye. When he first came under my observation in July, 1912, his appearance was that of a thickset boy of fifteen or sixteen, with very marked panniculus adiposis. The genitalia—infantile in type—suggested a child of ten or twelve. He had an enormous appetite, and was suffering from severe headaches and occasional nausea. The ocular disturbances had advanced to a state of complete right temporal hemianopsia. Aside from these marked glandular symptoms, the X-ray findings were very suggestive of pituitary trouble. As the latter showed no material deepening of the sella turcica, I felt that the lesion would be readily exposed from above. Under intratracheal anæsthesia, the operation was carried out in the manner above described. As soon as the anterior clinoid process was reached, a transverse incision, two centimetres long, was made in the dura across from one anterior clinoid process to the other and about a centimetre above the base of the skull, and with a retractor suitably placed there was seen projecting upward between the optic tracts what proved afterward to be a pituitary cyst. The cyst was opened and evacuated. The operation was devoid of any serious difficulty, and afforded a splendid exposure of the region of the sella turcica.

This method,[1] which is a modification of McArthur's, has certain advantages over the latter's; chiefly, in that the reflection of the osteoplastic flap from the frontal region admits of greater elevation of the frontal lobe and a correspondingly freer exposure of the deep-seated structures. This is a point of considerable importance. Secondly the portion of bone to

[1] Since the reading of this paper this operation was repeated in a second case with equally gratifying results.

be resected, including the supra-orbital ridge and a portion of the orbital roof, is of smaller dimensions. As this bone must be replaced for cosmetic reasons, its nutrition will be more readily supplied than the larger fragment of McArthur's operation, and necrosis is less likely to occur. This infrafrontal route deserves careful consideration in the selection of methods for hypophyseal operations. The presence or absence of a scar in the median line of the forehead is a matter of little consequence compared with the importance of selecting a method which ensures a minimum of risk to life with a maximum of exposure.

While it is still a matter of speculation which of the two methods, the extracranial or the intracranial, will become the conventional procedure, for the time being at least the operator should be influenced by the contour and conformation of the sella turcica. Ever since Oppenheim in 1899 discovered that enlargements of the sella could be reproduced by the X-ray and correlated with an increase in size in the gland itself, the radiograph has held an important place in the diagnosis and later in the mode of removal of tumors in the uncinate region. Thus, when the radiograph shows the sella deepened and encroaching upon the sphenoidal cells with a narrow orifice, access to the hypophysis from above, that is by one of the intracranial routes, is difficult and preference should be given to the transphenoidal method, in which the approach is made from below. When, however, the sella, whether deepened or shallow, has an enlarged orifice, showing its contents have encroached on the brain and not the sphenoidal cells, the transphenoidal method is practically impossible and one of the intracranial routes is indicated. In eleven out of fourteen deaths following a transphenoidal intervention (*Toupet, Revue de Chir.*, 1912, vol. xxxii, No. 6) autopsy showed that the tumor had encroached upon the intracranial space. It is very likely that the outcome in these cases might have been quite different had the intracranial method been applied.

Thus, we see there are cases in which the intracranial method is positively indicated and should be given preference. It gives a broader avenue of approach and lessens danger of infection.

Dr. John H. Jopson mentioned a case of fracture of the skull in which the line of fracture extended to the roof of the orbit and the patient developed a panophthalmitis. Dr. Shoemaker, who performed the enucleation, stated at the time that this condition was a not infrequent complication of fractures involving the orbit. It had occurred to him that in the operation described by Dr. Frazier, some such pathological condition in the eyeball might result.

Dr. Charles H. Frazier remarked, in response to what Dr. Jopson had said of involvement of the orbit, that great care should be exercised in separating the periosteum from the roof of the orbit before any attempt is made to remove the bone. The periosteum is quite thin there and may be readily torn unless one proceeds cautiously. It is rather presumptuous at this juncture to say that the transfrontal method of approach will be preferred to others, particularly the transphenoidal route. He could not, however, help but feel that surgeons will never become accustomed to working through such a long and contracted avenue as is necessary when approaching the sella through the sphenoidal sinuses. For the nasal specialist who is accustomed to open and drain the sphenoidal sinus, it may be a simple matter to go a step further and remove the thin shell of bone which forms the floor of the sella turcica. Or if nothing more than the removal of the floor of the sella, a sella decompression, is contemplated, the transphenoidal route may be given preference; but if one wants an exposure of the sella turcica sufficient to enable one to see the character of the lesion to be dealt with, some method other than the intranasal method of approach will be found to be absolutely essential.

FORMATION OF AN ARTIFICIAL VAGINA BY INTESTINAL TRANSPLANTATION.

BY FRANCIS T. STEWART, M.D.,

OF PHILADELPHIA.

ABSENCE of the vagina may be congenital or acquired, if one can define a loss as an acquisition. In the former the internal organs of generation generally share in the aplasia, but not infrequently the ovaries are present and functionally active. In obliteration of the vagina consequent upon cicatricial contraction the result of traumatism, operations, cauterization, or the severer forms of vaginitis, the uterine cavity and the ovaries likewise may have been destroyed or the uterus and the ovaries may have been removed, but in many instances they remain unaffected physically and physiologically. The functions of the vagina are to drain the menstrual fluid, to serve as an organ of copulation, and to act as a birth canal. If the vagina is absent and the internal organs of generation are healthy, there is no question as to the necessity for the creation or the restoration of the vagina, first and above all to permit the retained menstrual fluid to escape, and second, if the patient is married or contemplates marriage, to allow sexual intercourse. It is doubtful whether any artificial vagina would serve as a birth canal. Of course one could, instead of building a vagina, suppress the menstrual function by removing the uterus or the ovaries or both the uterus and the ovaries, but all would agree that these organs should be preserved unless their condition demands their removal. If the internal organs of generation are absent or functionally inert, should a vagina be formed merely for the purpose of sexual intercourse? This is the question with which we were confronted in the case herewith reported.

The patient, a woman aged forty-three, entered the Penn-

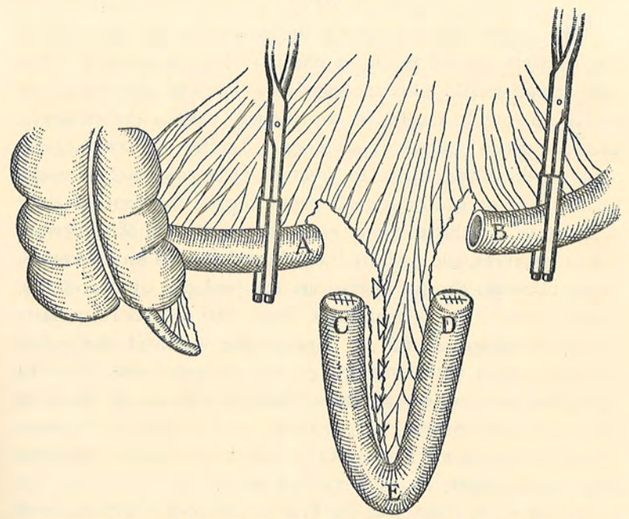
sylvania Hospital August 30, 1911. Seven years before admission a panhysterectomy had been performed in a neighboring hospital for carcinoma of the uterus. The bladder was accidentally torn or cut during this operation, and several attempts were made subsequently to close the resulting vesicovaginal fistula, all, however, without success. Upon examination the vagina was found to measure about two inches in depth and two inches in width. At its upper end was an opening, the size of a quarter of a dollar, leading into the bladder, which was markedly contracted and somewhat inflamed. After several superficial ulcerations which were present in the vagina had been induced to heal, we attempted to close the fistula in the following manner: The entire vaginal mucous membrane was excised, except over an area on the posterior wall corresponding in size to the opening in the bladder. The posterior vaginal wall was then separated from the rectum, and sutured to the anterior vaginal wall with catgut sutures, the undenuded area being fitted to the opening in the bladder. The perineum had been split to facilitate these manœuvres, and the split, together with the space existing between the rectum and the new floor of the bladder, was now closed with buried catgut sutures, and a few sutures of silkworm-gut emerging on the skin of the perineum, thus obliterating the vagina. In separating the posterior vaginal wall from the rectum, scissors had to be used freely because of the large amount of scar tissue resulting from a previous perineorrhaphy, and during one of the snips the rectum was unexpectedly wounded. The small opening in the rectum was immediately sutured and gave no further trouble. The bladder was drained for 10 days by means of a retention catheter passing through the urethra. At the end of two weeks, there having been no leakage in the meantime, an assistant, without orders, irrigated the bladder because of the turbidity of the urine. Following this a small urinary fistula, finding exit on the perineum, was discovered. During the day the patient passed most of the urine through the urethra, but at night there was a constant dribble. The patient left the hospital, and returned at the end of three months asking that the vagina be reopened. She was content to endure the leakage of urine, but

stated that she must have a vagina or her husband would desert her. At first we demurred, but her pleadings were so earnest that we consented on the condition that the other members of the Surgical Staff agree with her as to the necessity for the building of a new vagina. Drs. Harte, Hutchinson, Gibbon, and LeConte, of the Hospital Staff, and Dr. Binney, of Kansas City, who was visiting the hospital at that time, examined the patient, and all unhesitatingly took sides with her, one of the gentlemen stating that any operation destined to preserve the marital relations and keep the home intact was not only justifiable but mandatory. We selected intestinal transplantation as the method most likely to give an enduring success. The nature and the possible dangers of the operation were explained to the patient, but she was not to be frightened. Loss of life meant less to her than the loss of her husband.

Accordingly the operation was performed, November 16, 1911, before the Congress of Surgeons of North America, which met at that time in Philadelphia. The patient was placed in the lithotomy position, an incision made between the labia, and a space created between the bladder and the rectum by blunt dissection, which space was cautiously deepened until the peritoneum had been opened. A temporary tampon was then inserted, the patient placed in a horizontal position, and the abdomen opened by a longitudinal incision above the pubes. Our idea was to use, instead of the small intestine, the sigmoid flexure, because of its larger size and the absence of digestive juices, but finding its mesentery too short we were forced to select a segment of the ileum. A coil not far from the cæcum was drawn from the abdomen and found to reach well down over the pubes without tension. Both limbs of this coil, which measured about ten inches, were ligated and severed from the remaining small intestine, upon which clamps had been placed, and the ligated ends invaginated with silk sutures, the free ends of the ileum being united end to end by simple sutures. The mesentery attached to the distal (cæcal) half of the isolated loop of intestine was now ligated and divided, so that there should be no tearing of the mesentery when the loop was drawn down to the vulva, and so that the site of anastomosis would not be dragged down into the pelvis and thus predispose to kinking

(Fig. 1). Long forceps were now passed up through the space between the bladder and the rectum by an assistant, and the piece of intestine which had been severed from its mesentery drawn out through the vulva. The vesical peritoneum was next sutured to that of the sigmoid around the transplanted intestine, and the wound in the anterior abdominal wall closed. The patient was again placed in the lithotomy position, that part of

FIG. 1.



Segment of ileum (C E D) isolated, the ends C and D ligated and invaginated, and the mesentery along the distal half (from C to E) tied and cut. The end C was drawn out through the space between the bladder and rectum, the bowel at E attached to the vulvar orifice, and the excess (from E to C) cut off. The ends A and B were united by end-to-end anastomosis.

the ileum lying against the opening in the bladder fixed in position with catgut sutures, thus closing the fistula, the intestine protruding from the vulva (*i.e.*, that portion which had been severed from its mesentery) cut off, and the open end of the intestine sutured to the vulvar orifice. The new vagina was filled with gauze, so as to press its walls against the walls of the space between the bladder and the rectum.

The convalescence of the patient was uneventful, except that after a few days urine began to trickle from a small opening just below the urethral orifice. One year later the vagina admitted the index and the middle fingers for their entire length, and was performing the function for which it had been designed. Although there was still some leakage of urine the patient expressed herself as satisfied with the result, and refused further interference for the repair of the fistula.

