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OF THE

PHILADELPHIA ACADEMY OF SURGERY

STATED MEETING, FEBRUARY 6, 1905.

The President, Henry R. Wharton, M.D., in the Chair.

GANGRENE OF THE SCROTUM.

BY ALBERT DRAPER WHITING, M.D.,

OF PHILADELPHIA,

Surgeon to the Germantown Hospital; Assistant Surgeon, German Hospital, Philadelphia.

Among the different organs of man in which gangrene occurs, the external genital apparatus, according to Emery, is one of those most often involved. This is explained by anatomical considerations and by the vulnerability of the external genitalia in man to the lesions of venereal disease.

The principal anatomical considerations to be noted in connection with gangrenous processes of the scrotum are the laxity of the skin and subcutaneous tissues; the continuation of the dartos into the perineum and anterior abdominal wall, and its lateral attachment through Colles's fascia to the rami of the pubes and ischii; the large amount of loose areolar tissue beneath the dartos; the continuation of the three spermatic fasciæ into the groin; the free supply of blood from different sources with but few anastomoses between the arteries of the superficial and deep layers; and the abundance of large lymph spaces in the scrotum.

The greatest predisposing causes of gangrene of the scrotum are found in the laxity of the cellular tissue which

allows marked infiltration, and in the looseness of the skin which diminishes the resistance to inflammation. Other predisposing causes include those conditions which might result in œdema or infiltration of the scrotal tissues, such as nephritis, heart disease, certain conditions of the liver, or any interference with the free flow of urine from the bladder to the exterior; any systemic disease which lowers the vital resistance, such as Asiatic cholera, smallpox, diabetes, chronic alcoholism, etc. Edward Goodeve states that he has seen many cases of gangrene of the scrotum as a complication of Asiatic cholera among the natives of Bengal; and Marson says that "the scrotum is liable to become gangrenous after smallpox, especially in those suffering from gonorrhœa." Again, any wound, abrasion, eczematous patch of the scrotum or adjacent structures which might form an entrance of infection, is a predisposing cause. Age appears to play no part in the predisposition, cases having been reported varying in age from fourteen days to eighty years.

The exciting cause of gangrene of the scrotum may be anything which interferes with the nutrition of the part to such an extent that local death results. The rapidity with which gangrene occurs and the extent of the gangrenous process will be greatly modified by the condition of the nutrition of the part, the resistive powers of the patient, and the character of the exciting cause. The extent of the gangrene may vary from a spot the size of a dime to the entire scrotum and its contained organs, with extension into the perineum and the anterior abdominal wall. Usually, the testicle and its serous coats, the tunica vaginalis, are not seriously involved.

For the purpose of classifying cases of gangrene of the scrotum, it might be well to divide them into five groups according to exciting causes. Group I would then include those cases in which the gangrene was due to the action of bacteria either through "the specific chemical substance which they liberate or as the result of vascular obstruction due to the inflammatory process to which they give rise" (Warren). Group II would include those cases where there had been

interference with the nutrition of the part by obstructing the circulation, the causes being other than micro-organismal invasion, as in cases of non-inflammatory œdema and cases of infiltration of urine. Cases of gangrene caused by tight strapping of the testicle would also come under this group, although I have been unable to find any such cases reported. Group III would include those cases due to direct mechanical or chemical action upon the tissues. Group IV would include those cases caused by thermal agencies, heat or cold. And Group V might be called the neuropathic group, in which the gangrene is caused by injury of the so-called trophic nerves.

Group I would include by far the greatest number of cases of gangrene of the scrotum that have been reported. These might again be divided into three classes, viz., 1, those in which the invading organism is a streptococcus of great virulence which gives rise to the fulminating gangrene, or *gangrene foudroyante* of the French writers; 2, in which the streptococcus of erysipelas is predominant; and 3, in which the ordinary pyogenic micro-organisms are the invading bodies.

The first complete description of fulminating gangrene of the scrotum, according to Emery, who has written a very exhaustive treatise on the subject, was given by Fournier in 1883. Fournier cites three constant characteristics,—the sudden explosion of the phenomena in the midst of perfect health; rapid evolution of mortification; and the apparent total absence of any of the usual causes of gangrene. In 1894 Volterra gave a description of a remarkable case similar to Fournier's, accompanied by a report of a thorough bacteriological investigation. He concluded that the cause was a very virulent streptococcus. In 1896 Emery studied a case in which he confirmed the researches of Volterra.

The onset of fulminating gangrene is generally preceded by a vague uneasiness, heaviness, or dragging of the parts, at times by pain after micturition, or by a feeling of fulness in the perineum, the location of the initiatory symptom depending upon the point of invasion. This is followed very rapidly by

swelling of the scrotum and penis, or by a balanoposthitis and lymphangitis if the seat of the trouble be in the prepuce. The progress of the disease is so rapid that by the time the medical adviser sees the patient, there is redness of the scrotum and penis, with marked œdema. Here and there over the organs will be found purplish spots. The increase in size of the scrotum increases very rapidly, there is soon œdema of the perineum and anterior abdominal wall, with emphysematous crackling in all of the involved tissue. The parts become black, gangrene resulting either as a result of the poisons thrown off by the streptococci, or by the inflammatory interference with the circulation. The combative powers of Nature soon check the progress of the infection, a very distinct line of demarcation is formed, and the gangrenous portion sloughs away. The tunica vaginalis is exposed, covering the testicles which hang suspended by their cords. Granulations form rapidly, and the patient is usually restored to health with the functions of his procreative organs unimpaired.

Constitutionally, the symptoms from the beginning may be very slight,—a simple chill with rise of temperature, or there may be chills, sweats, headache, nausea, fever, and excessive thirst.

The first case I wish to report belongs to this class. C. T., aged thirty years, was kindly referred to me by Dr. W. H. H. Githens. The patient had gonorrhœa when nineteen; suppurating inguinal adenitis when twenty-one. For two or three years he was troubled by an eczematous patch on the scrotum, which at times caused intense itching. He arose on the morning of July 20 in perfect health, as far as he knew. About noon of that day he experienced a heavy sensation in the scrotum and felt sick, with headache and some nausea. At 3 P.M. he noticed that the scrotum was becoming enlarged. He retired. The swelling of the scrotum increased very rapidly, and by 6 P.M. was "as big as a hat," as he expressed it. He had considerable pain. Dr. Githens, who saw him the next morning, within twenty hours of the initial symptom, writes that "the patient was suffering from 'blood poisoning' consequent (most probably) upon

scratching himself with surgically dirty finger-nails. He had long suffered from eczema, and at that time had an eruption on the perineum and scrotum, and, according to his own account, was frequently relieving the local irritation by scratching with his finger-nails. I thought also of the possibility of fly-bites, but of that there is no proof. When I saw him first (July 21), the dorsum of the penis and the entire scrotum were black, crepitant on pressure, and offensive in odor. I ordered wet applications, and succeeded in soon stopping the sloughing process and getting lines of demarcation formed. There was no erysipelas. I did not note any increase of temperature."

I first saw the patient July 29, at which time he was very pale, pulse rapid, heart irritable. Temperature, 100.2° F. The penis and scrotum were greatly swollen. Most of the scrotum was gangrenous, and a portion of the skin of the penis was in a similar condition. There was marked bogginess in the perineum and the pubic region, with emphysematous crackling there and in the scrotum. The gangrenous portions were removed. They included all of the tissues down to the tunica vaginalis. A few sloughs were present on the tunica. There was sloughing of the superficial fascia of the anterior abdominal wall, which was removed in large pieces from below. The odor of the sloughing tissues was very offensive. The parts were bathed frequently with creolin solution and dressed with wet creolin dressings. Granulations soon appeared and grew rapidly. The spermatic cords retracted, drawing the testicles close to the external abdominal ring. After the granulations had covered the testicles, attempts were made to use the redundant prepuce for plastic work, but none of the stitches held, owing to the frequent erections which the patient had. Small skin grafts were then implanted on the granulation tissue and the parts were soon healed. With the exception of slight pulling on one side when he has an erection, the patient suffers no inconvenience at present from his trouble.

Erysipelas of the scrotum is not at all uncommon. The disease often spreads from adjacent parts, or may be primary in the scrotum. It has followed ritual circumcision, excoriation from dribbling urine, bites of insects, wounds, etc.; and Rush in 1804 reported a case in which the infection was made pos-

sible by the "patient putting a handful of 'polygonum persicaria,' instead of paper, to a common use, after going to stool."

In this form of infection, the skin of the scrotum becomes dusky red, followed rapidly by œdema. The scrotum assumes a smooth, shiny appearance. The inflammation extends rapidly to the perineum and the abdominal wall. There may be enormous swelling of the scrotum due to the accumulation of serum in the loose connective tissue it contains. In favorable cases the symptoms subside, and resolution takes place with very little, if any, destruction of tissue. In the unfavorable cases, the infiltration of the scrotal tissues is so extensive and so rapid that there is interference with the blood-supply, and death of the tissues results. The extent of the gangrene varies from small patches to the entire scrotum, with involvement of the subcutaneous tissues of the perineum and abdomen. A line of demarcation forms and the sloughs may be removed, leaving the tunica vaginalis exposed.

The constitutional symptoms are similar to those connected with erysipelas in other regions. There is generally rigor and rapid rise of temperature, with symptoms of an acute fever.

One of the earliest cases of gangrene of the scrotum reported belongs to this class. It was described by Leverett Hubbard, of New Haven, Connecticut, in a communication to the Medical Society of London in 1786. The patient was forty years of age. The first symptom was slight pain in the inguinal region, with a chill followed by high fever. Dr. Hubbard says, "I visited the patient and found him in a high fever; the scrotum and penis greatly tumefied, and of a livid color; I immediately opened a vein and took away seventeen ounces of blood, which was as buffy as is usual in a violent pleurisy, with very little serum; I ordered a fomentation of bitter herbs boiled in water, to which was added rum." The gangrenous portions were cut away, leaving the tunica vaginalis exposed. Dr. Hubbard's account of the reparative process is very descriptive. He says, "The perineum began

to granulate and to heal very fast, and caused an adhesion, or union, of the testicles from each extremity which now resembled a twin peach or apple; the spermatic cords suffered a great contraction, and the testicles adhered closely to the perineum, and cicatrized favorably."

The second case I wish to report belongs to this class. I am indebted to Dr. Fairfax Irwin, of the United States Marine Hospital Service, for the privilege of presenting it.

L. A., aged thirty years, was admitted to the United States Marine Hospital Service suffering from suppurating inguinal adenitis consequent upon chancroidal invasion. Incisions were made over the masses, the parts thoroughly curetted, and packed. The wounds suppurated freely, but granulations formed slowly. The patient's general condition was very poor. Six weeks after the operation he developed erysipelas, and was transferred to the Isolating House. The inflammation spread rapidly, involving the scrotum and penis. There was marked swelling of the scrotum, which had a dusky-red, glazed appearance. The inflammation of the penis subsided, but that of the scrotum persisted until death of the entire part ensued. The gangrenous portions were removed, leaving the tunica vaginalis exposed. Granulations soon grew rapidly, joining the testicles together. There was marked contraction of the spermatic cords, with elevation of the testicles. Final healing was hastened by skin-grafting, which was performed by Dr. Ross, who circumcised the patient, using the skin of the prepuce for grafts.

Invasion of the scrotal tissue by pyogenic micro-organisms generally results from some focus of suppuration in the adjacent structures, such as chancroids, a boil, etc., or from neglect of the principles of clean surgery when operating upon the scrotal tissues. The progress of the inflammation is much less rapid than in either of the previous classes. There is some redness of the skin with œdematous infiltration. The swelling generally does not take place rapidly, although ultimately it may be very great. In other respects it resembles the erysipelatous inflammation. There are few, if any, constitutional

symptoms, unless general sepsis supervenes. The extent of the sloughing varies greatly, being often superficial and not extending below the dartos.

A very early case of gangrene of the scrotum due to this cause, probably, was reported by Edward Luttrell before the Medical Society of London in 1779. The patient was a laborer, forty-three years of age, who was suffering "from indurated and greatly diseased testicle, which was judged to proceed from a venereal cause, having frequently had lues venera." The testicle was removed. Two weeks later the edges of the wound became inflamed, the inflammation spreading through the rest of the scrotum, which soon became gangrenous and sloughed off. The wound healed by granulation.

The literature contains reports of thirty-six cases that would be classed under Group I. Of these twenty-six recovered, eight died, and in two no result was noted.