The earlier operations for the formation of an artificial vagina were among the most unsatisfactory in surgery. The new canal would almost invariably become obliterated or useless, owing to cicatricial contraction, despite the energetic employment of dilators or plugs. Lining the raw cavity between the bladder and the rectum with epithelial or endothelial flaps or grafts seemed promising at the time of their application, but the ultimate results were failures. Mackenrodt, in two instances, successfully transplanted flaps of mucous membrane obtained during operations for prolapse of the uterus. Others turned in dermal flaps from the neighboring parts (Abbe, Burrage, Beck) or papered the walls of the newly formed vagina with Thiersch grafts. Stoeckel and Von Ott split Douglas's cul-de-sac, drew flaps of peritoneum down to the vulva, where they were sutured, and packed with gauze. When the gauze was removed the vagina contracted. Dreyfus ingeniously made use of a hernial sac.

Gersuny, in 1897, was the first to utilize the rectum, or at least a part of it. He fashioned a pedunculated flap, attached above, from the anterior wall of the rectum, sutured this flap beneath the bladder, and then closed the wound in the rectum. The sphincter ani was cut, so that there would be no constipation and interference with healing. The anterior vaginal wall was thus covered with epithelium, which, it was hoped, would finally extend over the entire raw surface. Two cases were treated in this manner. One had, at the end of ten months, a vagina completely lined with epithelium which admitted the index finger; the result in the second case is not known.

In a third case of the same kind small grafts of epithelium were placed also on the posterior wall of the new vagina. A rectal fistula followed but finally healed, and at the end of five and a half months the vagina measured 9 cm. long and 7 cm. in circumference. Pupel operated in a similar way, with a rectal fistula and narrowing of the vagina as a result. Amann modified the Gersuny operation by forming the rectal flap into a tube, a procedure requiring an unusually large rectal ampulla. Shubert cut the rectum at each extremity, closed the upper end, displaced the rectum forward, and sutured the sigmoid to the sphincter ani. Four months later the result was satisfactory, except for a tendency to narrowing at the vulvar orifice. Albrecht did the same sort of an operation, except that he used the sigmoid instead of the rectum. Sneguireff resected the coccyx, severed the rectum at its upper part, sutured the lower end of the upper segment of bowel into the wound, thus establishing an artificial anus, and closed upper end of the rectum, which was then used as the vagina. Most writers heap reproaches on this operation, for obvious reasons.

All continental writers, with the exception of De Bovis, give Häberlin (1907) the credit for suggesting transplantation of the small intestine for the purpose of forming an artificial vagina. As a matter of fact, the operation was devised by J. F. Baldwin, of Columbus, Ohio, in 1904, and first performed by him three years later. Since this time he has operated upon three additional cases, using the small intestine in each instance. Baldwin's method consists in opening the abdomen and drawing a coil of ileum down to the vulva by means of forceps, introduced through the space previously created between the bladder and the rectum. The upper ends of the coil are then severed and each end closed by an inversion suture, the continuity of the remaining bowel being restored by end-to-end anastomosis. The abdomen is then closed, the patient placed in the lithotomy position, the loop of bowel, still held with the forceps, opened and sutured to the skin, and each limb of the loop packed with gauze.

Thus there are two vaginas, the septum between which is removed in ten days or two weeks by clamp pressure. In addition to the four cases reported by Baldwin the small intestine has been employed in six instances to form an artificial vagina, thus making ten in all. Stoeckel (1912) and Abadie (1912) each proceeded in substantially the same manner as Baldwin. Mori (1909), Mueller (1910), and Halbans (1912) isolated a segment of ileum, closed the upper (oral) end, and dragged the other (cæcal) end down to the vulva, re-establishing, of course, the intestinal canal by anastomosis. It is difficult to understand how, without dangerous cutting or tearing of the mesentery, this dragging down of one end of the isolated segment could be accomplished, unless the site of anastomosis also was dragged down into the pelvis and kinked. In order to avoid this traction on the site of anastomosis, without compromising the nutrition of the bowel, and desiring to construct a single vagina, instead of a double vagina as in the Baldwin operation, we removed a portion of the bowel, as described above. If the uterus had been present we should have sutured the upper end of the transplanted bowel around the cervix.

Of the ten patients thus far operated upon all recovered and secured an excellent result. Stoeckel found that in his case the mucous membrane of the transplant continued to elaborate intestinal juices, and that the amount varied with the character of the food taken into the stomach; thus on an albuminous diet the total quantity of secretions in 24 hours was 6.2 c.c., on carbohydrates 3.7 c.c., and on fats 2.1 c.c. Stoeckel calls attention also to the increased danger of absorption and poisoning if corrosive sublimate, carbolic acid, lysol, or other strong antiseptic is employed as a vaginal douche.

REFERENCES.

Baldwin: ANNALS OF SURGERY, September, 1904; J.A.M.A., April 23, 1910.
Halban, Wiener klin. Wochenschrift, December 7, 1911.
Stoeckel, Zentralblatt f. Gynäkologie, January 6, 1912.
De Bovis, Semaine Méd., April 3, 1912.

STATED MEETING HELD DECEMBER 2, 1912

DR. GWILYM G. DAVIS, President, in the Chair.

INFECTIONS OF THE HAND.

A REVIEW OF 90 CASES.

BY LEROY W. HOON, M.D.,
AND
GEORGE G. ROSS, M.D.,
OF PHILADELPHIA.

THIS study is based upon all the cases of infection of the hand treated in the German Hospital Surgical Dispensary from April 1, 1912, to October 1, 1912. Ninety cases in all were treated during these six months, and it is of incidental interest to note that during this period only five cases of infection of the foot presented themselves for treatment.

In the main we followed closely the anatomy, diagnosis, and treatment as urged by Allen B. Kanavel, of Chicago, in his most excellent book, "Infections of the Hand." This line of treatment was a radical departure in several respects from our former treatment, but as the first few cases so treated gave such splendid results, we have been using Kanavel's method or a modification ever since.

The less severe cases will be taken up first, as we wish to reserve the deep infections for more emphatic discussion. Under the less severe infections come felons, paronychiæ, carbuncles, furuncles, infected blisters and cuts, and other superficial infections.

Felons (*Nine Cases*).—By "felon" we mean an infection occurring within the closed connective-tissue space which exists in the pad over the palmar surface of the distal phalanx of the thumb and fingers. Seven of these cases were seen before pressure had shut off the vessels supplying the diaphysis of the distal phalanx and thereby caused osteoperiostitis. These cases were at once arrested, and made rapid and complete recovery by making a deep lateral incision, opening the perios-

teum to evacuate the pus, and dressing the part with hot, wet 4 per cent. boric dressings for a day or two. Two of the cases already had osteoperiostitis of the diaphysis of the phalanx when first seen. The epiphysis was not involved in either case and immediate and complete removal of the diaphysis was practised. Both cases recovered with the joint intact and had a functionating stump. The Klapp suction cup and baking hastened the cure in one case. Nitrous oxide anæsthesia was used in all cases.

Paronychiæ (*Four Cases*).—These cases were all treated as advised by Kanavel, *i.e.*, under nitrous oxide anæsthesia a longitudinal incision was made along the lateral edge of the nail, going back as far as the sulcus and being especially careful not to cut the nail bed or overhanging cuticle. The eponychium was then pushed back, point of scissors inserted beneath the detached edge of the nail, and as much of the nail as had been lifted from the nail bed by pus was snipped off. Subsequent dressings of hot, wet boric for two or three days, followed by dry dressings, rapidly cleared up all four cases.

Carbuncles, Furuncles, Infected Blisters and Cuts, with other Superficial Infections (*Fifty-four Cases*).—Carbuncles and furuncles were treated under nitrous oxide anæsthesia by crucial incisions extending beyond the indurated area, followed by thorough undercutting of all four flaps. Squeezing of pus outward was avoided, and for two or three days following wet boric dressings were used. Recovery was hastened by the suction cup in several cases. Necrosis of the flaps was conspicuously absent and thereby less scarring resulted. Perfect drainage occurred. The infected blisters and cuts were opened where needed, and hot, wet boric dressings applied until the discharge began to thin, when iodine and dry dressings were used.

Every one of these 54 cases was saved from becoming a deeper infection by these simple means.

Having disposed of these less serious cases, we now approach the deep infections of the hand—those hidden struggles between microbe and body protoplasm deep in fascial space or

tendon sheath, the prize of battle being a pliant, useful hand, or the pathetically twisted "claw hand" so often seen.

Twenty-three cases of this nature were treated, and in comparison with the usual outcome in such cases the end results were most gratifying. An outline of the anatomy and operative incisions advocated by Kanavel should precede any discussion of these cases.

ANATOMY.

The anatomical knowledge needed is not so much a knowledge of the attachments of the palmar fascia and superficial transverse ligament, palmar arterial arches, and anterior annular ligament as it is an understanding of the fascial spaces and flexor tendon sheaths.

Pus may collect in the following six fascial spaces:

1. Dorsal subcutaneous, an extensive area of loose tissue over the extensor tendons of the back of the hand.

2. Dorsal subaponeurotic space, lying between the extensor tendons and the metacarpal bones.

3. The hypothenar space, an unimportant intermuscular space occupying the hypothenar eminence. Pus located here would not burrow into deeper spaces, but would spread to the surface.

4. The thenar space, an important space in the thenar eminence. It lies entirely to the radial side of the middle metacarpal and upon the palmar side of the adductor transversus muscle.

5. The middle palmar space, another important space, lying between the metacarpals and deep flexor tendons and extending from the middle metacarpal bone to the fifth metacarpal, and having extensions along the three outer lumbricals into the webs.

6. The web space, a subcutaneous space in the finger webs.

Besides these fascial spaces, the following flexor tendon sheaths are of the utmost importance:

1. The tendon sheaths of the index, middle, and ring fingers, extending from the middle of the distal phalanx to a line joining the ulnar end of the distal palmar crease and the

radial end of the proximal palmar crease (Kanavel's line).

2. The tendon sheath of the flexor longus pollicus and radial bursa. This extends from the base of the distal phalanx and when connected to the radial bursa (as it is in 19 out of 20 cases, Poirier) it extends to the lower end of the radius.

3. The tendon sheath of the little finger and the ulnar bursa, when connected (as in 50 per cent. of cases) extends from the distal phalanx of the little finger to the lower end of the ulna.

INCISIONS USED IN OPENING FASCIAL SPACES AND TENDON SHEATHS.

These incisions offer the most intelligent approach to deep pus pockets with the best drainage and least amount of after-scarring:

1. The tendon sheaths along the fingers are opened laterally along the proximal and middle phalanges; if sufficient drainage is not gained by these incisions, we may open laterally opposite the proximal interphalangeal joint as well.

2. The thenar tendon sheath may be split up to a thumb's breadth distal to the anterior annular ligament so as to avoid cutting the motor nerve going to the thenar eminence and thereby destroying apposition of the thumb.

3. The hypothenar tendon sheath may be cut from the base of the little finger up to the anterior annular ligament.

4. The ulnar or radial bursæ above the wrist. One incision is made on the ulnar side 1½ inches above the tip of the ulna and extending down to and across the flexor surface of the ulna. A closed hæmostat is now thrust across both ulna and radius and pronator quadratus, and a counter-incision made upon the radial side of the wrist, where the hæmostat shows beneath the skin. These incisions should both be enlarged to 1½ inches up the forearm.

5. The middle palmar space. This is opened by cutting into the lumbrical canals, preferably choosing the one between the middle and ring fingers. This incision may be carried 1½ thumb breadths up the palm and a hæmostat thrust beneath the deep flexors into the middle palmar space (Besley).

6. Combined opening of the middle palmar and thenar space. A hæmostat is pushed through the incision just described for opening the middle palmar space, pushed across the middle metacarpal bone through the thin partition between this space and the thenar space, and on across the adductor transversus muscle to the dorsum between the first and second metacarpals at about the middle of the second metacarpal. A counter-incision is made here and a rubber dam drain left in for about 18 hours as a rule.

7. Combined opening of the middle palmar space and subaponeurotic space. In the space between the middle and ring metacarpals where the middle palmar crease crosses, an incision is made and a hæmostat thrust through to the dorsum, where a counter-incision is made.

8. The thenar space. This may be opened by one incision through the dorsum on the radial side of the second metacarpal opposite the middle of that bone and on a level with its flexor surface. A hæmostat is then thrust through into the thenar space, being careful not to go beyond the middle metacarpal. No counter-opening on the palm is needed.