Case II.—Emery, 1896.—Patient aged thirty-nine years. Always in good health. November 15 had balanoposthitis. Preputial œdema neglected. November 30, general malaise, chills, high fever, headache, nausea, sweats. In bed three days. Genital organs normal. December 3, dull pain in inguinal region radiating to scrotum, accompanied by notable swelling of the scrotum. Patient very feeble. Scrotum swollen to size of child's head. Œdema extended to prepuce, into peritoneum, into inguinal and hypogastric regions. Three large incisions. There was no stricture of the urethra, nor any communication between the urethra and the incisions in the scrotum. Patient developed abscesses in different regions. The entire scrotum sloughed, exposing the testicles. Granulation. Recovery. Bacteriological investigation showed the presence of cocci with bacilli of various kinds. The cocci were in chains. Rabbits, submitted to intravenous injections of cultures, died of streptococcic septicæmia.

Case III.—De Bonnieres de la Luzellerie, 1887.—Age of patient not given. In 1853 had a chancre. In 1864 had severe rheumatism with lumbago. In 1880 had chancre. Addicted to use of alcohol. Had considerable œdema of prepuce after coitus. Made application to prepuce, which was followed by a phlyctenular eruption, which soon involved the penis and scrotum. There was general malaise. Patient became yellow. Scrotum increased rapidly in size and became gangrenous. Skin of pubic region very much inflamed and painful. Patient died of general sepsis.

Case IV.—Lallemant, 1884.—Patient aged twenty-six years. Had been in perfect health. First noticed pain in penis followed by œdema, which rapidly extended to the scrotum. This increased rapidly in size, became gangrenous and sloughed, exposing the testicles. Granulation. Recovery.

Case V.—Erichsen, 1860.—Patient aged twenty-eight years. No pre-existing cause. Penis and scrotum suddenly became infected with erysipelas. Scrotum increased enormously in size, followed by gangrene and sloughing. Testicles exposed. Patient died from pyæmia.

Case VI.—W. J. Smith, 1873.—Cook, aged fifty-eight years. In poor condition, intemperate. Had had poor food. Erysipelas of scrotum, which became swollen, œdematous, and crepitant. Gangrene with sloughing of the skin and dartos. Testicles not exposed. Patient recovered.

Case VII.—F. Howard Marsh, 1865.—Patient aged forty-nine years. Intemperate. When first seen was greatly prostrated. Penis and scrotum seat of erysipelatous inflammation. Scrotum size of four-year-old child's head. Perineum not involved. Urethra normal. Scrotum incised. Patient died of asthenia.

Case VIII.—Percival Pott, 1808.—Patient forty years of age. Had a large hydrocele. After hard ride on horseback, the scrotum was "covered all over with an inflammation of the erysipelatous kind. Was much increased in size and painful to the touch." Incised and large quantity of serum liberated. Next day the whole scrotum was mortified. "All the tumefaction of the scrotum was gone, but it seemed one large eschar. On the next morning he died."

Case IX.—Alexander Marcy, Jr., 1884.—Child, two weeks old. Penis and scrotum œdematous and swollen, and had the appearance of rhus poisoning. Evaporating lotions applied. Next day much worse, scrotum enormously swollen. Numerous punctures made into scrotum. Next day scrotum was gangrenous. Sloughed, exposing the testicles. Granulations. Recovery.

Case X.—Liston, 1834.—Patient aged fifty-four years. Exposed to all weathers. One month before, scrotum had become red, painful, and swollen, followed by gangrene and sloughing. On admission to hospital, both testicles were exposed. Granulation. Recovery.

Case XI.—Liston, 1835.—Age not given. Abscess over knee. Cured. Short time after complained of pain in groin, followed by erysipelas, which extended over groin, thigh, and scrotum, which became very much swollen. Gangrene of scrotum. Results not given.

Case XII.—Liston, 1834.—Shoemaker, aged twenty-one years. Erysipelas of scrotum, which became greatly swollen and gangrenous. Free incisions made. Scrotum sloughed, exposing the testicles. Granulation. Recovery.

Case XIII.—F. Lawton, 1880.—Child, aged fourteen days. Erysipelas of scrotum and groin with great pain. Scrotum greatly swollen. Dusky patch on scrotum, which sloughed. Testicles not exposed. Granulation. Recovery.

Case XIV.—R. Jones, 1868.—Farmer, aged fifty-two years. Smarting sensation and soreness of anus and genitals. No pain. Scrotum and

perineum became red and œdematous from erysipelas. Gangrene followed. Patient died in thirty-six hours after onset.

Case XV.—Harrison and Gross, 1887.—Private, aged forty-one years. Fall on buttock. Fulness in perineum. Urethra normal. Anterior surface of scrotum seat of dark streak. Scrotum swollen, but not very tender. Scrotum incised. Temperature rose to 104.5° F. Scrotum sloughed, exposing testicles. Granulations and skin graft. Recovery.

Case XVI.—George L. Cooper, 1847.—Patient aged fifty-two years. Intemperate. Exposed to cold. Uneasiness about anus. Twenty-four hours later scrotum red and swollen, crackling. Soon became gangrenous. Perineum boggy. Scrotum sloughed, exposing the testicles. Granulation. Recovery.

Case XVII.—George L. Cooper, 1847.—Patient aged fifty-five years. "Uneasy about the anus." Perineum boggy, scrotum very large, œdematous, emphysematous. Gangrene supervened. Scrotum sloughed, exposing testicles. Granulation. Recovery.

Case XVIII.—Morrant Baker, 1886.—Patient aged twenty-six years. Six weeks before had suppurating inguinal adenitis, which was opened. Soon followed by sudden, severe pain in scrotum, followed by rapid swelling until it became very tense. Perineum not involved. Scrotum incised. Became gangrenous and sloughed, exposing testicles. Granulation. Recovery.

Case XIX.—Morrant Baker, 1886.—Cabinet-maker, aged twenty-six years. Abscess in groin, which was opened. Patient did well for six weeks, then had sudden pain in scrotum, which became swollen to the size of a cocoanut. Temperature, 103° F. Scrotum incised. Became gangrenous and sloughed, exposing testicles. Granulation. Recovery.

Case XX.—E. G. Carpenter, 1880.—Age not given. Had been on spree. Slept in gutter. Next morning scrotum swollen. Went home and applied domestic remedies. Scrotum increased in size, but doctor not called in for a week. Scrotum size of man's head, doughy feel, ashy hue. Deep incision made into scrotum. Line of demarcation formed; slough of entire scrotum, exposing testicles. Granulations. Recovery.

Case XXI.—J. J. Summerell, 1875.—Pauper, aged eighty years. Had attack of erysipelas affecting scrotum, which became a gangrenous mass. Scrotum sloughed, exposing the testicles. Granulation. Recovery.

Case XXII.—J. J. Summerell, 1875.—Patient aged sixty years. Similar to above.

Lancet, September 15, 1860.—Ironmonger, twenty-eight years of age. Temperate. Six years previously had gonorrhœa. No stricture. Small, hard swelling in perineum six or seven times during last six years. This time ruptured, foul discharge. Infection of perineum, extending rapidly to scrotum. Scrotum size of man's head. Free incisions into scrotum. Erysipelatous blush over abdomen. Gangrene of scrotum, with sloughing exposing both testicles. Penis œdematous, but did not slough. Abscess in groin. Death from pyæmia on twenty-third day.

Case XXIII.—George B. Swayze, 1870.—Child, aged two years and

seven months. Phlegmonous erysipelas of scrotum. Greatly distended, hard, and very painful. Free incisions. Did not urinate for three days. Scrotum gangrenous, with ulceration into urethra. Scrotum sloughed, exposing testicles. Granulation. Recovery.

Case XXIV.—Mr. Sympson, 1878.—Patient aged sixty years. Abrasion of scrotum by long walk. Redness, œdema, marked swelling of scrotum. Gangrene, with sloughing of scrotum exposing testicles. Granulation. Recovery.

Case XXV.—H. W. Hagenbach, 1882.—Patient aged forty-two years. Pain in perineum and testicles. Perineum hard and indurated. Erysipelas of perineum and scrotum. Scrotum became enormously swollen. Erysipelas of lower abdominal wall. Penis much swollen. Lower half of scrotum sloughed, exposing testicles. Granulations. Recovery.

Case XXVI.—Blyckaerts, in 1876, reported a case in which gangrene of the scrotum followed the presence of pediculosis pubis. It is probable that this was a case of infection due to scratching the parts. The patient recovered.

Case XXVII.—C. W. Allen, 1894.—Patient aged thirty-four years. Had had gonorrhœa eight years before. Chancroid, with suppurating inguinal adenitis, three months before. Was addicted to use of alcohol. Had dull pain in scrotum, followed by marked swelling, emphysema, gangrene, sloughing of entire scrotum. Testicles exposed. Recovered. Granulation. Supposed cause to be infection, as patient gave indefinite history of having a wound.

Case XXVIII.—Mr. Jessop, 1871.—Patient aged twenty-five years. Had right-sided hydrocele. Was tapped three days later, had gangrenous patch at point of tapping. Gangrene spread, involving the whole scrotum, which sloughed, exposing the testicles. Granulation. Recovery.

Case XXIX.—Mr. Jessop, 1871.—Patient aged seventy-one years. Hydrocele right side. Tapped. One week later gangrene of entire scrotum. Patient died from sepsis.

Case XXX.—J. J. Harris, 1881.—Patient aged thirty years. Had small boil on scrotum, which he pricked with a pin. Infection, œdema, swelling to size of man's hat. Tension so great, drops of serum exuded. Scrotum incised. Gangrene of entire scrotum, which sloughed, exposing both testicles. Granulation. Recovery.

Case XXXI.—Morrant Baker, 1885.—Patient sixty years old. Some swelling of scrotum, to which he applied an irritating lotion. Marked swelling of scrotum in twenty-four hours. Gangrene, slough of entire scrotum, testicles exposed. Death from sepsis.

Case XXXII.—R. Liston, 1839.—Patient aged thirty-three years. Had an abscess near verge of anus. Opened. Two days later swelling of perineum and scrotum. Scrotum much distended, red, and shiny. Free incisions. Slough of scrotum. Result not noted.

Case XXXIII.—Samuel K. Brenner, 1895.—Patient eight weeks old. Breast-fed. No syphilis, tuberculosis, or rheumatism in parents. Temperature, 105° F. Swelling in right side of scrotum, from which

thirty cubic centimetres of pus was withdrawn by aspiration. Sac then incised and drained. Infection of scrotal tissues, sloughing. Patient died on third day. *Post-mortem.*—Serous covering of testicle and scrotal walls thick and injected. Thin layer of fibrin. Testicle and epididymis normal. Seropurulent collection in peritoneal cavity.

Case XXXIV.—C. D. Spivak, 1895.—Patient two years old. No hereditary history. Had varicella. Two days after eruption on face, scrotum became swollen and gangrenous. Three days later, penis, scrotum, and left inguinal region all swollen and very tender. Muddy crusts on left side of scrotum. Slough removed, left testicle exposed. Pus found in inguinal region. Granulation. Recovery.

Case XXXV.—W. H. Pollard, 1863.—Patient aged twenty-seven years. Strumous. Abscess in perineum. Infection and swelling of scrotum. Marked tension. Urethra normal. Gangrene of lower portion of scrotum. Penis gangrenous on dorsum. Scrotum sloughed, exposing testicles. Granulation. Recovery.

Case XXXVI.—George Wm. Pollard, 1875.—Patient aged fifty-three years. Had small boil on right side of scrotum. Scrotum swollen and painful. Incision of boil. Gangrenous spot appeared below the boil, spreading until the whole scrotum was involved. Scrotum sloughed, exposing testicles. Granulation and skin grafting. Recovery.

Group II would include those cases of gangrene due to non-inflammatory œdema and extravasation of urine. The cause of death in the former is due generally to interference with the nutrition of the part; in the latter there is added to this the marked irritating qualities of the urine when brought in contact with the tissues.