9. The subaponeurotic space is drained by adequate incision upon the dorsum over the interosseous spaces.

10. The hypothenar space is opened as any minor localized infection by direct incision.

DISCUSSION OF THE CASES OF DEEP INFECTION TREATED.

During the six months' period, 23 cases of this nature presented themselves for treatment, having infections classified as follows:

Tendon sheath infections	10
Middle palmar space infections	14
Thenar space infections	4
Collar button abscess at web	4
Dorsal subcutaneous infections	2
Dorsal subaponeurotic infections	2
Hypothenar space infections	1

The average age of these cases was 28 years, 19 were male and 4 female. Regarding cause, 9 arose from infected

cuts, etc., 5 from infected blisters, 1 from a bruise, and 8 from unknown cause. Six days was the average elapsed time between onset and first visit to the dispensary. The most prominent symptoms were pain, disability, and loss of sleep. Constitutional symptoms as chill, fever, and loss of appetite were present in about one-half of cases.

In diagnosing the location of pus, the most valuable aids were as follows:

1. In the frog felons or collar button abscess, web tenderness and redness, and a semiflexed position of the adjacent fingers.

2. In the tendon sheath infections, exquisite and unmistakable tenderness over the course of the sheath, a flexed position of the finger, and great pain upon attempting to passively extend the finger, were the three cardinal signs. Necrosis of tendon had already occurred in five cases, and necrosis of bone in three cases.

3. In the fascial space infections, the chief signs were localized tenderness over the thenar or middle palmar space, induration, flexion of the fingers with painful extension, loss of concavity of the palm with slight convexity in middle palmar infection, and ballooning of the thenar eminence with pushing outward of the first metacarpal in thenar space infections. Œdema and redness of the back of the hand was an ever-present feature, but tenderness was much less than that of the palmar surface, and in only three cases was pus present in the dorsum, this being diagnosed chiefly by induration.

As to treatment of these 23 cases, the incisions recommended by Kanavel were faithfully followed, with one exception, which will be discussed later. Nitrous oxide and oxygen anæsthesia was sufficient in 18 cases, ether being used in five cases. Preliminary bandaging of the forearm and arm above the operative field with elastic rubber bandages was tried in the first two cases. Kanavel advises this procedure in order to render the operative area bloodless and by subsequent gradual loosening over a period of about 18 hours to gradually allow the newly liberated toxins to enter the circulation, and thereby give the system a chance to form defensive products. After

carefully observing the effect upon these two cases, this procedure was abandoned as an unnecessary elaboration of technic, no deterioration of results being noted in the other cases. Irrigation of the infected areas after incision was also abandoned after using it in eight cases, and a rigid avoidance of any forcible squeezing or attempts to milk pus out of deep areas was practised in all cases. If adequate incision was made and wet hot boric dressings applied until the parts were draining freely, we found that the subsequent profuse and at first almost alarming discharge of thick clotted pus so moistened the edges of the incisions leading to the pus pockets as to preclude any danger of these incisions glueing shut.

In cases where tendon sheaths had been incised, the hand and fingers were dressed in extension with a wooden dorsal splint until all danger of tendon prolapse was past.

Passive motion of the fingers and hand was started on an average upon the second day after operation, and no extension of infection occurred from this practice. Exploratory incisions into areas which proved to be free from infection were made in seven of the cases, only one of these subsequently becoming infected—this case cleared up long before the original infection and did no ultimate harm.

Hot boric dressings were kept up on an average three days after operation, and were then discarded for dry dressing. Secondary operation was required in nine cases and secondary arterial hemorrhage (from a digital artery) occurred in only one case. Perfect restoration of function was secured in 18 cases and partial restoration in five cases, these latter cases already having developed bone or tendon necrosis before applying for treatment.

RÉSUMÉ.

In the 90 cases studied we wish to emphasize these points:

1. The 67 cases of simpler infection were all saved from becoming serious infections by the simple treatment outlined above.

2. The beautifully simple anatomy of the hand and forearm in relation to infective processes as emphasized by Kana-

vel forms an amply sufficient foundation upon which can be successfully built up treatment for simple or grave infections of these parts.

3. For the 23 cases of deep infection, the incisions recommended by Kanavel resulted in the most perfect restoration of function with the least after-scarring.

4. An utter disregard of the so-called danger of opening up uninfected areas in the hunt for pus did not result in harm. Incisions into doubtful areas were always made before opening into obviously pus-filled areas. In our future cases we intend to open up areas in which we cannot say definitely whether there is or is not pus, using the same incision as should be employed for opening up obviously infected pockets.

5. Rendering the operative field bloodless before operation and subsequent gradual release of the bandage is an unnecessary procedure.

6. Conservative irrigation did no harm, but just as good or better results were obtained by merely washing off what pus could be brought out by very gentle pressure.

7. Bending or extending of the fingers in a day or so after operation was found to be entirely free from danger of spreading the infection and of paramount value to the patient in securing for him an afterwards useful hand.

8. Incisions upon the back of the hand are rarely needed. The redness and œdema commonly present upon the dorsum in these cases is extremely dangerous because it often leads the uncertain practitioner to cut into pus-free areas, and then, finding no pus, to adopt one of the fatal policies of poulticing or waiting until the abscess shall "come to a head." Meanwhile the increasing infection may cause bone or tendon necrosis with crippling, that no amount of carefully made incision or faithful post-operative massage will wipe out.

9. Hot boric dressings, the dorsal splint, and flat rubber dam drains (never tubing) as used above form an indispensable trio.

10. All cases treated as we have described recovered perfect function excepting those few cases where necrosis of bone or tendon was present when the patient was first seen.

TREATMENT OF VOLKMANN'S CONTRACTURE.

A REPORT OF TWO CASES WITH DESCRIPTION OF APPARATUS.

BY EMORY G. ALEXANDER, M.D.,

OF PHILADELPHIA,

Surgeon to St. Christopher's Hospital, Out-patient Department of the Episcopal Hospital, and the Mary J. Drexel Home.

NEARLY forty years have elapsed since Volkmann first described a peculiar contracture of the hand, which he believed due to an ischæmia of the muscles from a cutting off of the arterial blood supply. He believed that the usual cause was too tight bandaging in the treatment of fractures, but also stated that the condition might follow injury to the blood-vessels, compression, or cold.

Volkmann thought the condition to be the result of a myositis and not to a primary nerve involvement, basing his belief on the fact that the paralysis and contractures appeared almost simultaneously, while the contractures following nerve injury were delayed.

Many articles on this interesting subject have been written, but little, excepting the treatment, has been added to the causes, clinical description, and pathology, as described by Volkmann.

The pathology of Volkmann's contracture is still a mooted question. Many follow Volkmann and believe the condition to be a contracture myositis; others, that it is primarily muscular in origin, but that there is a secondary nerve involvement, and still others believe that the nerves are primarily at fault.

Thomas, of Boston, in an excellent article on this subject, read before the American Neurological Society, says that if the nerves are involved in producing the muscle changes it is in the terminal muscle branches and that this is of secondary importance, and that "the involvement of part of a muscle only by the connective-tissue formation with a good response

to the remaining portion of the muscle to electrical stimulation," shows "that the nerve involvement in the primary process is not a necessary factor." The same author also calls attention to the frequent secondary involvement of nerve trunks in connective-tissue overgrowth. To this involvement Thomas thinks are due the disturbance of sensation, the reaction of degeneration and the atrophy of the hand muscles, as are seen in some cases of Volkmann's contracture.

The treatment for the contracture first recommended by Volkmann consisted in stretching the contracted muscles under an anæsthetic. The other methods that have been recommended consist in the gradual stretching of the muscles by means of a splint and by operation.

The operations devised are, freeing the nerves from connective-tissue formation, myotomy, and tendon lengthening, either by operating directly upon the tendons, or indirectly, by removing a portion of the bones of the forearm.

Volkmann believed his method applicable to recent cases, but in old cases with marked cicatricial changes there was danger of fracturing the bones or rupturing the tendons. In direct tendon lengthening, the disadvantages are the danger of infection, the length of time required to perform the operation, and the adhesions that sometimes form around the tendons. The deformity it produces, the weakening of the extensor muscles, and the liability of infection or non-union must be thought of before undertaking bone resection. Freeing the nerves and myotomy have both been practised with some success. Jones has discarded all operative measures and relies entirely upon "mechanical and manipulation routine." His reasons for so doing are that operative measures are "hazardous and inadequate," as any open operation must be performed through tissues deficient in circulation and usually cicatricial. He also states that after operation "almost immediate mechanical strain" is necessary to correct the deformity.

The following two cases were treated by mechanical means,

electricity, and massage. One case was of short duration, the other had existed for several months.

Case I.—A. W., female, age six years, was admitted to the Children's Hospital of the Mary J. Drexel Home in February, 1912, with the following history:

In June, 1911, the patient fell down a flight of stairs and sustained a T fracture of her right elbow. The fracture was treated with an anterior right-angle splint. The splint was too small, and when first applied was tightly bandaged to the arm and forearm. This caused so much pain that the bandages had to be loosened. The fracture was treated with this splint for six weeks, and on its removal, besides having a stiff elbow, it was noticed that the patient had a Volkmann's contracture. The limitation of motion of the elbow rapidly improved, but the Volkmann's contracture grew steadily worse. When seen by us the child showed a well-marked Volkmann's contracture of the right hand with atrophy of the muscles of the forearm, especially the flexors. The small muscles of the hand also showed atrophy. No accurate tests were made, but there was diminution of sensation in the hand. The muscles were not tested for degeneration. The circulation of the hand was impaired. If the hand was flexed to a right angle the patient could extend the fingers.

The case was treated on a splint, which I shall describe later, electricity and massage were given every other day, and the splint gradually extended. At the end of twelve weeks the case was discharged from the hospital cured, with good supination and pronation of the forearm, flexion and extension of the wrist and fingers. We heard from the patient a few days ago and no contractures have recurred.

Case II.—H. S., male, age ten years, came to the Children's Hospital of the Mary J. Drexel Home from a neighboring city with the following history:

Five days before admission sustained a fracture in the neighborhood of the elbow-joint. Reduction was attempted and an anterior right-angle splint applied. The patient stated that the splint was tightly bandaged to his arm. As a result of the tight bandaging the fingers became blue, cold, and numb. The patient suffered intensely the first night following the accident and gained no relief until the dressings were removed. On admission

to the Drexel Home, five days after the accident, the arm and forearm were greatly swollen. The forearm was dusky, cold, and showed numerous blebs. On the flexor surface of the forearm, just below the elbow, was a large superficial ulcer. An X-ray examination showed an unreduced supracondylar fracture of the left humerus with the usual displacement of the fragments. All dressings were removed, the arm elevated and placed on a pillow, and hot antiseptic dressings applied. The circulation gradually improved, and at the end of a week, all fear of gangrene having passed, an anæsthetic was administered and an attempt made to reduce the fracture and the arm placed in the Jones position.

The patient remained in the hospital one month and was then discharged and referred to the dispensary. At the time of discharge he showed no sign of a contracture. About two weeks after leaving the hospital, and six weeks after the injury, it was noticed that he had a Volkmann's contracture. As the patient was not under my care when first treated in the dispensary, I do not know the muscle and nerve condition at that time other than the nerve involvement was very marked, as the patient told me that he accidentally placed his hand on a hot stove and received a severe burn without feeling any pain.

This case was treated as Case I, and in about three months' time was able to flex and extend the fingers and wrist. Although the patient has good wrist and finger motion, he still shows atrophy of the muscles of the forearm and hand. Sensation in the hand is apparently normal. (Figs. 1 and 2.)

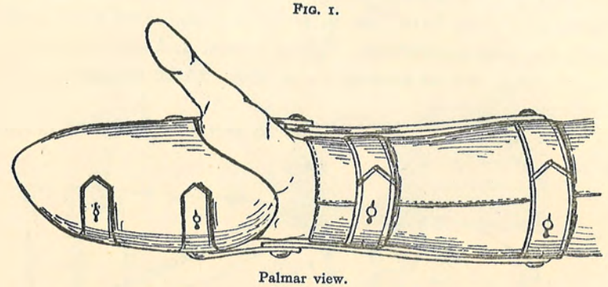
The only difficulty encountered in the treatment of these two cases was superficial pressure ulceration of the finger tips. This, I am sure, was due to faulty management and trying to produce too rapid an extension of the fingers. This difficulty we overcame by placing pads under the finger tips and "making haste slowly" with the extension.

Jones has noticed that, when the contracture has improved to such a degree as to permit hyperextension of the hand without a tendency to recurrence, the circulation will be found, as a rule, to have improved. He also claims that when the nerves are involved relaxation of the contracture is frequently accompanied by nerve improvement.

The apparatus used in treating the two cases reported consists of two parts.

Part 1 consists of a leather casing encircling the lower half of the forearm. The casing is reinforced on each side (radial

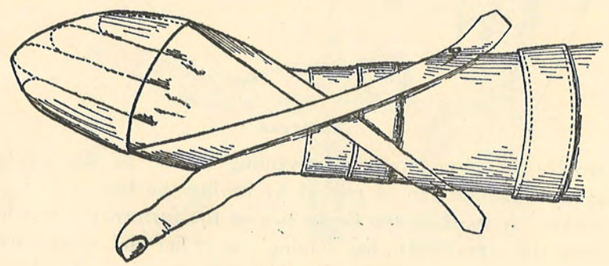
FIG. 1.



Palmar view.

and ulnar) by a steel bar. A semicircular bar at the upper end extends around the flexor surface from the radial to the ulnar bar. The casing is buckled on the extensor side of the forearm.

FIG. 2.



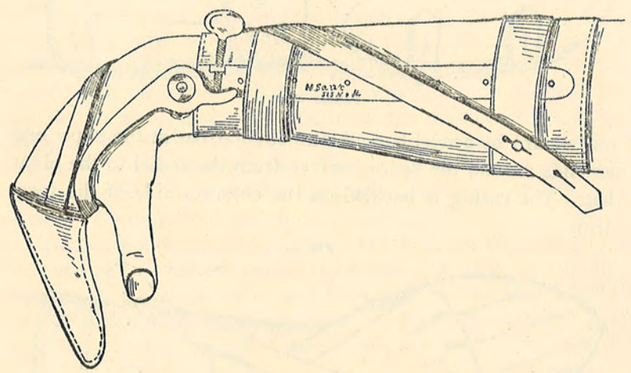
Dorsal view.

Part 2: A plate covered with leather is fitted to the palm of the hand and fingers. Extending from one side of the plate to the other, on the dorsal aspect, is a wide leather strap to hold the fingers straight and in position. Two bars attached in front on either side of the plate pass backward, the one on the radial side arching much more than the ulnar one, to join

at the wrist the radial and ulnar bars described in Part I. The joint formed by the union of these bars is provided with a lever and quick screw. Two long leather straps, attached in front at the junction of the plate and bars, pass backward, crossing on the dorsum of the wrist, and are attached to the radial and ulnar bars, just in front of junction of these bars with the semicircular one. These straps, and also the broad finger strap, are so arranged that they can be adjusted to fit the case.

The apparatus can be varied to suit the case. If much

FIG. 3.

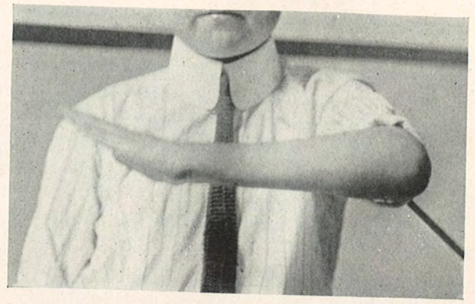


Lateral view.

trouble is encountered in preventing flexion of the wrist, greater fixation can be gained by having the leather casing buckled or laced on the flexor side of the forearm; if this is done the semicircular bar joining the radial and ulnar bars had best pass over the extensor side of the forearm. The long leather straps were not used in the first case, but in the second case they were found necessary to prevent the wrist from riding upward when extension was made on the fingers.

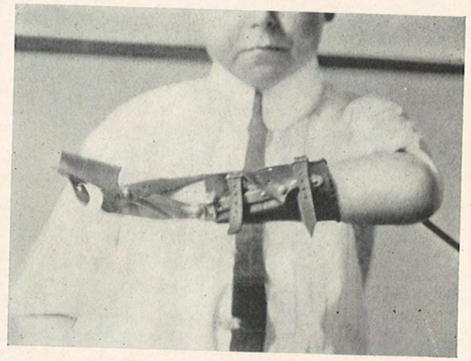
The apparatus is applied with the hand strongly flexed and the fingers extended as much as possible. By turning the screws the plate is elevated and the hand and fingers extended.

FIG. 4.



Case II. End result.

FIG. 5.



Case II. End result—apparatus applied.

Dr. Gwilym G. Davis reported two cases to illustrate the method of treatment adopted. He stated in preliminary that as to the etiology, the relative part played by the nerves and muscles is a matter of dispute. In his opinion the muscles are probably more affected than the nerves, although both may be involved. In many of these cases, the site of probable lesion is indicated by a scar on the forearm; both cases here reported had such scars. They are usually situated lower than the point of entrance of the nerve into the muscle, hence the latter escaped injury. The involvement of the nerves in these cases is not before they enter the forearm muscle, but of those nerves which lie between the muscles and tendons, and muscular disturbances due to such involvement are shown by atrophy and paralysis of the intrinsic muscles of the hand and not of those muscles which arise high up in the forearm. The nerves are apt to be involved only when all the adjacent muscles and tendons are matted together.

Injuries to the nerves in the region of the elbow will however produce muscular contractions which bear some resemblance to that produced by Volkmann's palsy, but the nerve lesion is more likely to manifest itself in the claw hand of Duchenne, while the muscular lesion exhibits a flexed wrist and contraction of most of the flexors of the fingers. The difference in the appearance of the hand and fingers in the two conditions is characteristic and is evidence of a nerve lesion as being the cause of one and the muscle lesion as being the cause of the other. As has, however, been stated there is undoubted nerve involvement in some of the true ischæmic cases.

In the treatment of these cases, Mr. Jones, of Liverpool, strongly advises persistent stretching, and his results show that very much can be accomplished by that method of treatment. It is a long and tedious undertaking, which is not always feasible to carry out. The cases here given will show what has been accomplished by tendon lengthening. Even resection of both bones of the forearm will in some cases add greatly to the use of the member.

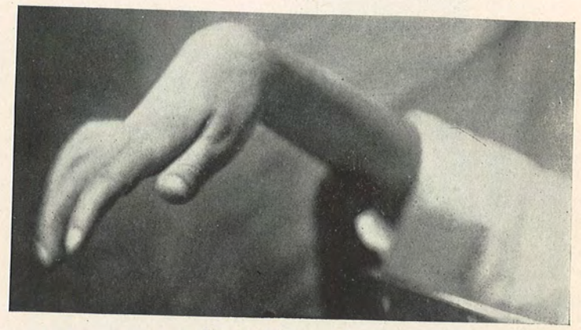
Case I.—A boy, aged 11 years, had fractured his forearm five years previously. On the second day after the injury the bones came through the skin and were replaced under ether and the arm put up in splints. The contraction of the hand and fingers was said to have begun while the splints were still on, and now the contraction of the hand and fingers is very marked

and they are almost entirely useless. This boy was treated persistently for two or three years with splints and apparatus made by his father, who is a skilful instrument maker.

An incision about three inches long was made down the ulnar side of the forearm, extending just above the pisiform bone. To this was added a transverse one directly across the wrist to the radial side. This flap was then raised and the tendons exposed. The palmaris longus, flexor carpi radialis, and the superficial and deep flexor tendons of the four fingers, ten tendons in all, were then cut and lengthened about half an inch, enough to allow the finger to be straightened. The median and ulnar nerves were not much involved. The tendons were then separated as much as possible by means of the adjacent fat and connective tissue, and the wound closed without drainage. Healing was uneventful, It is now five years since the operation and the patient is working in a grocery store and uses his hand quite well. When last seen, about a year after the operation, the result was almost perfect. Now, after the lapse of four years, there seems to be a small amount of contraction again present, but still the hand is a very good and useful one.

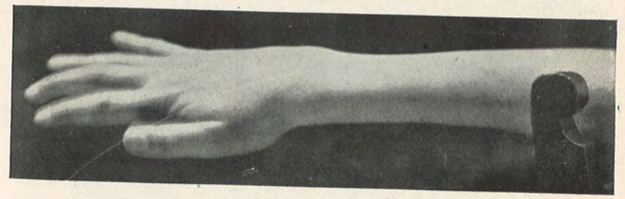
CASE II.—This was a boy aged 7 years. He broke his forearm twice, two months apart, and the contraction was noticed after the second break as soon as the splints were removed. He had marked deformity with the hand firmly flexed on the forearm at a right angle and the fingers strongly contracted. He applied for treatment about five months after the last injury. This boy came from a distance and it was practically impossible to give him the necessary attention if simply stretching was to be employed, and in view of the satisfactory result of the previous case and the difficulties experienced in carrying out the stretching treatment it was decided to operate. In this case a median incision was made and the sublime and deep flexor tendons of the index, middle, and ring fingers were divided and lengthened sufficiently to allow them to come out straight. Fine silk was used to unite the divided tendons. In two weeks the plaster cast was removed and a sinus was found in the line of the incision which had been made through a scar which was present. A couple of pieces of fine silk came out and the wound after several weeks finally closed. Despite this occurrence the result was almost a perfect one, and now, one year after the operation, extension is perfect, but the fingers when voluntarily flexed do not quite touch

FIG. 1.



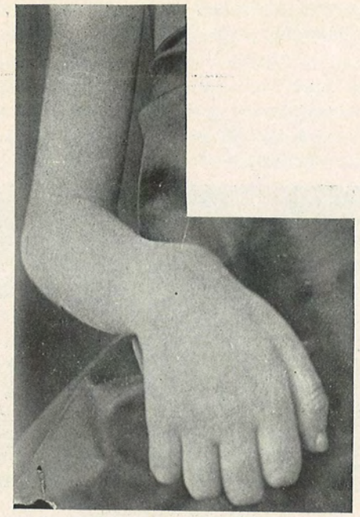
Case I. Before operation.

FIG. 2.



Case I. After operation.

FIG. 3.

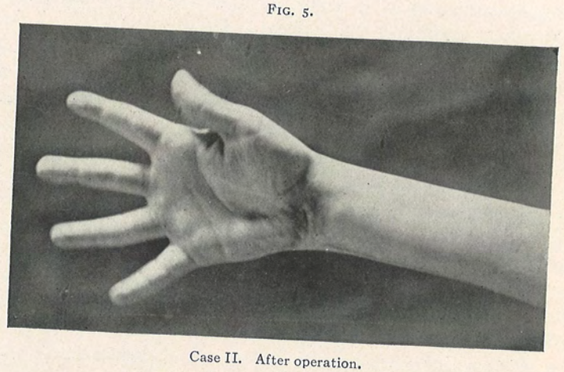


Case II. Before operation.

FIG. 4.

Case II. After operation.

FIG. 5.



Case II. After operation.

the palm. He is using the hand well and is learning to write with it.

In both of these cases, when the proximal and middle phalanges are held firmly, the distal phalanges of each of the fingers operated on can be individually flexed, thus showing that adhesion between the superficial and deep flexor tendons is not present. Operation is not advised in all cases, but only in those in which for any reason the conservative methods of treatment are considered unsuitable.

Dr. Francis T. Stewart said that he had treated one case of this condition like Dr. Davis, and although he secured vast improvement it was not nearly so great as in the cases reported by Dr. Davis. There is one objection to an apparatus of the kind which Dr. Alexander has shown: it provides the very condition that, in the first place, originated the contracture, that is, constant pressure. In one case he had ulceration as a result of this pressure. The pathology of Volkmann's contracture is not by any means clear. It is of some importance from a medicolegal standpoint to know that a few cases do not follow the application of a bandage, but result from a simple contusion. These contractures have more than one point in common with the contractures of the sternomastoid, where a bandage is almost never applied. The ischæmic theory has always seemed to him to be unsatisfactory. It may be that the condition is due to infiltration of the muscle with blood, and that this induces inflammation and subsequently fibrous overgrowth. This condition occurs almost entirely in children; very few patients are more than 12 or 15 years of age. Perhaps it is because the muscular tissue of adults is tougher than that of children.