Non-inflammatory œdema of the scrotum is generally the result of renal or cardiac disease, or of inguinal or pelvic tumors. There is generally noted a uniform swelling of the scrotum which begins at the most dependent portion. The whole scrotum soon becomes involved. It is then doughy and inelastic and pits on pressure. There is no pain. The skin is semitransparent, becoming smooth and glossy, the rugæ disappearing with the increase of the œdema. The swelling is usually bilateral, although Percival Pott has reported one case in which there was one-sided non-inflammatory œdema which he diagnosed hydrocele. This was a patient forty-five years of age which Mr. Pott reported in 1808. He tapped the supposed hydrocele, but withdrew very little fluid. He

then recognized the true condition, and made a true incision into the scrotum. He says that "in three days the whole scrotum and skin of the penis were completely mortified and a considerable part of the pubes altered and eviscerated. In about three weeks the whole scrotum, the integument of the penis, and some part of the pubes cast off, leaving the corpora cavernosa and the tunica vaginalis as clean as if they had been dissected. The man got well." Mr. Pott also reported other cases which he called acute anasarca of the scrotum. He strongly advised against free incisions, after he had had some experience with these conditions, claiming that there was always sloughing of the tissues after incisions, but never after puncturing. Dr. Agnew also taught not to incise in these conditions, and never even to puncture unless the distention of the parts became so great as to threaten their vitality.

Extravasation of urine greatly resembles the acute inflammatory œdema, or erysipelas, of the scrotum in its progress. There is generally, however, a history of a neglected stricture, retention of urine, traumatism preceding the extravasation, or possibly a hard lump in the perineum. The trouble is generally first noticed in the perineum, where there is some swelling and bogginess, with pain and interference with micturition. A catheter should always be passed to aid in making a diagnosis. After the urine has invaded the periurethral tissues, there is rapid infiltration of the perineum, scrotum, penis, and pubic region. The urine acts as a violent irritant, inducing intense inflammation, which is usually followed by suppuration and sloughing. There is systemic effect, with chills, fever, thirst, great prostration, and delirium. Death usually results from septicæmia or uræmia, unless very early operative interference is instituted. This consists in free incision wherever there is infiltration, with drainage of the bladder, usually through the perineum.

The third case I wish to report comes under this group. W. G., aged twenty-seven years, was admitted to the German Hospital under the care of Dr. Deaver, to whom I am indebted

for the privilege of reporting the case. There was a history of the patient having had a stricture of the urethra, with several attacks of retention of urine. He was profoundly septic and delirious. Temperature, 104° F. The perineum, scrotum, and anterior abdominal wall were extensively infiltrated. The scrotum was ecchymotic from attempts, which had been made prior to admission, to reduce a supposed strangulated hernia. It was impossible to pass a catheter. An external urethrotomy was performed, with permanent drainage of the bladder. Free incisions were made into the scrotum and anterior abdominal wall. The superficial fascia of the abdominal wall was gangrenous, forming an immense slough, which was subsequently removed. The entire scrotum sloughed, exposing the tunica vaginalis with the testicles suspended by the spermatic cords. There was no sloughing of the skin of the penis. The testicles were covered by granulation tissue. The patient left the hospital seventy-two days after admission. He experienced nocturnal emissions before leaving the hospital.

The literature contains reports of fifteen cases that would belong to this group, of which eleven recovered and four died.

Group II., Case II.—William Corless, 1853.—Patient thirty-eight years of age. Had retention of urine from old stricture. Rupture of urethra with extravasation of urine, resulting in gangrene and sloughing of scrotum. Testicles exposed. Granulation. Recovery.

Case III.—Morrant Baker, 1885.—Patient aged fifty-four years. Had had retention of urine two weeks before. Perineum swollen and painful. Skin of scrotum and penis gangrenous. Free incisions made. Patient died.

Case IV.—Thomas Bain Whitton, 1888.—Patient aged forty-eight years. Never had had any trouble with urinary organs. Went on spree, and slept in wet clothes. In morning could not pass urine. Had retention. Rupture of urethra with extravasation of urine. Swelling of perineum, scrotum, and penis. Free incisions made. Gangrene of scrotum with sloughing, exposing testicles. Granulation. Recovery.

Case V.—William A. Byrd, 1876.—Age not given. Retention of urine. Small gangrenous spot in perineum. Scrotum then involved. Free incisions. Gangrene of scrotum with sloughing, testicles being exposed. Two inches of rectum were exposed. Granulation. Recovery.

Case VI.—D. H. Dickinson, 1879.—Patient thirty-five years of age. First seen with extravasation of urine. Temperature, 105° F.; pulse, 130. Scrotum size of cocoanut, black, with abscess in right inguinal region.

Free incisions allowed escape of urinous fluid. Gangrene, with sloughing of entire scrotum. Testicles exposed. Granulation, Recovery.

Case VII.—F. Howard Marsh, 1865.—Patient forty-five years of age. Intemperate. Had had stricture many years. Pain and swelling in perineum several days. Scrotum six inches in diameter, tense, pallid, glossy, œdematous. Œdema extended as high as umbilicus. Free incisions into perineum and scrotum. Gangrene. Slough of scrotum, groin on both sides. Patient died in five weeks from uræmia.

Case VIII.—W. A. Lightbourne, 1888.—Patient aged twenty-nine years. Working in bush felling trees. Sudden violent pain in right groin and testicle. Three days no medical attention. Fourth day, temperature, 96.5° F. Elongated swelling in right groin, extending into scrotum. Scrotum swollen half-way to knee. Gangrene of skin of scrotum and of groin. Testicles not exposed. Granulation. Recovery.

Case IX.—W. L. Wharton, 1843.—Carpenter, aged thirty-one years. Had connection with squaw during menstrual flow. Phimosis, with obstruction to flow of urine. Great distention of penis and scrotum, almost prevent walking. Scrotum punctured. Gangrene, with sloughing of parts of prepuce, entire scrotum, integument of right inguinal region. Testicles exposed. Ulceration into urethra posterior to glans. Granulation. Recovery.

Case X.—William Auchincloss, 1829.—Patient eighteen months old. Had retention of urine, ulceration into urethra. Died. *Post-mortem.*—Abscess of kidney, ureters distended to three times size of crow-quill. Bladder studded with fungous tumors.

Case XI.—Perry Dickens, 1853.—Butcher, sixty-four years of age. Had retention from hypertrophied prostate. Pain and fulness in perineum. Became inflamed, extending to scrotum, which became enormously swollen. Gangrene of scrotum and perineum. Free incisions, liberating fœtid gas and fluid. Slough of scrotum exposing testicles. Granulation. Recovery.

Case XII.—Christopher Fleming, 1858.—Laborer, forty-five years of age. Had had difficulty in urination, with swelling of penis and scrotum for four years. Had general anasarca. Fulness in perineum, extending to scrotum, which became hard, swollen, tense, and painful Erysipelas of scrotum and penis. Free incisions. Gangrene with sloughing of scrotum. Testicles exposed. Granulation. Recovery. Case of general anasarca with erysipelas.

Case XIII.—Percival Pott, 1808.—Patient aged fifty-eight years Was "afflicted with an anasarcous tumor of the belly, legs, thighs, scrotum, and penis. He had taken many medicines and more than one quack remedy since being in London." The swelling in penis and scrotum became so great that he could not wear trousers. Incisions made on each side of scrotum. Edges of incisions became hard and inflamed, with marked pain. Followed by a "kind of emphysematous tumescence." Nine days later the "whole bag was in a state of mortification." Scrotum sloughed, exposing both testicles. Granulation. Recovery.

Case XIV.—Percival Pott, 1808.—Patient forty years of age. Had

drinker. "His legs, thighs, scrotum, and penis were loaded with a watery tumor." Incisions made into scrotum. Wounds became inflamed, swollen, and very painful. "The whole scrotum and skin of the penis became black and mortified, as did also the part of the pubes." Patient died on the eleventh day.

Case XV.—American Medical Weekly, 1876.—Patient forty years of age. General acute anasarca. Had had intermittent fever. Scrotum size of crown of hat. Scrotum punctured. Gangrene followed. Slough of entire scrotum with testicles exposed. Granulation. Recovery.

Group III would include those cases due to direct mechanical or chemical action upon the tissues. There is traumatism or the action of some powerful escharotic which acts here as elsewhere in the body, with the exception that the destruction of tissue is more rapid and more extensive. In traumatic cases, the gangrene may be due to the rupture of blood-vessels supplying the part, or to the consequences of infection which take place at the time the traumatism is inflicted.

Baurienne, in 1764, reported a case in which a boy of fourteen had been gored by an ox. Four days later he was admitted to the hospital with an enormously swollen scrotum, which was very painful, œdematous, and shiny. Death of the part had commenced. Free incisions were made into the scrotum, but it soon sloughed, exposing the tunica vaginalis. The patient recovered, the testicles being covered by granulations.

An interesting case was reported by Mr. Hagan in 1877, in which the patient, who was thirty years of age, was inconvenienced by the unusual length of his scrotum, which reached half-way to the knees. The lower third was amputated. This was followed almost immediately by swelling of the remainder of the scrotum, which in six hours reached an enormous size. The pain was intense. Gangrene supervened, with sloughing of the scrotum to within an inch of the pubes. The patient recovered.

Galloupe and Graves reported a case in 1876 in which the scrotum of a man twenty-one years of age was almost completely torn off by machinery. Strange to relate, the testicles and spermatic cords were not injured. The scrotum was replaced, but soon became gangrenous and sloughed. The patient recovered.

The literature contains the reports of thirteen cases which would belong to this group. Of these seven recovered and six died.

Group III, Case IV.—James B. Burnett, 1869.—Patient fifty years of age. Fell twenty feet, struck on nates. Scrotum and perineum soon became swollen and gangrenous. The body from the pelvis to the sternum was emphysematous. Free incisions made. Patient died from asthenia. *Post-mortem.*—Superficial fascia from pelvis to umbilicus was gangrenous. Bladder and urethra dissected out and found to be normal. Scrotum contused. Supposed that there was an extravasation of blood which decomposed. No signs of uræmia.

Case V.—Liston, 1834.—Patient forty years of age. Kicked in perineum. No trouble for eight days. Then pain and swelling of scrotum, with emphysematous crackling. Free incisions. Cellular tissues were gangrenous. Patient died before sloughs had separated.

Case VI.—William Auchincloss, 1829.—Patient thirty-seven years of age. Had a large right-sided hydrocele. Probably contused. Small patch of gangrene, which rapidly invaded the whole scrotum. Urethra normal. Patient died of sepsis.

Case VII.—J. B. Shapleigh, 1882.—Patient forty years of age. Fell on joist. Inflammation, œdema, discoloration of the perineum and scrotum. Retention of urine. Attempt to puncture bladder through rectum failed. Suprapubic drainage of bladder. Gangrene of scrotum, with sloughing. Testicles exposed. Rupture of urethra by fall. Granulation. Recovery.

Case VIII.—Shapleigh.—Patient fifty-four years of age. Had had stricture of urethra. Fell on barrel, striking perineum. Rupture of urethra with extravasation. Swelling of scrotum, which became gangrenous. Sloughing of scrotum. Patient developed an acute diarrhœa and died.

Case IX.—Stephen Smith, 1851.—Laborer, aged fifty-one years. Intemperate. Struck testicle. In three days the scrotum was very painful. Not red, not tense. Became inflamed, followed by gangrene and sloughing. Testicles exposed. Developed erysipelas and died.

Case X.—W. F. Stevenson, 1883.—Patient forty-five years of age. Scrotum and penis swollen and gangrenous when first seen. Swelling in perineum. Patient voided urine free from blood. Redness of abdominal wall. Penis, scrotum, and perineum incised. Collapse. Patient died fifty-four hours after receiving an injury, having been struck by a tent-pole. *Post-mortem.*—All organs healthy. Urethra patulous. Body of penis infiltrated with dark blood. Small ecchymotic patch towards outer end of urethra.

Case XI.—A. Grainger Bisset, 1904.—Age not given. Scraping contusion of scrotum which caused shock. Unable to work. Retired. Had rigors, with fever. Unable to take food. Sharp and severe pain in lower part of abdomen. Much pain in scrotum. Urinated freely. Temperature, 103° F. General appearance one of collapse. Whole scrotum swollen and tense, size of a cocoanut. Penis not affected. Gangrene of scrotum. Gangrenous portions removed. Testicles exposed. Plastic operation by means of flaps from thighs. Recovery.

CASE XII.—THOMAS M. CULLEY, 1876.—Age not given. Patient thrown against saddle while riding. Marked inflammation of scrotum, with enormous swelling. Gangrene. Sloughing. Testicles exposed. Granulation. Recovery.

CASE XIII.—ROSENBERGER, 1885.—Patient twenty-six years of age. Injured the penis by striking against the pubic bone of his wife. Marked swelling immediately of the penis, extending to the scrotum. Urine withdrawn by catheter. Swelling of the scrotum became very great. Gangrene of scrotum followed by sloughing. Testicles exposed. Plastic operation by taking flap from thigh. Recovery.

Group IV would include those cases caused by thermal agencies, heat or cold. There have been three cases reported in which exposure to cold was the cause of gangrene of the scrotum. Curling and Sir Astley Cooper have each reported one, and D'Alvigny makes mention of a third which came under his notice in 1853. The patient, thirty years of age, was frost-bitten on the scrotum. He exposed the part to the heat of a large fire. Two days later the scrotum was so large "that its bursting was apprehended at every moment. There was intense pain. Gangrene supervened and the entire scrotum sloughed, exposing the tunica vaginalis." The patient recovered.

Group V would include the neuropathic cases in which injury to the so-called trophic nerves is the cause of the death of the part. Platt, Winslow, and William J. Jones have reported cases in which operations had been performed for the removal of enlarged inguinal glands. In their cases, gangrenous patches of the scrotum appeared at intervals varying from two to ten days after the operation. In arriving at the cause of the gangrene, Platt considered erysipelas, which was not present; gravitation of septic fluids or direct extension from the groin to the scrotum, which was not admitted; interference with the circulation by obstructing the free flow of blood to or from the part. There was no such obstruction. He therefore concluded that the cause was "probably an acute reflex trophic lesion due to irritation of the branches of the ilio-inguinal nerve of the groin, reflected to the terminal filaments in the scrotal tissues."

The gangrene occurs in patches, spreading to the greater part of the scrotum in some cases. In some instances the sloughing is superficial, not extending below the dartos.

The literature contains six cases that would belong to this group. Of these five recovered and one died.

GROUP V, CASE I.—RANDOLPH WINSLOW and W. J. JONES, 1886.—Patient forty years of age. Had chronic inguinal adenitis, which suppurated. Whole mass dissected out. Wound loosely approximated and dressed with carbolic acid and oakum. Wound all right for one week. Then lost its healthy appearance. Scrotum became œdematous, followed by gangrene of lower third of sac. Patient died three weeks after operation from pyæmia.

CASE II.—WINSLOW and JONES.—Patient forty years of age. Chronic inguinal adenitis. Mass excised. For four days all went well. Then the scrotum became œdematous and finally gangrenous. Patient recovered.

CASE III.—WINSLOW and JONES.—Patient thirty years of age. Inguinal adenitis dissected out. Wound healthy for ten days. Then œdema of scrotum began, followed by gangrene, with sloughing of two-thirds. An abscess developed in Scarpa's triangle. Patient recovered.

CASE IV.—W. B. PLATT, 1885.—Male, aged forty years. Inguinal adenitis of two years' standing. No suppuration. Syphilis denied. Glands were excised, wound being closed except at lower end, where drainage was introduced. On second day after operation, left side of scrotum became red and swollen. Gangrenous patch formed on scrotum, measuring one and one-half by two inches. This sloughed and healed by granulation. The testicles were not exposed. Patient recovered.

CASE V.—PLATT.—Age not given. Suppurating inguinal adenitis. Mass curetted. In a few days the bottom of the scrotum was red, swollen, and tender. Two patches of gangrene formed, separated by skin, but connected subcutaneously. Testicles not exposed. Wounds healed by granulation. Recovery.

CASE VI.—PLATT.—Age not given. Inguinal glands curetted. Had gangrenous patch four inches square on bottom of scrotum, which sloughed. Healed by granulation. Recovery.

Several cases of gangrene of the scrotum have been reported in which no cause for the trouble was assigned.

ISAAC OTT, 1873.—Patient sixty-six years of age. First seen with small red spot on lower surface of prepuce. Inflammation extended rapidly, involving the penis and scrotum. Scrotum size of pig's bladder. Gangrene of scrotum, with purplish spots over abdomen. Patient died same day. No cause stated.

Two days after onset of trouble, the wife of patient used husband's commode. Had not copulated for some time previously. Three days later wife had purplish inflammation of vulva, extending over abdomen. Vulva much enlarged. Patient died four days later. Cause not given. Probably erysipelas.

C. M. Ford, 1870.—Seaman, twenty-eight years of age. Burning in scrotum. Scrotum dark brown, cellular tissue filled with serous fluid. Three incisions. Gangrene of the whole scrotum with sloughing. Testicles exposed. Granulation. Recovery. No cause stated.

Robert Paley, 1839.—Had seen one case twenty-five years before. Patient thirty years of age, very regular in habits. Uneasiness in scrotum. Soon became swollen and inflamed. A dozen leeches were applied, followed by fomentations and purgatives. Scrotum became gangrenous. The scrotum, prepuce, and greater part of the skin of the penis sloughed. Patient recovered. No mention made of covering of testicles.

Robert Paley.—Second case. Farmer, thirty-five years of age. Itching of penis and scrotum. Both became swollen and inflamed. Blood drawn, and fomentations applied. Gangrene of scrotum, inflammation extending as high as the umbilicus. Scrotum sloughed. Patient recovered. No mention made of covering of testicles.

Paley calls attention to the following: The surgeon in charge of the first case had six cases of puerperal sepsis while treating the scrotal case. The surgeon in charge of second case had a patient with puerperal sepsis, and was advised to leave his practice for a few weeks. Paley says, "There is not the slightest doubt on my mind that the surgeon who was in attendance was the means of communicating something (call it what you please) from the patient laboring under the disease of the scrotum to the lying-women, which in them produced puerperal fever."

Mr. Paget, 1865.—Carman, aged forty-six years. Admitted to hospital in collapse. Scrotum and penis were swollen, the former being dull green and very œdematous. Large catheter passed. Scrotum incised. Patient died in a few hours.

Post-mortem.—Normal organs and urethra. Had been intemperate. No cause could be found for the condition. Probably result of depressed condition of system.

J. M. Smook, 1874.—Laborer, aged fifty-four years. Had slight but constant pain in penis, scrotum, and inguinal regions. Blister appeared on penis. Scrotum and penis became greatly enlarged and emphysematous. Gangrene with sloughing. Testicles exposed. Patient died of asthenia. No cause given.

Lapaume, 1876.—Patient forty-two years of age. In good health. While riding felt pain in penis, followed by œdema of prepuce, which extended into scrotum. Scrotum became gangrenous and sloughed, exposing both testicles. No result stated. No cause given.

A. de Castro Jobin, 1885.—Patient aged twenty years. Suffered from double suppurating inguinal adenitis. Marked pain in penis and scrotum, both of which became enormously enlarged. Scrotum became gangrenous, followed by sloughing. Testicles exposed. Granulation. Recovery.

Lallemant.—Patient aged forty-nine years. Pains in penis and scrotum followed by marked swelling of both organs and by gangrene of the scrotum. Patient died. Cause not stated.

E. E. Kelly, 1894.—Patient thirty-four years of age. No venereal disease. Swelling of prepuce, then penis and scrotum. Slight itching and dull pain. Temperature, 103° F. Scrotum gangrenous and sloughed. Testicles exposed. Granulation. Recovery. No cause stated.

The symptoms of the conditions preceding gangrene of the scrotum vary, as shown, with the exciting cause.

The prognosis in these cases should always be guarded. Of ninety-three cases, including those reported this evening, seventy recovered and twenty-three died, a mortality in all cases of 23.5 per cent. The testicles almost invariably retain their functions, if the patient recover.

The most effective treatment is prophylactic. All conditions which interfere with the free flow of urine from the bladder should be corrected as early as possible. All wounds that might form an entrance for micro-organisms should be treated under the strictest principles of clean surgery. After swelling of the scrotal tissues has commenced, free incisions should be made in all cases except those of non-inflammatory œdema. In the latter cases attention should be directed to the underlying cause of the œdema. The incision should always extend through the skin and dartos, thus reaching the loose areolar tissue beneath in which much of the infiltration takes place. After gangrene has supervened, the gangrenous portions should be removed and the exposed structures treated according to the principles of clean surgery, special attention being paid to any recesses in which pus might collect.

The testicles will be covered by granulation tissue which will form a sufficiently useful scrotum. A larger scrotum may

be formed by a plastic operation. Bissett reports a case in which a plastic operation was performed by Mr. Parry. An elliptical flap was dissected from the inner aspect of each thigh. These were united by horse-hair sutures above the testicles and to the remnants of the scrotum. Three weeks later the pedicles of the flaps were divided and brought together below the testicles. The result was perfect.

Lente reports one case in which the surgeon did not know what to do with the testicles, and so performed double castration. This should never be done, except in cases where the gangrenous process has destroyed the organ. Even when this is suspected, it is better to wait until Nature throws off the sloughing portions before sacrificing the entire testicle.

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Dr. John B. Deaver said his experience has been limited to cases of gangrene of the scrotum due to extravasation of urine; he has never seen a case not due to this cause. They are quite common at the Philadelphia Hospital, where cases of obstruction of urine, and consequently extravasation, are numerous.

MULBERRY VESICAL CALCULUS.

Dr. Addinell Hewson showed a mulberry vesical calculus, together with the bladder, prostate, and penis of the subject from whom it was removed. The man was an Irishman of eighty-three years, an unmarried, illiterate laborer, and a moderate drinker. He died in a poor-house, but had complained of no symptoms whatever referable to the stone. The bladder was found thickened and ribbed, and partially embedded in the wall was the typical mulberry calculus shown. The bladder wall was also the site of two cysts. One was situated in front just above the pubis and was the size of an egg; the second was behind the prostate gland. That organ was enlarged and very firm and dense, but the middle lobe was almost free from involvement. Evidently there was but little interference with urination.

CHRONIC DUODENAL ULCER; GASTROJEJUNOSTOMY.

Dr. De Forest Willard presented a specimen removed from a man, thirty-eight years of age, who entered Dr. Musser's Service, Medical Ward, Presbyterian Hospital, on account of hæmorrhage from the bowels which had lasted for three weeks. Seven months previous he had an attack of severe pain in right upper quadrant of abdomen. He was in bed two weeks; since then has had frequent but less severe attacks of same pain, and had noticed that his stools had a tarry appearance. Present attack began three weeks before admission, with sharp pain in epigastrium radiating along right costal margin to lumbar region. Nausea, gaseous distention, retching several hours after taking food, with vomiting of small quantities of material which he described as resembling tobacco juice. Appetite poor. Emaciated; extremely pallid; red blood-corpuscles, 2,500,000; hæmoglobin, 23 per cent.; stools contain blood. Examination of gastric contents showed hyperacidity, hypersecretion, and retention; no blood. Stools showed blood. Urine negative. Physical examination, tenderness to right of epigastrium. No tumor.

Diagnosis, duodenal or gastric ulcer near pylorus; possible gall-duct obstruction. Operation following day. Median incision. Hard mass with duodenum, gall-bladder, pancreas and pylorus condensed and adherent. No signs of peritonitis. Removal impossible; anterior gastrojejunostomy with Murphy button. Patient was so profoundly anæmic, hæmoglobin 23 per cent., that additional suture of the two limbs of the bowel could not be done. Operation apparently had no effect, good or bad, and he died from exhaustion three days later with continued bleeding.

Post-mortem.—No evidences of peritonitis; no leakage from gastro-enterostomy; all stitches tight and in good position. Large duodenal ulcer just beyond the pylorus, which had perforated entirely through the coats of the bowel; but before perforation, the gall-bladder had become thoroughly adherent, so that no escape had occurred into the peritoneal cavity. This inflammatory process had thickened and condensed the gall-bladder and its ducts, so that its wall was a third of an inch in thickness and it was entirely empty. The lumen of the button was filled with soft coagula, but no leakage had occurred at the stitches.

Dr. W. W. Keen asked if examination of the blood had been made after the operation. The hæmoglobin before operation was 23 per cent., below the limit of safety as placed by von Mikulicz. Death apparently was not connected with the anæsthetic, and a blood count might have thrown further light upon the matter. The anæsthetic would reduce the hæmoglobin to some extent.

Dr. E. B. Hodge, who exhibited the specimens for Dr. Willard, said no blood examination had been made after operation. Small quantities of blood were passed by the mouth and by the bowel, but the patient was more comfortable for a day or two. He then gradually failed, and died of exhaustion sixty hours after operation.

SENILE ATROPHY OF CRANIAL BONES.