Dr. John H. Jopson referred to a case reported here a year or two ago, in which he operated by lengthening the tendons of the muscles, but improvement has not been very marked. The condition was a very advanced one, the degeneration of the muscles amounting to complete alteration of the normal appearance of the muscle tissue. The muscles were yellow and brittle in appearance, and it seemed impossible to get any recovery of contractile joints. The nerves also showed marked alteration. They looked as if pinched between the contracting muscle fibres and were markedly atrophied for two or three inches.

Dr. John H. Gibbon said that he had seen a case of Volkmann's contracture following the placing of the arm in Jones's position

where no bandage whatever was applied about the arm. He saw the patient when the accident occurred and placed the arm in this position, and did not see it again for some time. A number of weeks later the child had a Volkmann's contracture. It was due to swelling, the arm not being brought down as it should have been.

Dr. Davis remarked, apropos of the cause as to whether it is nervous or muscular, that in a good many of these cases there is an injury visible on the forearm, and the cicatrix in most of those that he had seen had been below the entrance of the nerve into the muscle; if, however, the nerves have been injured at the site of the injury of soft parts, the injury will show itself lower down, not only in disturbance in sensation but in the paralysis and atrophy of the intrinsic hand muscles. In a good many of these cases the hand-muscles do not appear to be atrophied, and the affection of the nerves may be due to their inclusion in the inflammatory process and the exudate which occurs after the injury. An interesting question is as to the treatment which shall be adopted in these cases in which a trial by stretching has been made and has failed. What shall be done after that? and on that point his two cases show what may be accomplished by tendon lengthening. In the small boy the result is almost perfect. In the older boy who had the deformity for five years, although he has not an absolutely perfect result, yet the hand is very useful and shows that a great deal can be done by operative means. Not much has been said about resection of the bones for this condition, but even that at times will be much better than leaving the cases alone.

Dr. Emory G. Alexander (in closing) remarked, as to Dr. Stewart's criticism, that the apparatus is apt to produce the same conditions that cause a Volkmann's contracture. The pressure exerted by the apparatus is not constricting, therefore it does not cut off the circulation. The worst that can happen by improper use of the splint is superficial ulceration of the finger tips. There is no constriction of the forearm and the slight pressure exerted by the semicircular bar is not sufficient to do any harm.

As to the cause of the contracture, Volkmann thought that venous stasis played some part in causing or hastening the contracture. The fact that the condition has followed injury to blood-vessel, embolism, and constriction by an Esmarch band seems to prove that it is ischæmic in origin. Although attempts to produce the condition experimentally have not been successful, it may be possible that other causes than ischæmia, either combined with or the result of circulatory disturbances, are associated in producing the contracture.

It is of interest to note that all of the cases reported at this meeting give a history of too tight bandaging. A very famous American surgeon claims that Volkmann's contracture is a "surgeon's lesion." While he did not agree with such a broad assertion, certainly in the majority of instances the contracture could be prevented if proper care were exercised in the application of constricting dressings in the treatment of fractures in the neighborhood of elbow-joints.

A very important advantage gained by mechanical treatment, according to Jones, is that the structures are stretched in the order of their tension, and that the deep structures which are impossible to divide at operations may thus be elongated.

ARTERIOVENOUS ANEURISM TREATED BY ANGEIORRHAPHY.

Dr. Francis T. Stewart presented a boy, aged 7 years, who was admitted to the Pennsylvania Hospital, Nov. 27, 1911. Four years before this date he was circumcised by his physician. During the operation the knife was laid on the left groin, and as the patient was not completely relaxed by the anæsthetic he suddenly flexed his left thigh, impaling it on the knife. This was followed by a furious hemorrhage, which was controlled by enlarging the wound and applying ligatures. It was thought at the time that the femoral artery had been included in one of these ligatures. About one month after the injury a soft systolic murmur was noticed over the right heart, and later distinct enlargement of the heart was detected.

On admission to the hospital there was a scar about the middle of the anterior surface of the left thigh, and over this point a continuous thrill could be felt and a continuous bruit heard, the latter being transmitted down the femoral vessels as far as the knee and up as far as Poupart's ligament. Both thrill and bruit were reinforced at each arterial systole, and both ceased when firm compression was made over the scar, or over the artery above the scar, but this compression did not seem to

have any influence on the cardiac murmur. There was no appreciable difference between the pulsations in the right and the left tibial arteries. The entire lower extremity was bluish in appearance, owing to the large number of dilated venules that ramified through and beneath the skin. In none of these venules could pulsation be demonstrated; there were no large veins. The left leg was one inch longer than the right and one-half inch greater in circumference, but there was no œdema.

Under ether anæsthesia the femoral vessels were exposed above the scar and then traced downward. No tourniquet was applied, and many ligatures were needed to check the bleeding from the dilated veins. The vessels were adherent for about one-half inch, and there was no sign of a sac between them. After an assistant had grasped the artery and the vein on each side of the adherent point the vessels were separated with a sharp knife and the opening in each, which measured about one-eighth of an inch in diameter, closed with sutures of fine silk. A flap of the vastus internus was then passed around the artery so as to form a canal for it and separate it from the vein. The muscles, the fascia, and the skin were next closed, without drainage, the limb placed on a splint, and a tourniquet applied loosely to the root of the thigh, so that if bleeding should occur the nurse could at once control it. The pulse in the foot reappeared, full volume, as soon as the blood current was turned on, and continued undiminished as long as the patient was under observation. The murmur over the right heart could no longer be heard after the operation, and the heart diminished considerably in size before the patient was discharged, Dec. 8, 1911, 10 days after the operation. The only unpleasant feature in the case was a small stitch abscess at the upper angle of the wound.

Dr. Stewart remarked that, as far as he was aware, attention had not been directed to the possible influence of an arteriovenous aneurism on the cardiac muscle, although one can readily understand how the right heart might dilate under the strain of the large amount of blood delivered to it under high pressure and with increased velocity, the strain being proportionate to the size of the involved vessels, to their proximity to the heart, and to the size and directness of the orifice of communication between the artery and the vein. In a case of arteriovenous aneurism of the subclavian vessels which he had the opportunity of examining recently, thanks to Dr. Gibbon, under whose care

the patient was admitted to the Pennsylvania Hospital, another factor increasing the strain on the heart was found. The veins of the upper extremity were thrombosed, and almost all the blood from the artery was turned back into the right heart, which was dilated. The aneurismal bruit was transmitted to the heart and along the pulmonary arteries, but when the aneurism was compressed no murmur could be heard over the heart. In the present case the cardiac murmur was apparently due to dilatation, since it subsided promptly after operation. If it had been transmitted from the aneurism it would have been heard over the abdomen, would have ceased when compression was made over the aneurism, and would not have been punctually systolic, but post-systolic, because of the time necessarily elapsing between the contraction of the heart, the production of the murmur in the aneurism, and its propagation back to the heart. That it might have been intermittent and still due solely to the aneurism may be possible, since the weaker portion of the murmur might have been lost in the journey from the middle of the thigh to the heart.

Increase in the length of the limb has occurred in other cases (Franz, Cordonnier), and appears easy to explain, until one reads, as in Brindejone's case, that the limbs may be shorter and thinner than normal. Perhaps the size of the orifice of communication may have some influence on the growth of the limb. If it is small, as in this case, the arterial current is not diverted completely, hence the arteries below the fistula do not atrophy, but continue to irrigate the extremity with almost a normal quantity of pure blood. Further, the amount of arterial blood diverted may be just enough to enrich the venous current without seriously obstructing it. In such an event, which is well illustrated by this case, the circulation would remain active and there would be little or no œdema. If, on the contrary, the abnormal opening were very large, practically all of the arterial blood would pass into the vein, because of the lower pressure on the venous side of the circulatory apparatus, and most of this blood would be hurried directly back to the heart through the central segment of the vein, while the rest would distend the peripheral segment and prevent the return flow of the venous current; in addition the arteries distal to the aneurism would shrink and there would be passive congestion, œdema, and atrophy. In some cases, of course, the malnutrition may be aug-

mented by atheroma, thrombosis, injury to the nerves, destruction of the collateral vessels, cardiac disease, or some debilitating malady of a general nature.

As to the treatment separation of the vessels, with excision of the sac, if such there be, and suture of the opening in the artery and in the vein is the ideal method in all cases in which the major vessels are involved and in which this operation is possible. Extirpation of the aneurism, after ligation of both artery and vein above and below, is the only rival of angeiorrhaphy, and it must be confessed is a formidable rival, since it precludes recurrence, and, contrary to what one would expect from a study of the statistics of ligation, is rarely followed by gangrene. Ligation of the subclavian artery causes gangrene in 2 per cent. of the cases (von Bergmann), of the axillary in 6.6 per cent., of the brachial in 18.75 per cent., of the common femoral in from 19 to 21 per cent. (Raabe), of both femoral artery and vein in from 48.3 per cent. (Ziegler) to 60 per cent. (von Bergmann), of the popliteal in 54.5 per cent., of both popliteal artery and vein in all. In 105 extirpations for arteriovenous aneurism, taken from the tables of Delbet and Monod and Vanverts, 99 were followed by recovery, 4 by death, and 3 by gangrene, one case of gangrene being due to ligation for secondary hemorrhage. These cases, among which are not included extirpations of arteriovenous aneurisms of the head, face, neck, and foot, in which there is no danger of gangrene or other serious disturbance in the parts supplied by the artery, are distributed as follows: common carotid 3, with 3 recoveries; external carotid 3, with 3 recoveries; subclavian 2, with 1 recovery, and 1 death within a few hours; axillary 6, with 6 recoveries; brachial 12, with 1 death from erysipelas; common femoral 12, with 12 recoveries; superficial femoral 24, with 23 recoveries, and 1 death within a few hours; deep femoral 1, with 1 recovery; popliteal 28, with 25 recoveries, 1 death on the second day, one gangrene followed by amputation, and 1 partial gangrene of the foot and permanent œdema; tibials and peroneal 14, with 13 recoveries, and 1 death (anterior tibial). In the last case extirpation was followed by sepsis and secondary hemorrhage, necessitating ligation of the popliteal, then of the femoral, and finally amputation for gangrene. Extirpation we would reserve for arteriovenous aneurism involving vessels of the second class,

i.e., vessels whose removal would not cause gangrene or other grave nutritional changes in the parts irrigated by the artery, and for most cases in which angeiorrhaphy is not feasible.

The ligation methods cannot be wholly discarded however, for in some instances neither angeiorrhaphy nor extirpation can be performed, either because of the relations of the aneurism or because of the condition of the patient. Quadruple ligation, *i.e.*, ligation of the artery and the vein above and below the aneurism, is the best of these methods, but so far as gangrene is concerned is no safer than extirpation, and, owing to the presence of collateral vessels that sometimes empty into the sac, is more likely to be followed by recurrence.

With angeiorrhaphy the aneurism can be dealt with radically and the vessels conservatively, thus effecting cure without interrupting the blood stream and without producing gangrene. Unfortunately suture of the vessels is not always possible. In a number of instances the surgeon has attacked the aneurism with vascular suture in mind but was forced to abandon the idea because of hemorrhage (Delanglade), friability of the artery (Thompson), the large size of the opening (Mignon), or because of dense adhesions (Cranwell, J. C. Stewart). Cestan found, after suturing the brachial artery and vein, that the vessels at the sutured point had been obliterated, hence proceeded with resection. Furthermore, in a number of cases the operator, owing to unforeseen difficulties, was compelled to alter his original plan, so that numerous modifications of the typical and ideal method have been adopted. Instead of analyzing these modifications we have considered it best to include them in the subjoined table, in which these cases are grouped according to the vessels affected. It will be noticed that in the 23 cases there was no fatal result and only one recurrence (Case 18). This list, it must be explained, does not contain the cases of arteriovenous wounds that were sutured soon after the accident, of which there are about 10 on record (Matas, Murphy, Lund, Perugniez, Lissjanski, Oliver, Rost, Sonnenberg, Körte, Stewart). Such cases we believe should be classed, not with arteriovenous aneurism, but with vascular wounds, since in the latter instead of dense adhesions there is a hæmatoma (false traumatic aneurism), and additional factors, *e.g.*, pre-operative hemorrhage, shock, and infection, come into play.