Dr. De Forest Willard presented the skull of a man, seventy years of age, who, after a fall down-stairs, became totally unconscious, with stertor, and slow pulse. Operation without ether, and with no signs of pain. Entire left side of skull found broken into a dozen pieces, brain crushed, and oozing from openings in dura.

This great destruction was due to the extreme thinness of the cranium, which in many places was infantile in thickness and exceedingly fragile. Many fragments, an inch square, were removed, but patient never recovered consciousness. With a skull so atrophied, a very slight injury would have caused a fracture.

AN EXPERIMENTAL AND HISTOLOGICAL STUDY OF CARGILE MEMBRANE.

WITH REFERENCE TO (1) ITS EFFICACY IN PREVENTING ADHESIONS IN THE ABDOMINAL AND CRANIAL CAVITIES AND AROUND NERVES AND TENDONS, AND (2) ITS ULTIMATE FATE IN THE TISSUES.

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EXPERIMENTAL STUDY BY DR. CRAIG.

IT is not worth while to attempt an enumeration of the efforts which have been made to prevent adhesions in the peritoneal cavity; nor is it necessary to lay stress upon the necessity for preventing such adhesions when it can be accomplished. Adhesions within this cavity are, on the whole, beneficial, however harmful under certain circumstances. We cannot expect Nature to differentiate; it is left to the devices of the surgeon to prevent, if he can, adhesions when they would be harmful, and, in truth, it may be stated that he has succeeded but poorly.

In May, 1902 (*Medical Record*, May 17, 1902), Dr. Robert T. Morris, of New York, published the results of a series of experiments carried out upon rabbits, to determine the value of a specially prepared animal membrane derived from the peritoneum of the ox. The effort was made to prevent adhesions within the peritoneal cavity. Attention was first called to this membrane by Dr. Charles Cargile, of Bentonville, Arkansas, who sent Dr. Morris specimens of the membrane to be used, hence the New York surgeon termed the material Cargile membrane, an eponym which has since become common. The membrane is not essentially different from goldbeaters' skin, except in the method of its preparation. As prepared by Johnson and Johnson, it comes in small sheets about eight by sixteen centimetres in size, and is treated after a special method. Some of it is treated evidently somewhat after the manner of chromicized catgut, and is hence termed chromicized Cargile membrane; another preparation is unchromicized. The report of Dr. Morris, on the whole, was favorable, and he appeared to believe that the membrane possessed distinct advantages in preventing adhesions. His conclusions, somewhat abridged, were as follows: Cargile membrane seems to resist absorption in the peritoneal cavity for more than ten days and less than thirty days. Its presence apparently causes the formation of temporary loose adhesions, which are harmless, and which become absorbed for the most part in less than thirty days. The membrane seems to cause very little disturbance to the peritoneum; it does not furnish a good culture medium for bacteria, and it protects areas of peritoneal surface that have suffered injury to their endothelial covering, until new endothelial cells have repaired the injury without involving the neighboring peritoneum. It is not necessary to suture the membrane in place, as it becomes instantly adherent to moist surfaces, and is not readily dislodged afterwards.

If the membrane possessed the merits which Dr. Morris's experiments seemed to warrant, I could not understand why surgeons did not make more general use of it as a protective covering for surfaces denuded of peritoneum, and in other situations in which it would appear applicable.

To satisfy myself of the value, or the reverse, of this membrane, in the summer of 1904 I undertook a series of experiments in the laboratories of the Jefferson Medical Col-

[1] The death of Dr. Craig, March 14, 1905, from cerebrospinal meningitis, contracted while in attendance upon a patient suffering from that disease, lends additional interest to this report of his latest study.

lege Hospital. The membrane was kindly furnished me by the manufacturers above mentioned. Dogs were used in the experiments, and not only were tests made in the peritoneal cavity, but likewise in the protection of tendons and nerves, and the cranial cavity was invaded. After various intervals of time the seat of operation was exposed in each case, the clinical conditions ascertained, and, in a number of instances, specimens of tissue which had been in contact with the membrane were submitted to Dr. Ellis, associate in pathology at the College, who kindly undertook the microscopic investigations in this research. His findings are set forth in a separate portion of this paper.

It will be noted in the following recitation of the experiments, that when Cargile membrane was used in the peritoneal cavity of a dog, in most instances the membrane was anchored in place by fine silk sutures. It was of course recognized that the irritation produced by the sutures would, in a measure, vitiate the experiment; but it was believed, and subsequent experiments showed the assumption warranted, that if a sufficiently large piece of membrane were used, so that the sutures could be placed on either side of the intestine well towards the mesenteric attachment, the irritation produced by them need not interfere with the surface opposite that attachment. Furthermore, it was found by simple tests that the statement of Dr. Morris, namely, that the membrane would adhere readily and sufficiently to a denuded surface without suturing, was correct so long as the peritoneal, or denuded surface, was dry, or relatively so; but directly the intestine with the attached membrane was returned to the peritoneal cavity and bathed for a short time in the peritoneal fluid, the membrane ceased to adhere and readily slipped from the particular point covered. With this fact, repeatedly demonstrated, in mind, we of course could not expect that the membrane would adhere and remain where placed, despite the various movements of the animal and the peristaltic activity of the abdominal viscera. I therefore anchored the membrane by sutures, to be sure that it remained *in situ* over the denuded

area. It is conceivable that Cargile membrane may be placed in the pelvis or similar situations, between the peritoneum and a denuded surface, or between denuded surfaces, and remain in place without being anchored. It certainly will not remain, when unanchored, on either visceral or parietal surfaces when these are bathed in fluids and subjected to friction, be it never so little, from peristaltic activity. I may state in passing that I tried anchoring by means of celloidin and also by means of formalin-gelatin. Neither was a success.

All the dogs operated upon were profoundly anæsthetized with ether and treated according to the rules of aseptic surgery, so far as could be conveniently carried out. In only one instance did peritonitis occur, and this was from a defective end-to-end anastomosis.

Experiment No. I.—The abdominal cavity of a dog having been opened, a loop of intestine near the stomach was lifted out and two surfaces opposite the mesenteric attachment, each one and one-half centimetres square, were denuded of peritoneum, sponged until dry, covered with separate pieces of unchromicized Cargile membrane without anchoring, the abdominal wound being closed with silkworm-gut sutures. Twelve days later the abdomen was reopened and a mass of omentum was fairly firmly adherent to the distal denuded surface, and both omentum and liver were adherent to the proximal denuded surface; no Cargile membrane was found; either it did not remain *in situ*, or it had been absorbed and adhesions formed subsequently.

Experiment No. II.—The abdomen of a dog was opened and a loop of small intestine was brought out. A surface one centimetre by one and one-half centimetres was denuded of peritoneum and covered with chromicized membrane, the piece being large enough to extend back on either side to the mesenteric attachment, where it was anchored by sutures. Ten centimetres distal to this was anchored in like manner a piece of unchromicized membrane over an undenuded surface; further distal by ten centimetres was anchored similarly, a piece of chromicized membrane over a denuded surface; while still distal to this was anchored a sheet of chromicized membrane over an undenuded surface. In this experiment I sought to compare the effects of placing chromicized and unchromicized membrane each on denuded and undenuded surfaces. The sutures were so placed that I could identify the several pieces. Fourteen days later, forty centimetres of the bowel containing the four separate experiments were resected, examined macroscopically, and submitted to Dr. Ellis for microscopic examination. It was of interest to note that while a mass of adherent omentum completely covered the site of opera-

tion in each case, and a loop of bowel was adherent in two places, yet the Cargile membrane was at no place completely absorbed; both the chromicized and unchromicized membranes were clearly detected by splitting the mass of adherent omentum. The latter was adherent directly to the membrane, and more firmly still to the bowel at the periphery of the membrane. Under the membrane the denuded area was rough and scar-like, and there was no macroscopic evidence of regenerating peritoneum. Clearly, used in this manner, the membrane would not prevent adhesions.

Experiment No. III.—The abdomen of a dog was opened and two areas of the duodenum seven centimetres apart and each one and one-half by two centimetres in area were denuded of peritoneum, and the proximal one was covered with unchromicized Cargile membrane, while the distal one was left with its raw surface exposed. At the same operation an area two centimetres square on the anterior surface of the stomach was denuded of peritoneum and covered similarly with unchromicized membrane, but the latter was not anchored by suture. The abdominal wound was closed in the usual way. Nineteen days later the abdomen was reopened and firm adhesions were found at each site of denudation. Apparently they were as firm and as numerous where the Cargile membrane had been placed as where it had not been placed. A careful search revealed no Cargile membrane.

Experiment No. IV.—The abdomen of a dog was opened and four pieces of Cargile membrane were placed as follows: (*a*) A piece of unchromicized membrane was placed over a denuded surface one by two centimetres in size and anchored well towards the mesenteric attachment; (*b*) a piece of unchromicized membrane was placed over an undenuded surface and similarly anchored; (*c*) a piece of chromicized membrane was placed over a denuded surface of similar size and anchored, as above; and (*d*) a piece of chromicized membrane was placed over an undenuded surface and attached by sutures as in the foregoing. The number of sutures differed with each piece anchored, so that the several pieces could be recognized. Four days later the abdomen was again opened and thirty-five centimetres (fourteen inches) of the bowel, to which the four pieces of membrane had been attached, was resected and end-to-end anastomosis done. Adherent omentum completely covered and surrounded every piece of membrane. The adhesions were easily broken up, being so recent, but they were numerous. At the two places where the unchromicized membrane was placed, none of the Cargile membrane could be found macroscopically, though Dr. Ellis was able to find fragments microscopically. The chromicized membrane, however, was plainly visible where it had been placed. Neither had prevented adhesions, particularly at the periphery of the membrane. The resected portion of the intestine was submitted to Dr. Ellis for microscopic examination.

Experiment No. V.—A dog's abdomen was opened and an area one and one-half by four centimetres was denuded of peritoneum and covered with unchromicized membrane. It was anchored *in situ* as above explained. Ten centimetres distal to this, an area one and one-half by

two centimetres was similarly denuded, but left exposed without Cargile covering. The abdomen was closed and sixteen days later reopened. A mass of omentum covered the entire site of operation in each instance, and no membrane was found.

Experiment No. VI.—A dog's abdomen was opened and a surface one and one-half by three centimetres on the duodenum was denuded of peritoneum and covered with the unchromicized membrane, the edges being anchored as in previous instances. Ten centimetres distal to this a similar area was denuded and not covered with membrane. Eleven days later the abdomen was reopened and fairly firm adhesive omentum covered alike both areas. No membrane was found.

Experiment No. VII.—A dog's abdomen having been opened, an area one and one-half by two centimetres on the duodenum was denuded of peritoneum and covered with unchromicized Cargile membrane, the latter being anchored as above. Three days later the abdomen was reopened. A large omental graft had covered the entire site of operation. The membrane immediately covering the actual denudation had disappeared, but it persisted in the rest of its extent; that is, the centre of the sheet of membrane had been digested or dissolved by the raw surface. This showed that some element in the actual wound acted, probably in a digestive capacity, in dissolving the membrane in immediate contact. A portion of the intestine containing the field of operation was resected and submitted for microscopic examination.

Experiment No. VIII.—A dog's abdomen having been opened, a small area of duodenum was denuded of peritoneum, covered with unchromicized membrane which was anchored by sutures, and this in turn was covered by a piece of sterile rubber dam which extended well beyond the Cargile membrane; this, too, was in turn anchored by suture. Three days later the abdomen was reopened, and it was found that a mass of omentum and aplastic lymph completely covered the entire site of operation, including the rubber dam. I desired by this experiment to determine whether it was a phagedenic property of the omentum that destroyed the membrane, or was it granulation tissue, or was it peritoneal fluid? The mass was removed from the rubber dam; the latter was likewise carefully removed and no Cargile membrane was recognized macroscopically, though fragments were observed by Dr. Ellis microscopically.

Experiment No. IX.—This was a repetition of Experiment VIII, except that the abdomen was reopened on the sixth day instead of the third after operation. Practically, the same conditions were found, namely, the sheet of rubber dam, under which the Cargile membrane had been placed, was covered with an omental graft, and on examination the Cargile membrane had all disappeared to macroscopic view, though seen by Dr. Ellis microscopically.