TABLE OF CONSERVATIVE OPERATIONS FOR ARTERIOVENOUS ANEURISM.

Name of operator.	Date of operation.	Vessels.	Age of patient.	Cause.	Time between accident and operation.	Operation.	Result.	Pulse.
1. Vean.....	1906	Axillary	15	Stab	2 months	Double ligation of artery, suture of vein.	Cure	?
2. Marchant...	1898	Brachial	?	Stab	2 months	Suture of artery and vein.	Cure	Reappeared in ¾ of hour then grew fainter.
3. Van Imschoot	1903	Brachial	26	Stab	?	Ligation of canal between artery and vein, ligation of vein.	Cure	?
4. Protherat....	1907	Brachial	19	Stab	?	Suture of artery and vein.	Cure	?
5. Doyen.....	1908	Brachial	11	?	?	Suture of artery and vein.	Cure	?
6. Auvray.....	1909	Common femoral	15	Stab	1 month	Suture of artery, lateral ligature of vein.	Cure	Persistent.
7. Montaz.....	1893	Superficial femoral	16	?	?	Double ligation of artery, lateral ligature of vein.	Cure	?
8. Garrè.....	1904	Superficial femoral	16	Stab	10 years	Suture of artery, double ligation of vein.	Cure	?
9. Gessner.....	1906	Superficial femoral	22	Gunshot	12 years	Intrasaccular suture of opening into artery and both ends of vein (restorative endo-aneurysmorrhaphy)	Cure	Persistent.
10. Westergard..	1907	Superficial femoral	19	Stab	3 years	Double ligation of artery, lateral ligature of vein.	Cure	?
11. Abalos.....	1909	Superficial femoral	19	Gunshot	?	Suture of artery and vein.	Cure	?
12. Zeidler.....	1910	Superficial femoral	18	Gunshot	2 months	Suture of artery and vein.	Cure	Persistent.
13. LeConte and Stewart	1912	Superficial femoral	7	Stab	4 years	Suture of artery and vein.	Cure	Persistent.
14. Bramann....	1906	Superficial femoral vein, deep femoral artery	17	Stab	?	Double ligation of artery, lateral ligature of vein.	Cure	?
15. Manteuffel...	1895	Deep femoral	18	Gunshot	?	Suture of artery, resection of vein.	Cure	?
16. Wiesinger....	1904	Popliteal	18	Gunshot	?	Suture of artery and vein.	Cure	Persistent.
17. Cranwell....	1906	Popliteal	21	Stab	?	Lateral ligature of artery and vein.	Cure	?
18. VanEiselberg	1906	Popliteal	38	?	?	Ligation of canal between artery and vein.	Recurrence in 3 weeks; extirpation.	?
19. Lexer.....	1907	Popliteal	34	Stab	?	Resection and anastomosis of artery and vein.	Cure	Persistent.
20. Sabadini....	1908	Popliteal	19	Stab	?	Lateral ligature of artery and vein.	Cure	?
21. Garrè.....	1908	Popliteal	16	Explosion	1½ years	Resection, anastomosis of artery, double ligation of vein.	Cure	Persistent.
22. Aubert.....	1910	Popliteal	?	Gunshot	?	Double ligation of artery, suture of vein.	Cure	?
23. DaCosta....	1912	Popliteal	29	Gunshot	3 months	Longitudinal incision of vein, suture of opening in artery from within the vein, division of vein on each side of the opening, with utilization of the flap of vein to reinforce the arterial suture, anastomosis of the vein.	Cure	Persistent.

REFERENCES.

Monod and Vauverts: Rev. de Chir., Oct., 1910.
Gessner: New Orleans Med. and Surg. Jour., lx, p. 553, 1906.
Zeidler: Chirouguitchesky Archiv. Veliaminova, xxvi, 1910, p. 1022; abstract in Jour. de Chir., vi, 1911, p. 46.
Aubert: Marseille Medicale, xlvii, 1910, p. 560.
Da Costa: ANNALS OF SURGERY, April, 1912.
LeConte and Stewart: Surgery of the Pericardium, Heart, and Blood-vessels, American Practice of Surgery, vol. vii.

DR. JOHN H. GIBBON remarked as to the case referred to by Dr. Stewart which recently was under his care at the Pennsylvania Hospital and in which he did not operate. This man had a gunshot wound, the bullet passing between the subclavian vessels and lodging in the trapezius. He was laid up for two weeks, went back to work, then developed a weakness in the left arm and suffered pain. With this condition he was admitted to the hospital; there was a marked thrill and evident arteriovenous aneurism. Dr. Gibbon was quite keen to operate on him, but waited a few days and in that time he showed a great deal of improvement, the pain got very much less, and finally disappeared altogether, the weakness in his arm disappeared until his grip was as good as in the other, and he was finally allowed to go home. He had an arteriovenous fistula, no aneurismal sac, and notwithstanding the heart changes which Dr. Stewart refers to it was the wiser thing to let this man go and operate later if his heart condition became so bad as to demand operation. If the heart condition which Dr. Stewart found in the boy, which had lasted four years, disappeared within ten days, there was no reason in this case not to wait and watch the progess. Another reason why he did not operate on him was that one is not always as successful in arteriorrhaphy as Dr. Stewart was in his case. In a great many of these cases, unless done by such men as Carrel or Sweet, one will get a thrombosis of the vessel and if this man got a thrombosis of his subclavian he would be in a great deal worse condition than he is now.

THE EFFECT OF THE REMOVAL OF THE HYPOPHYSIS IN THE DOG.

BY JOSHUA EDWIN SWEET, M.D.,

AND

ALFRED REGINALD ALLEN, M.D.,

OF THE UNIVERSITY OF PENNSYLVANIA.

THE problem of the physiology and pathology of the hypophysis represents one of the curious instances in medical science of such contradictory observations, often additionally deflected by speculative fancy, that the answer to any given question concerning the function of the gland in health or disease is even yet not certainly established. The apparently simple proposition—is the organ essential to life?—has divided all workers into two almost evenly balanced groups: those who maintain that the gland is essential to life, and those who hold it to be non-essential.

A detailed review of the literature is here unnecessary, since the appearance of the excellent paper by Aschner (*Pfluger's Archiv.*, 1912, cxlvi, p. 1). Aschner reports extensive experiments made chiefly upon young dogs, discusses the various functions and supposed functions of the hypophysis, and gives a very complete bibliography, covering both the experimental and clinical literature of the subject. We wish in this paper to briefly discuss our own findings, and to leave aside for the present the consideration of results which we have not been able to corroborate.

The work on which this report is based began over a year ago, when the question of the essential character of the hypophysis was perhaps of more importance from the stand-point of experimental medicine than it is to-day. It is evidently a question of prime importance to the surgeon, for if it be really essential to life, the limit of safety in partial removal

must be determined. The results in 22 dogs are as follows: 4 died after an average of three days of evident traumatic encephalitis; 1 died of acute lobar pneumonia after two days; 3 died after an average of 23 days of distemper pneumonia; 4 died after an average of 15 days of basal meningitis; 1 died after 38 days, showing at necropsy a thrombosis affecting the hemisphere opposite the field of operation, with a large abscess of the base; 2 died after an average of ten and a half days, the cause of death being uncertain; 2 met accidental deaths after an average of 23½ days; 5 lived for months. None of these dogs showed any immediate symptoms peculiar to the operation, no peculiar gait, nor position, no tremors, nor any other clinical symptom; recovery was prompt and without complications.

The method of approach is through an incision about 2 inches in length, perpendicularly over the centre of the zygoma —the zygoma forming, as it were, a base line with the two-inch incision extending perpendicularly to such a base line. The zygomatic arch is removed, the coronoid process of the mandible resected, and the base of the skull approached in a direct line. The skull is trephined and the hole somewhat enlarged, and after opening the dura, the brain is carefully elevated by a suitable retractor. The hypophysis is then removed by a special loop forceps (Fig. 1) which enables the operator to grasp the gland and generally remove it in two pieces, the anterior lobe in one piece and the posterior lobe separately. The wound is closed without drainage. With a strong light the field of operation is ample and no difficulty is encountered. This approach, which has been used before, was chosen because the Paulesco-Cushing incision with its extensive removal of the skull seems unnecessary and in our opinion exposes too large an area of the brain to the compressive action of the large masseter muscles. In several instances the operation has failed because of an atypical course of a large branch of the pterygopalatine artery. This branch, ordinarily not in the field of operation, has now and

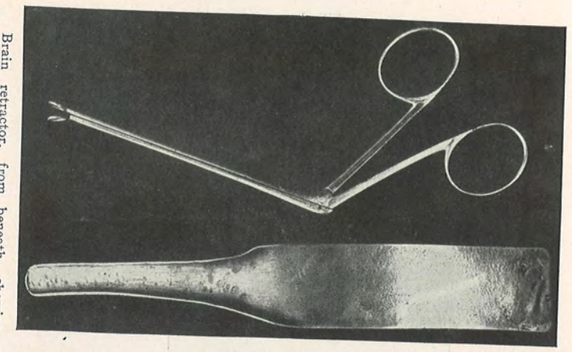


FIG. 1.

Brain retractor, from beneath, showing rounded edges. Loop forceps, for grasping the hypophysis.

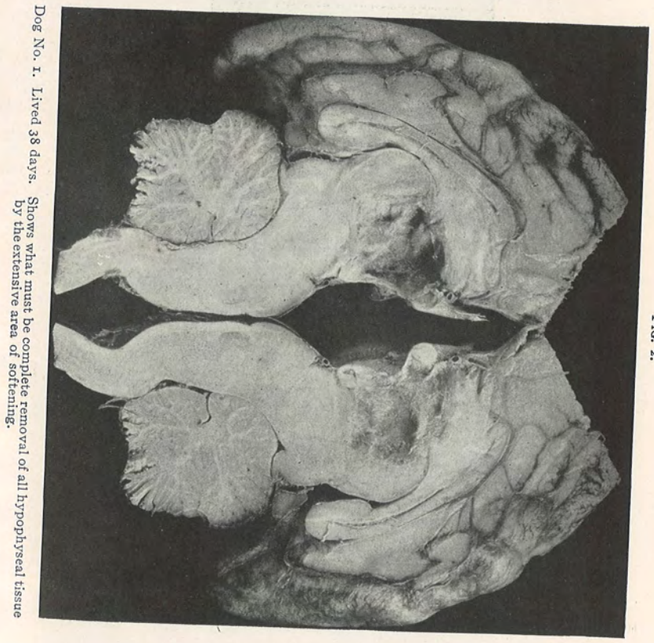
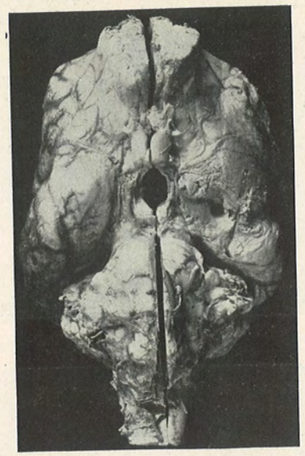


FIG. 2.

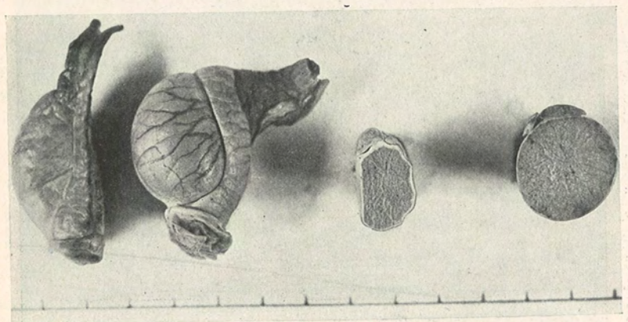
Dog No. 1. Lived 38 days. Shows what must be complete removal of all hypophyseal tissue by the extensive area of softening.

FIG. 3.



Dog No. 1. Area of softening.

FIG. 4.



Dog 19. Atrophy of testicles. On the right, testicle removed at time of hypophysectomy. On the left, companion organ, fifteen days later.

FIG. 5.

Dog No. 15. Eight months after operation.

FIG. 6.

Dog No. 13. Eight months after operation.

then been unexpectedly cut, with a resulting hemorrhage very difficult of control.

The first point which we sought to determine is whether the entire gland can be removed by this or any other method. Two points must here be recognized: Are we justified in speaking of a complete physiological extirpation when either macroscopically or microscopically some portion of the gland can be recognized after the operation? The anatomy of the gland in the dog is such that it is probably impossible to completely remove all the cells of the pars intermedia. These cells extend for a considerable distance forward toward the chiasm and backward toward the corpora mammillaria. Such a condition makes total removal from a microscopical point of view impossible, but can the gland be physiologically removed? The point is perhaps well illustrated by the history of the work upon the relation of the complete removal of the pancreas to diabetes. It is doubtless impossible to remove completely every cell of the pancreas, and because of this fact the relation of the pancreas to diabetes was for a time in dispute, the explanation being offered that the diabetes was due to the nervous shock incident to the operation. Nevertheless there can be no doubt to-day that enough of the pancreas can be removed to ensure physiological results. It is the same with the parathyroids and with the thyroid, so that a limit of safety has been established by surgeons beyond which it is not safe to remove thyroid tissue. We believe that it is possible to remove the hypophysis physiologically, that is, to remove enough so that certain characteristic changes will follow. Dog No. 1 (Figs. 2 and 3) lived for 38 days, showing no peculiar symptoms until shortly before death, when symptoms of meningeal irritation developed. The autopsy showed an extensive area of softening in the infundibular region, which, as shown in the accompanying plates, must certainly have removed all hypophyseal tissue. Concerning the extent of removal of the hypophysis we have taken the following means of ascertaining whether we have been successful in completely removing it: At the autopsy of several animals which died early, and of all

those which lived for months, a block of tissue was removed which included the optic chiasm anteriorly and the corpora mammilaria posteriorly, with about 4 mm. of tissue each side of the medial sagittal plane. This block was mounted in paraffin and serial sections prepared. Careful examination of this material revealed that in only two dogs, dogs Nos. 11 and 22, can it be said that there is no evidence of either pars intermedia or pars anterior. The remnant of the gland found in dog No. 12 was functionally very active, if one may judge by the extensive colloid-like formation and the same appearance of the cells of the pars intermedia which one sees in the normal gland; this dog presents complete atrophy of the testicles.

In the work reported by Aschner with young animals he notes that, in his experience, no marked changes occur after the removal of the gland from the adult dog. The dogs in our series were all full grown. We have no means of judging their exact age except by the fact that they all possessed at the time of operation a complete second set of teeth; in fact, dogs Nos. 19, 20, and 22 were noted as old, their front teeth being worn down almost to the gums.

In this series the first change to be noted was an indetermined effect upon the pancreas. At the autopsy of the dogs in the latter part of the series, that is, in those dogs in which we regularly made note of the condition of the pancreas, it is recorded that the organ presented a striking red coloration, having at autopsy the appearance of the gland seen at the height of digestion. Ordinarily at autopsy the pancreas presents the usual picture of a pale, even whitish, organ, the lobules at the edge being rather hard to differentiate from the neighboring fat tissue. In these animals the pancreas was evidently much congested and yet the microscopical study of sections of these organs did not reveal any very marked changes. The changes seen were perhaps identical with those to be found in a pancreas at the height of digestion. The second change in point of time, which we have noted, has been the atrophy of the genital apparatus, particularly of the testicles. From dog No. 19, at the time of the operation (Fig. 4) upon the hypophysis, the left testicle was removed; 15 days later the dog choked to death in an endeavor to swallow a whole cold boiled potato. The autopsy showed that the remaining testicle had undergone a very marked atrophy, due microscopically to a complete loss of the spermatogenetic cells. Dog No. 20, likewise an old dog, showed the same condition of striking atrophy after three weeks. Dog No. 21, dying on the thirteenth day from an undetermined cause, shows no clusters of young spermatozoa in Sertoli cells nor spermatozoa free in the lumen. Spermatids of first and second order are present in moderate quantity. The epididymis is crowded with spermatozoa. Just how soon after the removal of the hypophysis this atrophy commences we are unable to state, but from the three cases cited it is evidently very early. The third change which we have noted has been the increase in weight. This change in our experience does not begin until some time after the operation. For example, Dog No. 15 (Fig. 5), operated on February 7, 1912, weighing about 17 kilos, showed no particular change until the middle of the following June; the dog then weighed 18 kilos. On October 4 the dog weighed 27 kilos. The same may be said of the other dogs in our series (Fig. 6), so that the question has arisen in our minds whether this tendency to obesity is due to a loss of the hypophysis or to a loss of some other function of the body which is controlled by the hypophysis.

The change in the pancreas has been a constant finding; the testicular atrophy apparently is quite constant. Dog No. 16 showed what seemed to be a decided atrophy on palpation some weeks after operation, but at autopsy 7 months after the testicles were normal; this dog showed quite a large rest of pars anterior and pars intermedia, but dog No. 12 showed an equally large rest, with complete atrophy of the testicles, and dog No. 22 showed no demonstrable gland substance, yet had normal testicles. The increase in weight is apparently constant if the dog lives long enough. Perhaps the most important question to-day in connection with the ductless glands is

the matter of their interaction; are we to consider the hypophysis, for instance, as a link in a chain, which link, if broken, breaks the chain, or as members of a family, where if one member drops out, he can never be replaced, but the other members of his family can take up his work to a greater or less extent?

In three of the dogs which we have autopsied after several months' time, the thyroid presented a change, the significance of which is hard to interpret. There is an evident increase in the amount of colloid with a flattening of the cells of the alveoli. In summing up our experience with these 22 cases, it is evident that the hypophysis is not essential to life; there are undoubtedly three well-marked changes which follow hypophysectomy; the first change concerns the pancreas. We have not worked very extensively with the question of sugar tolerance and therefore have nothing to say. It is evident that such a study can only be made by determining the individual sugar tolerance before operation and obtaining an index by this means as to the normal carbohydrate tolerance of the individual animal. The second change is the atrophy of the testicles, which is of very early appearance, being extremely marked by the end of the second week after operation. Whether or not this atrophy can be compensated for by the function of some part left behind or of some glandular rests which have been described by Cushing in the floor of the sella turcica, we cannot say. Increase in weight is of late appearance, and whether it be due to the loss of the hypophysis primarily or due to the secondary atrophy of the testicle is not at all clear in our minds.

Our results agree with the most recent work on the subject reported by Aschner, except perhaps in two particulars. He worked almost exclusively with young animals, and inclines to the belief that the removal of the hypophysis from the adult dog is without effect. In the second place he ascribes the atrophy of the testicles to injury of the tuber cinereum. This point of view seems to us a purely academic one. There can

be no agreement as to where tuber cinereum ends and infundibulum begins. We have found no evidence whatever in our work which would incline us to agree with him in this particular.

We are presenting this paper at the present time for two reasons: First, we believe that the question of the essential or non-essential nature of the hypophysis is an important surgical matter, and from the results of our work we believe that the entire gland can be removed without danger to life. In the second place, from our work we believe that there is but one surgical indication for operating, namely, intracranial pressure. If such experimental experience is of any value when applied to clinical questions it is our further belief that the intracranial method of approach is to be preferred to any other method, and that the method of operation in human cases which has been elaborated by Frazier is undoubtedly the most correct from the point of view of anatomy and of surgical technic.

DR. CHARLES H. FRAZIER remarked, with regard to the conflicting testimony as to whether the pituitary body is essential to life, that it seemed to him as time goes on that the evidence is accumulating in favor of the position which he has taken. Dr. Sweet will remember a rather crude technic which together they employed five years ago for the removal of the hypophysis. An incision was made through the pharynx exposing the vault; by removing a button of bone with a small conical trephine the sella turcica was opened and the pituitary body exposed; the opportunities for infection were so great and the exposure so limited that complete and satisfactory removal of the pituitary body was not practicable.

OPERATIVE FIXATION AS A CAUSE OF DELAY IN UNION OF FRACTURES.*

BY JOHN B. ROBERTS, M.D.,
OF PHILADELPHIA,
Professor of Surgery in the Philadelphia Polyclinic.

THE great activity, developed in recent years, in the operative treatment of closed fractures, makes it desirable to report any instances of operative fixation that have been followed by unsatisfying symptoms or disastrous results. Many of us have for years been opening recent, closed fractures for the discovery of complicating lesions, for operative reduction, or for satisfactory fixation. My own advocacy of such measures began about 1885. Hence I should not be considered an unduly prejudiced critic of the present furore for operative uncovering of the ordinarily severe closed fractures of the tubular or long bones.

It seems to me, however, that the earnest advocacy of such radical procedure by especially expert and experienced operators has a tendency to do harm to surgical science and to encourage the assumption of unnecessary risks by the public. The situation resembles that of the period when hundreds of women were unnecessarily rendered sterile by oöphorectomy for the so-called sclerotic ovary, others subjected to needless nephrorrhaphy for loose kidneys, and both sexes deprived of useful thyroid glands; because these operations were found to be comparatively free from fatal issue and because neither the docile patients nor the hasty surgeons knew the true physiological worth of the organs thus subjected to surgical insult. A similar illogical following of brilliant operative masters is now occurring in the domain of tonsillar pathology, and is fast approaching, one may fear, in the treatment of closed fractures of the bones of the extremities.

* Read before the Philadelphia Academy of Surgery, Dec. 2, 1912.

Operative surgery has a brilliant career, but its activities must be controlled by a logical mind, not too much given to dwelling on the conservatism of the past or so flushed with victory that it encourages running amuck through hospital wards.

I recently reported [1] two deaths following fixation of closed fractures of the femoral shaft with plates and screws. Dr. Joseph Ransohoff,[2] of Cincinnati, says that Babler in a late report of the St. Louis City Hospital mentions two deaths occurring out of 13 cases of simple (closed) fractures of the femur treated by plating. He himself knows of two other deaths after operative treatment of this injury. I, myself, have heard of one death other than mine occurring in Philadelphia under similar circumstances. This shows that operative fixation of fractures of the femur at least is not as innocuous a proceeding as some medical men seem willing to assume.

My present purpose is to seek information on the comparative rapidity of bony consolidation of fractures under non-operative and operative treatment. It will be conceded at once that to obtain a mathematical determination of this question, it would be necessary to apply both methods to the same number of fractures of the same character and severity, occurring in the same part of the skeleton, and treated under the same circumstances by the same surgeon. These conditions are manifestly unobtainable. I must, therefore, be content to give the statements, which I have obtained from recent surgical literature, bearing on the length of time required for the union of broken bones under these dissimilar methods of treatment.

My attention was called to the possibility of plating being a cause of delay in union by having under my care a young man in whom this contingency seemed to take place.

Mr. D. S. B., aged twenty-nine years, sustained on April 13, 1912, a closed fracture of the right tibia, a little below the middle of its shaft, and a double fracture of the fibular shaft of the same

leg, which also was closed. The injuries were due to striking his leg against that of another player in a game of baseball. His general health was good. A surgeon endeavored to set the fractured leg without anæsthesia, but was not successful. Then 15 pounds extension, made with an anklet and a pulley, was employed for several days. Ten days after the receipt of injury, an X-ray picture was taken showing a fracture of the tibia, which was almost transverse, and two adjacent fractures of the fibula. At this time an attempt was made under chloroform anæsthesia to reduce the fragments. This was unsuccessful.

Fourteen days after the accident the tibia was exposed by a longitudinal incision under ether anæsthesia, and a Lane plate about four inches long was applied with screws to the fibular aspect of the tibia. The reduction of the fracture was perfect. No fixation apparatus was used for the fibular breaks. A gypsum encasement was put upon the leg for external support. It covered the ankle-joint. I do not know whether it went above the knee. The external wound healed by first intention and without pain. The gypsum splint was split two weeks after its application.

Ten weeks and two days after the receipt of the fracture (June 24, 1912) he came to me walking on crutches, and with the leg still protected with the gypsum splint. The fibula had apparently united, but there still was marked anteroposterior mobility at the seat of the fracture of the tibia. There was no swelling as of tibial callus on the subcutaneous surface of the shin bone; and the apposition of its fragments was perfect. I treated him with calcium carbonate, gr. v., and calcium lactophosphate, gr. v., internally three times daily before meals, used the rubber bandage around his thigh for congesting the seat of fracture, supported the broken bone with a gypsum encasement, and had him walk on crutches and stay a good deal in the open air. This line of treatment I continued for six weeks (until August 5, 1912) without producing any special effect on the ununited tibia. He was quite anxious about his useless leg, but seemed in good health except for this worry. He was a rather free user of tobacco.