Experiment No. X.—Experiments VIII and IX appeared to offer fair evidence that it was not the omentum *per se* that had destroyed the membrane, but it proved nothing as to the action of the peritoneal fluid. Accordingly, I placed a piece of unchromicized membrane, five centimetres square and made into a small roll, in a glass tube one centimetre in

diameter and seven and one-half centimetres long, and containing about a dozen small perforations; in another tube of about equal size was placed a similar piece of the chromicized variety. These tubes were closed sufficiently to prevent the escape of the membrane and placed loose in the peritoneal cavity of a dog. Fourteen days later the abdomen was reopened and both tubes were easily found. The tube containing the chromicized membrane was practically free, and when removed the membrane was quite softened, pale, and œdematous, but apparently little changed in other respects. It was delivered to Dr. Ellis for further examination. The tube which had contained the unchromicized membrane was wrapped about with omentum, but the membrane had entirely disappeared, leaving the tube empty. Clearly, the chromicized membrane was much the more resistant.

Experiment No. XI.—From the glass-tube experiments we had fair proof that the unchromicized membrane would soon disappear when placed in the abdominal cavity, without actual contact with the omentum. It appeared a natural deduction that the peritoneal fluid could itself be potent in dissolving the membrane. To exclude the phagocytic action of the leucocytes, at Professor Coplin's suggestion and under his direction, I placed a piece of unchromicized membrane three centimetres square in a celloidin capsule five centimetres long, containing salt solution. Pathologists state that this capsule will permit the osmosis of the body fluids, but leucocytes will not pass through its wall. The sealed capsule, with the contained membrane, was placed free in the abdominal cavity of a dog. On the seventh day the capsule was removed and opened. The membrane, aside from being œdematous and apparently thickened, was little changed macroscopically. There was little fluid left in the capsule. The membrane was submitted to Dr. Ellis.

Experiment No. XII.—The above experiment was repeated in every detail, except the celloidin capsule was not removed until the thirtieth day. It was easily found wrapped in a small mass of omentum. There was apparently no infection. Professor Coplin opened the capsule. It contained a milky, slightly blood-stained fluid, and the membrane, hardly recognizable as such, just at the point of disintegration. It had apparently almost dissolved. Professor Coplin examined some of the fresh fluid from the capsule under the microscope. The findings are detailed in the paper of Dr. Ellis.

Experiment No. XIII.—The left tendo-Achillis and the left posterior tibial nerve of a dog were exposed, and each was wrapped separately with four turns of unchromicized Cargile membrane. At the same operation the right tendo-Achillis and accompanying posterior tibial nerve were exposed and wrapped with three turns of chromicized Cargile membrane. The wounds were sutured. Fourteen days later the dog was killed and three centimetres of each tendon and its accompanying nerve were resected *en masse*. Examined macroscopically, the right nerve, around which the chromicized membrane had been placed, showed the membrane still in place; and while there was a mass of granulation tissue outside the membrane, the latter had plainly protected the nerves,

there being no macroscopic adhesions to the latter whatever, except at either end of the tube formed by the protecting Cargile membrane. The left nerve, about which the unchromicized membrane had been placed, showed no Cargile membrane macroscopically, though microscopic fragments were found by Dr. Ellis. And while adhesions to the nerve were distinctly fewer and less firm where it had been protected by the membrane than where it had not, yet fairly firm adhesions (for fourteen days) were present, and it was evident that the nerve had not been so well protected as where the chromicized membrane had been employed.

Experiment No. XIV.—Under ether the two tendons, as above mentioned, of a dog were exposed for a distance of five centimetres, and when each tendon was raised from its bed it was wrapped about by two turns of unchromicized membrane and the skin wound was closed. Twenty days later the dog was killed, and both tendons and the accompanying posterior tibial nerves were removed. Plainly, there were fairly firm adhesions to the tendon, more marked than at points not subjected to trauma. No membrane was found. The specimens were submitted to Dr. Ellis.

Experiment No. XV.—The right tendo-Achillis of a dog was exposed, lifted from its bed, and four turns of unchromicized Cargile membrane were passed around it, thus isolating it completely. The accompanying posterior tibial nerve was isolated, wrapped separately with two turns of membrane, and plaster dressing was applied to the dog's leg. It was hoped by immobilizing the parts that a better idea of the actual protection afforded by the membrane, if any, could be had. Inability to keep the wound aseptic necessitated the removal of the plaster dressing. Five days after operation the wound was reopened. A mass of granulation tissue surrounded the tendon and nerve, but not a vestige of Cargile membrane could be found. Plainly, it had afforded little or no protection. It could only be assumed that the granulation tissue would follow the usual course and result in scar tissue, thus causing adhesion, unless constant motion prevented.

Experiment No. XVI was a repetition of Experiment XV, except that, in addition to covering the nerve and tendon separately, a piece of Cargile membrane two and one-half by five centimetres in dimensions was made into a small roll wrapped about with fine silk thread by a number of turns and placed in the depth of the wound between the nerve and tendon. Nine days later the wound was reopened, and, while granulation and organizing tissue was plentiful, no Cargile membrane was found, not even the roll mentioned above, but the rolled-up silk ligature was easily found. Evidently the membrane had all been dissolved.

Experiment No. XVII.—The right tendo-Achillis and right posterior tibial nerve were exposed and wrapped separately with two turns of unchromicized Cargile membrane. The left side was treated in like manner, and the wound closed. On the fifty-fourth day after operation the dog was killed and each tendon and nerve was resected and examined.

With the exception of a very small amount of scar tissue about the tendons and nerves, they appeared normal. No Cargile membrane was seen. Specimens were submitted to Dr. Ellis.

EXPERIMENT No. XVIII was a futile attempt to determine whether or not Cargile membrane could be made to replace, with any degree of efficiency, the dura mater. The temporal muscles of a dog having been turned down from the side of the head, the skull was opened by trephining. It was intended to remove a portion of the dura and replace it with Cargile membrane. Hæmorrhage, however, was copious, and I contented myself with rolling up a piece of unchromicized Cargile membrane three by four centimetres in dimensions, making a roll the size of a probe. This was wrapped about with several turns of fine silk suture to retain the form, in the hope that I might identify it when again sought. It was simply placed under the flap of temporal muscles to determine the action of the body juices. The wound, however, suppurated and vitiated the experiment, and the membrane was not again seen.

EXPERIMENT No. XIX.—A dog's temporal muscles having been turned down, the skull was trephined, and by means of rongeur forceps an opening in the skull two by three centimetres in dimensions was made, a piece of dura one by two centimetres was turned back and resected. This was replaced by a piece of chromicized Cargile membrane, the edges being slipped well under the dura throughout the entire periphery. A suppurating wound vitiated the experiment; but the resistance of the membrane is shown from the fact that, when removed thirty days later, the membrane was still intact, though porous and brittle. It was submitted to Dr. Ellis.

Two other operations were performed to determine, if possible, the efficacy, if any, of Cargile membrane in the cranial cavity. My results, on the whole, were bad; infection, as a rule, vitiated the experiments, and only the four were tried. Judging from my work, however, I am inclined to believe from the frailty of the membrane and the difficulty of handling it, except in the dry state, that the unchromicized variety is without value in cerebral surgery. I am inclined to think better of the chromicized membrane for this purpose. It is much more easily handled in the presence of a moist surface, and is not absorbed for a much longer period.

This completed the series of experiments so far as they seemed of value for the purpose of record.

My estimate of the value of Cargile membrane in preventing adhesions in the situations under consideration is embodied in our joint conclusions at the end of the article.

I avail myself of this opportunity to express my gratitude to Professor Coplin for his interest in this research, and for invaluable laboratory materials placed at my disposal; to Professors Keen and Da Costa for valuable suggestions and material aid; and to senior students C. C. White, L. F. Milliken, and Richard F. Taylor for assistance in the operative work.

HISTOLOGIC STUDY BY DR. ELLIS.

My part in this investigation consisted in studying histologically a number of specimens obtained at operation or autopsy by Dr. Craig. The tissues were fixed in Heidenhain's or Bensley's fluid and finally embedded in paraffin. Sections were stained by hæmatoxylin with the addition of eosin or Van Gieson, Mallory's reticulum stain, polychrome methylene blue, and Weigert's stain for elastic tissue. Those stained by hæmatoxylin and Van Gieson were the most satisfactory for purposes of study. I am deeply indebted to Professor W. M. L. Coplin for advice and assistance during the progress of the work. The description can best be taken up seriatim as the specimens were obtained and according to the experiment numbers of Dr. Craig.

The first specimen studied was a piece of unused Cargile membrane, sections of which were mounted and stained to obtain a basis of comparison for that in the tissues. The infiltrated membrane is very brittle, and in many of the sections is broken into numerous fragments. This must be borne in mind in interpreting the later findings; breaking alone cannot be considered as evidence of actual destruction by the tissues. The membrane elects fibrous tissue stains and by them is colored deeply. The larger part appears homogeneous, but in many areas the membrane seems to be made up of several layers which are intimately fused. For this reason they are not clearly differentiated, but are indistinctly outlined by slight differences in stain reaction. These differences are not sufficiently definite to warrant the assumption that in the preparation of the material it is actually formed by assembling several layers. The membrane contains neither demonstrable cells nor cell nuclei.

EXPERIMENT II.—Intestine on which was placed Cargile membrane under four different conditions; specimen removed at end of fourteen days. A. Peritoneum denuded; chromicized Cargile. Over the operated area the peritoneum and longitudinal muscle are lacking. On the surface of the circular muscle and intimately connected with it is a layer of new fibrous tissue. At either margin of the denuded area, where the Cargile was folded upon itself, are from two to four layers of almost perfectly intact membrane. Between these layers, as well as separating them from the intestine, is new fibrous tissue. At both margins, beyond the Cargile, the omentum is firmly adherent. This new tissue also encloses the portions of the membrane still remaining. The whole area of adhesions thus appears to be surrounding and healing in the layers of membrane. Within the folds of the latter at one margin is a number of so-called foreign body giant cells, some of which are very large. The majority of these cells are in the new tissue at some distance from the membrane, but a certain number are directly upon it. Even where they are in contact with the Cargile, that material shows no evidence of degenerative action due to the cells, and phagocytic action by them is not demonstrable. Between the areas of adhesion at the margins of the denudation, Cargile is present only at some distance from the intestine, and there in the shape of short fragments that show some thinning. That it was broken by the knife in cutting may be inferred from the facts that the new fibrous tissue over the intestine beneath is firm and smooth, and that no adhesions of the omentum have formed. Sections lower in the block, from the undenuded margin of the described area, show practically the same condition at the borders where adhesions have formed. Between these borders the appearance is also much the same, except that a narrow zone of very loose fibrous tissue is on the surface of the peritoneum; this zone is continuous externally with a band of dense new fibrous tissue similar to that over the denuded area. At points quite broad bands of new tissue extend from the peritoneum across the comparatively clear zone to the superficial layer, and thereby anchor it firmly to the intestine; this attachment of the new tissue, however, is not so intimate as in the case of the exposed muscle in the denuded area. Sections stained by polychrome blue show the presence of a very few cocci arranged singly

and in pairs; morphologically they correspond to the ordinary pyogenic cocci.

B. Peritoneum denuded; unchromicized Cargile. The Cargile has essentially the same arrangement as in A. The folds at the margin of the denuded area are more fragmented, and the pieces show more disintegration than in the preceding instance. It is surrounded by the new tissue of omental adhesions. At one margin is the peritoneum and longitudinal muscle of a second coil of intestine that is firmly adherent at this point. Giant cells are not seen.

C. Peritoneum intact; chromicized Cargile. New fibrous tissue has formed on the surface of the peritoneum. The latter structure is dissociated, and through it the new tissue is extending into the outer muscle layer, where it substitutes certain of the fibres. As in the two preceding instances, there are dense omental adhesions beyond the margins of the membrane, and they extend inward and enclose the folds of that material. It is fragmented, conspicuously so between the adhesions where omentum is absent, but otherwise is fairly well preserved.

D. Peritoneum intact; unchromicized Cargile. This specimen is essentially the same as C, in which chromicized membrane was used. The membrane is slightly more frayed on the margins. Where the omental adhesions have formed and included the Cargile, the underlying peritoneum, as such, is no longer clearly demonstrable because of its disruption and intimate association with the new tissue.