As sixteen weeks and two days had by this time elapsed without union of the major bone occurring, I advised removal of the Lane plate and inspection of the site of fracture. I expected to find muscle or fascia between the ends of the fragments, or that the tibia was held apart at the break by the plate or by the already united companion bone. My suggestion to the patient was that I would remove the plate and then perhaps refracture the fibula to gain close contact of the tibial fragments or insert a bone graft cut from the crest of the same tibia in the gap between its fragments.

The tibia was exposed by an incision in the old scar, the plate was found hidden, under fibrous tissue and a small boss of callus, on the fibular aspect of the tibia. The subcutaneous or inner surface of the tibia was smooth, showing no deformity and no elevation of callus under the periosteum where the line of fracture was situated. The screws were imbedded in the bone, but were readily removed. There was no pus about the plate or screws. There was, however, a slight darkening of the tissues and some softening of the structures in a few places where they were in contact with the metal. The plate was removed, as were all the screws. A few drill punctures were made into the bone ends and into the tissue between them. The wound was closed without drainage, and it healed promptly.

The leg was dressed with a gypsum encasement and in a few days the man was allowed to be up on crutches. The rubber bandage for engorging the limb was used for longer periods of the day than before, lime salts and tonics were given, he was sent to the seashore, and much was done to encourage him. His tobacco was limited.

When seen on November 30, 1912, which was exactly 33 weeks after the fracture occurred, he still had a slight anteroposterior movement of the tibia at the seat of the fracture. At this point there is a slight mound of callus, and the bone is nearly solid. The gypsum splint has been discarded for three weeks and he has not used the rubber bandage for a short time past. He still takes small doses of calcium carbonate and calcium lactophosphate. He uses a cane for walking outside his home, but in the house uses the leg without any support. He has been attending to his scholastic duties for about two months. He was ordered to wear the rubber bandage for an hour a day and to take a small amount of lime salts. He evidently soon will have firm and satisfactory cure of the fracture without deformity.

In looking for a cause of delayed union in this patient I came to the conclusion that it was not unlikely that the opening of the tissues to apply the fixation plate had something to do with the delay in solidification of the fracture of the larger bone. Slow union or non-union of a fracture from interposition of muscle or fascia is not unusual, but here my exploratory observation at the time I removed the plate showed that this was not the cause of the trouble in this instance. It is true that the patient was very much worried over his condition and was away from his family at the time the accident took place. He also was very anxious to obtain a rapid cure because of the necessary resumption of his teaching in the fall. All these facts have seemed to me scarcely a sufficient reason for the want of callus formation at the seat of the fracture of the tibia in a man so young and apparently so healthy. It is true that there were three fractures, the two in the fibula and the one in the tibia, to be united, the existence of which threw a little more responsibility upon the bone-making powers of the blood.

Upon looking over recent surgical literature, I have been struck with the number of surgeons who believe that the opening of a closed fracture, for the purpose of establishing an anatomical correction of a deformity, has a tendency, not to shorten but to lengthen the time of consolidation of the broken bone.

Some of the advocates of the operative treatment of fractures, and particularly, I think, Mr. Arbuthnot Lane, believe that opening the tissues to gain access to the seat of fracture does not delay the union of the broken bone. Mr. Lane, I think, states that anatomical reposition in the manner advocated by him is almost never followed by delayed union or non-union.

Dr. Thomas W. Huntington, of San Francisco, says that it is interesting to note that in practically all cases where anatomical reposition has been attempted, three things have been accomplished: rapid bony union, absence of deformity, and absence of pain.[3]

Huntington in another article printed in 1908[4] in speaking of fractures of the femoral shaft states that approximate anatomical reposition is essential to quick repair and ideal result. He also believes that a very large percentage of all cases of delayed or non-union can be attributed to faulty adjustment. These two writers represent, I think, the opinion which most of us held when, within recent years, the unusual activity in operative treatment of these lesions began. That broken bones should unite by first intention when the fragments were properly adjusted seemed in accord with what happened in wounds of the soft parts and was, therefore, accepted. Perhaps due weight was not given to the possible physiological differences in the repair of tissue in which the deposition of inorganic salts is required to complete the restitution of physiological function. It is also possible that our reasoning was faulty, because the proper distinction was not made between bad open fractures which notoriously require a long period of time for proper cure, and uncomplicated closed fractures.

Dr. William Darrach, of Roosevelt Hospital, New York, has had a wide experience in the operative treatment of fractures, and is an earnest advocate of the method in a large range of cases. He says in his paper[5] read before the American Medical Association and published in August of this year that his experience has been that firm union comes a little more slowly in fractures that have been opened.

Another similar opinion is given by Dr. Astley P. C. Ashhurst[6] in his article on the treatment of fractures of the forearm, in which he gives the notes of 52 cases treated without operation. He states that if in treating these fractures the surgeon will use "the eyes in the ends of his fingers, he will secure by conservative means quite as good, and in many cases a much better result than by operation, and in a shorter time." In another part of his paper he gives as his opinion that after operation the process of union often is slower than it would have been if no operation had been employed.

One of the advocates of the rather frequent necessity for direct fixation of fractures is Dr. Leonard Freeman, of Colorado. His statement is that it is certain that delayed union is more common after operation than when fractures are treated by ordinary means.[7]

In a later article published in 1911,[8] when discussing the operative procedure, Dr. Freeman makes this statement: "All this gives rise to two dangers—infection and delayed or non-union." In the same article, he continues: "The tibia is one of the most frequent sites of delayed or non-union, and particularly is this true of fractures that have been operated upon and perhaps united by wires or bone plates. Fritz Koenig asserts that this is due to the removal of blood clots and tissue fragments, which are supposed to stimulate bony union, while others place the blame upon the foreign bodies introduced by the surgeons; but whatever the explanation may be, the fact remains." In the earlier article Dr. Freeman says that this delay in union may occur when the periosteum has not been disturbed and when no wires are employed. This seems to indicate that he attributes the slowness of bony repair to the operative intervention itself without reference to foreign bodies being used or the periosteum being unduly disturbed. In another part of his earlier article he speaks of the delayed union after operative intervention being more frequent when fractures of the femur are so treated than those of the tibia, and attributes this more frequently delayed union to the necessary disturbance of the tissues in a deeper wound.

Probably this experience of Dr. Freeman has something to do with his advocacy of subcutaneous fixation with long screws and an external clamp.

In an article in the *Journal of the American Medical Association* of October 21, 1911, Dr. Edward Martin, of Philadelphia, asserts that: "It is noteworthy that union is usually delayed, that the time of treatment is not materially shortened, that the results are not uniformly good. But taken as a whole, they are infinitely better than could possibly have been secured by other than operative means." He thinks: "There

has seemed to be a relation between the size of the internal splint and the promptness of final union. In other words, we have felt that the less foreign matter we put into the wound the quicker it got well." The same writer in an article on the open treatment of transverse fracture of the femoral shaft printed last year[9] makes the statement that union is nearly always delayed, the delay being proportionate to the amount of stripping of the bone ends and trauma of the soft parts at the time of operation. He thinks that we have no evidence that the period of after-treatment, before complete, or what we call complete, restoration of function is accomplished, is materially shortened by plating.

These opinions of Dr. Martin are confirmed by his statement made in September of this year[10] that as a rule the presence of a plate (Lane plate), instead of stimulating osteogenesis between the broken bone ends, retards it.

This statement of Martin is quoted by Dr. F. H. Albee[11] in his paper on bone transplantation in the treatment of Pott's disease, club-feet and ununited fracture as a reason for advocating the use of bone grafts in non-union of fractures.

These writers are not alone in the belief that direct fixation may be a cause of delay in union. William Hessert[12] has written that it has been his experience to see union delayed weeks, even months, though he has never had a case of infection.

S. C. Plummer, of Chicago,[13] states that he has heard Dr. John B. Murphy express the opinion that union was slower when a Lane plate had been applied. Plummer says that this has also been his experience in some cases. Plummer, therefore, does not agree with the opinion of Mr. Lane, whom he quotes[14] as making the statement that operative treatment "shortens the duration of the period during which he (the patient) is incapacitated for work, since union is practically by first intention, and, consequently, very rapid and perfect."

I finally give the opinion of Joseph A. Blake,[15] of New York, on this subject, which is valuable, because Dr. Blake has been greatly interested in the operative treatment of fractures and

has written a good deal in its favor. In speaking of non-union after the operative treatment of broken bones, he says: "The occurrence of non-union is not so very rare, even when the fragments have been maintained in end-to-end position by ordinary external splints. I have seen such results notably in the femur. I have also seen non-union occur when the femur had been wired. In these cases non-union has usually been attributed to the presence of the wire. When, however, the wire was changed for a plate which kept the fragments rigidly fixed, union resulted in spite of the presence of much more foreign material."

Many surgeons have probably seen this occurrence. I, myself, a good many years ago was unable to get union of an ununited fracture of the humerus by wiring, which another surgeon subsequently cured, I understood, by the insertion of a plate.

Blake further says that he has had three cases of mild infection after operations upon the femur in which there was a rather excessive production of callus. In these instances "union did not seem to be delayed, but even seemed to be accentuated." He makes the assertion that "mild infections apparently do not interfere with union, but, on the other hand, seem to stimulate the formation of callus." He maintains, however, that: "Infections severe enough to cause necrosis of tissue manifestly will prevent union." He calls attention to the fact that he does not look upon infection of such operative wounds with satisfaction, for infection must be considered, he says, "the worst misfortune that can happen in operations for fractures."

Plummer, in commenting upon the fact that slight degrees of sepsis seem to hasten union of the broken bone, truly says that all agree that the one chief and overwhelming cause of failure in the operative fixation of broken bones is sepsis.

I have reported my own case of apparent interference with union by operative fixation with a plate to maintain coaptation of the fragments after a difficult reduction. I have also gone over the recently expressed opinions of surgeons doing

this kind of work. My intention has not been to discourage the election of direct fixation in fractures, which are difficult to reduce or hard to maintain in position after reduction. This contribution is rather a plea for caution against the enthusiastic adoption of this method of treatment as a routine means of dealing with closed fractures. The profession and the public should know that while it is a necessity in some cases and its adoption a question of judgment in other cases, there are many instances of subcutaneous or closed fracture in which it is not needed. Good results can often be obtained, both as to anatomical restoration of the parts, good function and rapid cure, by external dressings guided by a thoughtful, careful surgeon, who has a mechanical mind and anatomical knowledge. The operative treatment is particularly dangerous when adopted by novices in aseptic surgery, or in places where complete aseptic surroundings cannot be obtained.

REFERENCES.

[1] International Clinics (1912), vol. iii, 22d Series; also Trans. College of Physicians of Philadelphia, 1912.
[2] Lancet Clinic, August 17, 1912.
[3] International Clinics, 21st Series, vol. iii.
[4] Annals of Surgery, September, 1908.
[5] Journal American Medical Assoc., August 3, 1912.
[6] Am. Journ. of Med. Sciences, June, 1912, p. 843.
[7] Surgery, Gynæcology and Obstetrics, Feb., 1909, p. 120.
[8] Annals of Surgery, September, 1911, p. 382.
[9] Surgery, Gynæcology and Obstetrics, August, 1911.
[10] Surgery, Gynæcology and Obstetrics, September, 1912.
[11] The Post-Graduate, November, 1912.
[12] Surgery, Gynæcology and Obstetrics, August, 1911.
[13] Journal of Iowa State Medical Society, June, 1912.
[14] Surgery, Gynæcology and Obstetrics, April, 1909, p. 344.
[15] Surgery, Gynæcology and Obstetrics, April, 1912, p. 338.

INDEX

*Read Feb. 5, 1912; by error this paper was bound up in Vol. xiv of the Transactions of the Philadelphia Academy of Surgery (1911–1912, pp. 32–33). Authors, Dr. Astley P. C. Ashhurst and Dr. Rutherford L. John.