EXPERIMENT IV.—Intestine on which was placed Cargile membrane under four different conditions; specimen removed at end of four days. A. Peritoneum intact; chromicized Cargile. On the surface of the peritoneum of half the circumference of the intestine is a layer of formative tissue covered by fibrin in which is entangled a great many red blood-cells. At some points are numerous polynuclear leucocytes. The peritoneum is infiltrated with leucocytes which also invade the longitudinal muscle. Slight suppuration has occurred on the surface of the exudate as shown by many irregular spaces in the fibrin net-work, some of which contain granular detritus and polynuclear leucocytes. External to the exudate and not intimately attached to it is the Cargile, which is present on the borders of the involved area only, the middle half having almost or entirely disappeared. The ap-

pearance of the specimen and comparison of it with similar tissues indicate that the Cargile over the central portion disappeared mechanically during preparation or cutting of the tissue. That part which is present is broken into long pieces, but otherwise is intact. The exudate beneath the membrane and that included in the free central area are identical in structure. There is no evidence of adhesions of any kind.

B. Peritoneum denuded; chromicized Cargile. The peritoneum and longitudinal muscle are lacking. Over the denuded area is a fibrinocellular exudate in which organization is beginning, fibroblastic tissue being present on the surface of the circular muscle, which is infiltrated with leucocytes. Over this exudate is Cargile, which is intact throughout. There is no exudate external to the membrane and no signs of adhesions. Sections from a second block of this specimen are from the undenuded margin of the described area. They differ but little from the denuded space. Organization of the exudate is slightly further advanced. The Cargile over the denuded and undenuded areas presents the same appearance. Sections stained for elastica show none in the newly formed tissue; that in the vessels of the intestine is unchanged.

C. Peritoneum intact; unchromicized Cargile. An exudate composed of fibrin and polynuclear leucocytes is on the surface of the peritoneum, which is also infiltrated with these cells. Organization is beginning in the deeper layers, where vascularized tissue has already formed. The Cargile membrane has entirely disappeared. No adhesions have formed. Giant cells are not present. Sections appropriately stained show the presence of a very few cocci differing in no way from the ordinary pyogenic types.

D. Peritoneum denuded; unchromicized Cargile. The peritoneum and longitudinal muscle are lacking. The circular muscle is infiltrated with leucocytes. On the surface is a thin layer of vascularized organizing exudate which is surmounted by numerous wavy fibrils of Cargile, appearing as if several sheets of the membrane had split a number of times and the layers had then broken into short fragments. Into the inner portion of this mass of membrane the formative tissue is extending. External to the membrane, for a part of its extent, are fibrin and polynuclear leu-

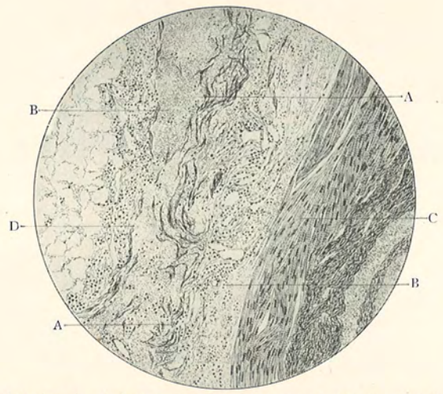

FIG. 1.—Intestine denuded of peritoneum and covered with non-chromicized Cargile membrane. Appearance at end of four days. (B. and L. ⅔ obj., 1 inch ocular.)
A A. Fibrillated and fragmented remains of the Cargile membrane.
B B. Organizing exudate on either side of the membrane. That on the left, especially in the upper part of the field, is still largely fibrinous.
C. Circular muscle of the intestine; at this point the longitudinal muscle was removed during denudation. To the right are the submucosa and basement membrane.
D. Disrupted serosa of the adherent omentum.

FIG. 2.—From the same section as Fig. 1. (B. and L., ⅙ obj., 1 inch ocular.)
A A. Fragments of the disintegrating Cargile membrane.
B B. Organizing tissue on either side of the membrane. That to the right is on the surface of the intestine; that to the left, on the surface of the adherent omentum.
C. Capillary blood-vessel in the new tissue.
D D. Two areas in which fibroblasts from either side have met through the fragmented membrane, thereby forming bands of adhesion.

cocytes. Covering the remainder of the Cargile and also surmounting the fibrinous exudate is a second layer of organizing tissue arising from the omentum, which here is closely adherent (Fig. 1). The serous covering of the omentum is disrupted, and the new tissue extends through it and for some distance into the underlying adiposa. At several points where formative tissue approaches the dissociated Cargile from both sides, the fibroblasts extend directly through the mass of fragments, forming continuous bands which at either end are vascular and becoming distinctly fibrous in character (Fig. 2). Sections from a second block of this specimen are from the undenuded margin. With the exception that the intestinal coats are intact, though infiltrated with the leucocytes, there is no essential difference from the denuded area. The adhesion of the omentum is the same as described when considering the preceding sections. In sections stained by polychrome blue, there are seen in the exudate moderate numbers of cocci arranged singly and in pairs.

EXPERIMENT VII.—Intestine of dog from which peritoneum was denuded and Cargile membrane applied; specimen removed at end of three days. Under the microscope, as macroscopically, no membrane is to be seen. The peritoneum is lacking over a considerable area, and, except at the extreme margins, the longitudinal muscle also has been removed. The central part of this denuded area is covered by a thick layer of exudate which is mainly fibrin, but also contains a few leucocytes, both mono- and polynuclear. This fibrinous exudate extends into the circular muscle, separating many of the superficial fibres. Beyond this, for more than half its breadth, the muscle is infiltrated with leucocytes, mainly polynuclears. Near the margin of the denuded area is a great deal of blood. The longitudinal muscle as it appears on the margin is densely infiltrated with leucocytes, and also contains numerous red blood-cells. Blood-vessels of the musculature are distended and contain an excess of leucocytes. The muscle fibres show varying degrees of atrophy. The fibrinous exudate extends for some distance over the peritoneum on either side of the denuded area, gradually thinning as the distance becomes greater. The sections are perfectly free from adhesions to omentum or other surrounding tissue.

EXPERIMENT VIII.—Intestine from which peritoneum was denuded and covered with Cargile membrane, which in turn was

covered by rubber dam; specimen removed at end of three days. Microscopic examination of the denuded area shows absence of the peritoneum and essentially all of the longitudinal muscle. On the surface of the circular muscle is a thick layer of exudate which is mainly red blood-cells, but also contains some fibrin and a few leucocytes. This extends into the muscle and separates many of the superficial fibres. The blood-vessels of the muscle are distended, and the inference is that from them hæmorrhage has occurred. Surmounting this mass of blood is a layer of Cargile membrane, which for a small part of its extent, at one end, is perfectly intact. Throughout the greater part of its length it has undergone more or less marked disintegrative changes. It is split into numerous thin layers or fibrils, and these are broken into pieces irregular in shape and of variable size, some being very small. The fragments are widely separated, occupying a space many times as broad as the normal Cargile. Between and surrounding these fragments is the exudate. External to the membrane is a layer of exudate nearly as thick as that between the membrane and the intestine, but differing greatly from it in constitution. The former is made up almost wholly of fibrin and polynuclear leucocytes, very few red blood-cells being present. Leucocytes are exceedingly numerous, and both they and the fibrin show some necrosis. At the point where the Cargile is intact, there is a very sharp differentiation between this external layer of fibrinocellular exudate and the blood beneath the membrane. Where the Cargile is disintegrating, the blood has passed through and permeated for some little distance the exudate externally; the polynuclear leucocytes of the latter have in turn penetrated the blood-clot, this admixture through the partially destroyed membrane being very conspicuous. Polynuclear leucocytes are at many points in direct contact with the fragments of Cargile, but there is no evidence of special disintegration at those places. Phagocytosis is not demonstrable.

Experiment IX.—Fold of chromicized Cargile membrane that was enclosed in a perforated glass tube and placed in peritoneal cavity; tube removed at end of two weeks. A small amount of reddish-colored material adhered to the end of the tube near the largest opening. Under the microscope this is shown to be made up of red blood-cells and leucocytes, the latter ten times

as numerous as the former and mainly polynuclear in type. Eosinophiles are not in greater proportion to other leucocytes than in normal blood. On section, the Cargile is found folded in many layers. The membrane is slightly thicker than normal, or when placed on tissue, and appears to be swollen, possibly by the imbibition of fluid. This appearance is further heightened by lessened density, as shown by the staining reaction and also by roughening or slight fraying of the surfaces. The membrane, however, is intact throughout. Between the layers are masses of partly disintegrated red blood-cells and numerous leucocytes, mainly polynuclear in type.

Experiment X.—Intestine denuded of peritoneum and covered by Cargile membrane, the latter being covered by rubber dam; specimen removed at end of six days. The peritoneum and longitudinal muscle are lacking. On the surface of the circular muscle is a thick layer of organizing exudate, the most advanced portions of which, bordering the muscle, are just assuming the characters of fibrous tissue; external to this is a well-marked zone of vascularized tissue, and on the surface a layer of fibrin and polynuclear leucocytes. The circular muscle also shows leucocytic invasion. In the fibrinous exudate at one point are a few fragments of Cargile membrane, the remainder having entirely disappeared.

Experiment XI.—Cargile membrane from a sealed celloidin capsule that was in the peritoneal cavity for seven days. The membrane is very much swollen, most of it being more than twice the normal thickness. The margins are decidedly frayed, presenting at some points a serrated appearance. Although the sections are very thick, the density is much lessened, many areas being semi-translucent; at points are small clear spaces or openings. Stains are taken with much less avidity than by the other specimens of the membrane studied. No cells are present. The appearance of this specimen is strongly indicative that the membrane is undergoing slow absorptive changes.

Experiment XII.—Cargile membrane and fluid from celloidin capsule that had been in peritoneal cavity thirty days. This specimen was first examined by Dr. Coplin, who kindly furnished the following description: "The capsule is surrounded by what appears to be fibro-fatty tissue, presumably a part of the omentum. Around the irregular and slightly rough end of the capsule, that

had been closed by ligature and sealing, the tissue attains a thickness of two to five millimetres. Towards the opposite or smooth end of the capsule the enveloping tissue hardly exceeds one millimetre, and at points is so thin that it is quite transparent. After incision of the soft tissue the capsule readily slipped out. Along one side it is dark in color, and in places is slightly wrinkled. It is evident there is fluid within, but it escapes at no point, even when gentle pressure is made upon the capsule. Upon opening the latter, the contained fluid is found to be of about the consistency of blood serum, slightly opalescent, possessing a faint pink tinge, decidedly cloudy, and containing scarcely perceptible irregular granules to which the cloudiness appears to be due. This fluid was examined in the fresh condition, also stained by Sudan III, methylene blue alone, and with eosin, and by Wright's stain. It is found to contain large quantities of granular material of a form usually characterized as cellular detritus. Some of the granules are grouped, and occasionally small, stringy granular bodies are observed. The granules vary in dimensions from one to four or five microns, and in some fields are collected into masses 100 or more microns in diameter. The larger number of granules are strongly acidophilic. With them are numerous spherical bodies possessing the general appearance of fat droplets and taking Sudan III strongly. Occasionally one sees what, by stretching the imagination, may be thought to resemble a shrunken cell of some kind; such bodies, however, are extremely rare. No structures resembling leucocytes or bodies corresponding to any histological structure can be identified. By proper staining methods, bacilli two microns in length and less than one micron in width are seen to be fairly abundant. These bodies could be recognized in unstained specimens, and were not motile. Cocci of ordinary dimensions, indistinguishable from usual pyogenic organisms of this group, are occasionally observed; they are not, however, in masses, nor are they abundant. The bacilli are far more numerous. The bacteria were not identified. The capsule also contains an extremely thin membrane-like structure, the dimensions of which are not determined." Later examination of this structure left little doubt that it was the much thinned Cargile membrane. It was left in salt solution for some hours; at the end of that time the salt solution was very turbid and the membrane had entirely disintegrated and disappeared. The value of this experiment, undertaken to determine the effect upon Cargile membrane of body fluids without the presence of cells, was vitiated by the occurrence of infection, and deductions therefore must be restricted.

The new tissue which had formed around the capsule is a band of varying breadth, the external portion of which is quite dense, newly formed fibrous tissue. Firmly adherent to three-fourths of the circumference is normal appearing adipose tissue. Towards the inner surface of the band, the fibrous tissue is less dense, and contains more cells. On this surface at points are leucocytes, both mono- and polynuclear in type. At other places, or along with the cells, is considerable fibrin. Both cells and fibrin show evidence of slight necrosis.

Experiment XIII.—Posterior tibial nerve which was isolated and wrapped with Cargile membrane; specimen removed at end of fourteen days. A. Nerve from left side, covered with four layers of unchromicized Cargile. Sections from one block of this specimen show between the nerve trunk and the fibrous tissue which half surrounds it the layers of the membrane. Of the four layers, the outer two, or those in contact with the tissues on either side, are intact, or nearly so. The two inner layers are not so well preserved. All four are separated some distance from each other in the wide space between the nerve and the enclosing tissue. The outer layers are partly enclosed by polyblasts or by recent fibrous tissue. This extends through the small breaks that are present in the membrane. Organizing tissue is also found between the layers of the membrane, but is not so prominent around the two inner as is that enclosing the two outer. No distinct adhesions are present in this section, the newly forming fibrous tissue on the two sides apparently being prevented by the membrane from uniting. A few giant cells are in the new tissue surrounding the nerve. One large one with six nuclei has in it a fragment of fibrous tissue that is roughened, and appears not unlike equal-sized pieces of Cargile membrane as it is found elsewhere. From the fact that these are typical "foreign body" giant cells developed only in the neighborhood of the membrane, it is reasonable to suppose the Cargile is the origin of the fragment in question. Whether or not this be an instance of phagocytic destruction and removal of the membrane, it is the only suggestion of such process found in the entire series of specimens. The membrane in those

areas where reparative processes are most active is splitting into fibrils, and between them polyblasts and spindle-shaped fibroblasts are insinuating their way (Fig. 3). In this manner the membrane appears to be disrupted and removed, or finally incorporated with the new tissue. Sections from another block of this specimen show the new fibrous tissue more prominently; at one point is a continuous band joining the two sides, though it extends in an irregular and zigzag manner among the fragments of Cargile. The appearance of the entire section is that uniform adhesions will finally result. A few giant cells are present, but they are not large, and are not in direct contact with the membrane.

B. Nerve from right side, covered with three layers of chromicized Cargile. Two layers of Cargile extend entirely around the nerve, except where broken in cutting or by destructive action of the tissues. Within these, directly upon the nerve, is a band of forming fibrous tissue, upon the surface of which is a fibrinous exudate containing many red blood-cells; this exudate is for the most part in contact with the Cargile. The areolar connective tissue, which was separated from the nerve when the Cargile was placed, is also covered by a layer of new tissue which is smooth and sharply limited as though repair was complete; it is nowhere penetrating or adherent to the membrane in the sections from A (Fig. 4). No giant cells are seen. Sections from another block of this specimen show new tissue advancing between the layers of Cargile, but no adhesions have formed.

EXPERIMENT XIV.—Tendo-Achillis and posterior tibial nerve. Two layers of Cargile around tendon, nerve not covered; specimen removed at end of twenty days. Cargile can be identified over approximately three-fourths of the circumference of the tendon. It is split into several thin layers and broken into short fragments. Throughout the entire extent, where visible, it is enclosed in a narrow space bounded by dense, newly formed fibrous tissue. For a part of the distance it is partially free in this space, which also contains red blood-cells. In such areas actual adhesions do not appear to have formed. At irregular intervals, however, fibrous bands unite the tissue on either side, and the Cargile is thus incorporated in a nearly healed wound; at many of these points the membrane has essentially lost its identity as a distinct structure. In several areas are numerous foreign body giant cells nested in small spaces, which they entirely fill or

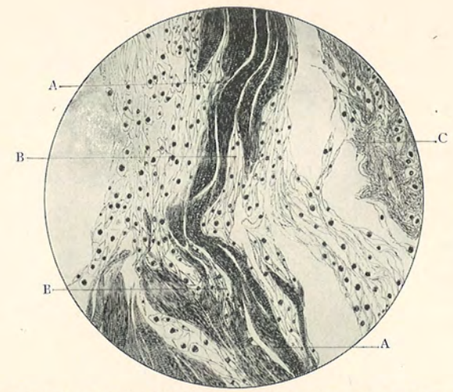

FIG. 3.—Layer of non-chromicized Cargile membrane surrounding posterior tibial nerve for fourteen days. (B. and L., $\frac{1}{12}$ homo. imm., 1 inch ocular.)
A A. Cargile membrane splitting into fibrils, but otherwise fairly well preserved.
B B. Spindle-shaped fibroblasts which are entering between the fibrils of the membrane. The appearance at and below the lower letter indicates that there is an intimate connection between the splitting of the Cargile and the intercalation of the formative cells.
C. New fibrous tissue internal to the membrane.

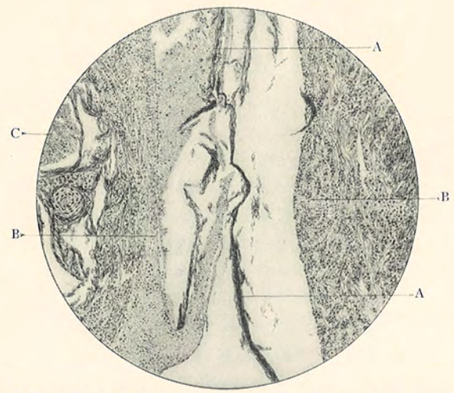

FIG. 4.—Three layers of chromicized Cargile membrane surrounding posterior tibial nerve for fourteen days. (B. and L., $\frac{2}{3}$ obj., 1 inch ocular.)
A A.—Cargile membrane. Two layers and a few isolated fragments of the third are still present. Varying degrees of fibrillation and fragmentation are shown.
B B. Newly formed or forming fibrous tissue bordering the space containing the Cargile. That on the right surmounts the connective tissue separated from the nerve when the membrane was placed; on the comparatively smooth border repair is sufficiently advanced probably to be beyond the adhesive stage. The new tissue on the left, surrounding the isolated nerve, is not so far advanced; on the surface and extending between the layers of the membrane is fibrinous exudate containing a few leucocytes.
C. Part of a nerve bundle immediately beneath the new tissue. Degenerative changes have rendered this portion of the nerve almost unrecognizable.

they are surrounded by loose areolar tissue. From these areas the Cargile has entirely disappeared. Phagocytosis by these cells is not demonstrable. In the fourth of the circumference where Cargile is entirely absent is a solid band of fibrous tissue, giving the impression that the membrane had not been present over this area.

EXPERIMENT XVII.—Tendo-Achillis and posterior tibial nerve. These were separated and each covered with Cargile membrane; specimen removed at the end of fifty-four days. In sections from this specimen can be found no evidence whatever of the membrane or the place formerly occupied by it. There appears to be but little excess of fibrous tissue over that which would normally be found in this location. At one point is a small circumscribed area made up almost entirely of giant cells surrounding fragments of a suture.

EXPERIMENT XIX.—Chromicized Cargile membrane from brain of dog; specimen removed at end of thirty days. This specimen is very brittle when mounted. Sections show that portions are of normal density, but slightly thinned. Still other parts are thickened, spongy in character, and stain less deeply than usual. The total bulk of the membrane appears to be slightly less than for normal membrane of the same extent; the loss, however, is not conspicuous.

The object of these histologic studies was to determine, if possible, the fate of Cargile membrane in the tissues, and also its effect upon those tissues it was intended to protect. The major portion of the findings has been embodied in our conclusions, but one point seems worthy of special emphasis. The irritative action of the membrane as a foreign body, especially in the peritoneal cavity, is so pronounced that it cannot be disregarded, and appears to be the principal factor militating against the otherwise beneficent possibilities of the material. In the case of raw surfaces it is difficult to estimate this action, but in every instance in which the membrane was placed over intact peritoneum, reactionary new tissue formed on the surface of the latter, which in many cases was disrupted and incorporated with the new formation. When the membrane is placed between two freshly incised surfaces, this

stimulus towards "healing in" of the foreign material is added to the reparative efforts common to all wounds, and their resultant action must be withstood if adhesions are prevented. It does not appear that Cargile membrane is able so to do.

Our joint conclusions are:

1. The most distant time at which we found unchromicized Cargile membrane existing intact, macroscopically, within the peritoneal cavity, was the fourteenth day; in most instances it had disappeared to macroscopic view much sooner. The earliest time at which we found the membrane had disappeared over the area of actual denudation was on the third day.

2. Unchromicized Cargile membrane when buried in living animal tissue, as when placed around tendons and nerves, or in muscle, is apparently absorbed sooner than when placed within the peritoneal cavity. In no instance was so much as a fragment of the membrane observed macroscopically so late as the fifth day, though in the fragmental state membrane was noted microscopically so late as the fourteenth day.

3. Chromicized Cargile membrane when placed within the peritoneal cavity or when buried in living animal tissue remains unabsorbed much longer than does the unchromicized variety. The two varieties doubtless bear relatively the same relation to each other, so far as absorbability is concerned, as do chromicized and unchromicized catgut.

4. While the unchromicized, and to a less extent the chromicized, variety will adhere fairly firmly to a surface denuded of peritoneum when such surface is relatively dry, yet neither can be depended upon to remain where placed, unless anchored by some method, in a situation which is subject to peristaltic activity.

5. A logical deduction from the results of the foregoing experiments seems to warrant the belief that neither variety of the membrane is of value in preventing adhesions within the peritoneal cavity. In every instance the membrane, until absorbed, appeared to act as a foreign body, and therefore as an irritant.

6. We believe from the results of our observations that

both varieties of the membrane are of value in preventing adhesions to wounded nerves and tendons when such structures lie in tissues which have been subjected to trauma, operative or otherwise. Our conviction is that for this purpose the chromicized is the more valuable.

7. We believe that several layers of either variety of the membrane when placed around tendons or nerves afford a safer and better protection than one layer.

8. We believe that, when used in the cranial cavity to replace destroyed or removed dura, the unchromicized variety would be exceedingly difficult to handle on account of its being unmanageable when moist; and we further believe, on account of the rapidity with which it dissolves, that it would be of no special value in this situation even though it could be used with ease. Owing to the facility with which the chromicized variety can be handled, its greater toughness and increased power to resist absorption, we believe that it would prove of greater value in replacing the dura.

9. Our studies indicate that the membrane is destroyed by a lytic substance, or substances, contained in the body fluid. The celloidin capsule experiments, even though bacteria were present in one, show that the membrane is softened, and at least partially absorbed by body fluids without the presence of cells. In the tissues it is split into fibrils, this change being accompanied or followed by the penetration of formative cells of the new tissue enclosing it. Fragmentation, disintegration, and absorption finally ensue. Phagocytosis may safely be excluded as a chief important contributing cause.

Dr. W. M. L. Coplin said the detailed experiments were to him interesting from two points of view: 1. From the purely scientific aspect of the question, and, 2, when viewed in the light of our knowledge regarding the healing in of foreign bodies. As a result of constant findings, the pathologist cannot regard a dead organized body as being other than an irritant when placed in the tissue. This is true even of isolated tissues in the body from which they are derived, detached periosteum or fragments of bone acting as irritants to the surrounding structures. Because

of this action, reintroduced tissue, in essentially every instance, is eventually absorbed and replaced by newly formed tissue. An interesting point is the method by which this absorption is accomplished. Following the studies of Metchnikoff and his school, there was a tendency to lay stress upon the action of phagocytes in the removal of the foreign body. The introduction of the celloidin capsule method of studying the effect upon bacteria of the body juices has furnished evidence, however, that lytic substances are present in the body fluids. This study of Cargile membrane appears to be the first investigation of the action of lytic substances upon foreign bodies in the tissues. Ziegler and his students have investigated the exudate cells found between embedded cover glasses, but in the experiments made by Drs. Craig and Ellis no cells could enter the capsules containing the membrane. Yet the membrane was destroyed or in process of solution, though no cellular bodies were in the fluid. In view of the question as to whether this process is a fatty degeneration, the contents of the capsules were very carefully examined for fat, but none was detected. The trend of opinion now is to look to the action of lytic substances in the destruction of irritating bodies, whether they are the cells of animals or actual foreign bodies that have been introduced. The absence of applied phagocytes in the present experiments is significant. Müller, in his studies of the absorption of teeth, and others have found the destroying cells applied to the tissue to be removed where they appear to secrete a material that destroys the tissue. Here the giant cells are not applied to the membrane; disintegration, however, is proceeding, an indication that lytic substances—possessing some of the attributes of familiar enzymes—are at work. Whether or not these substances come from the cells of the new tissue is a question at present under discussion; such origin is probable. The experiments make it clear that Cargile membrane acts as a foreign body, the chromicized and unchromicized varieties appearing to be equal in this respect. The practical application of the membrane, as to its harmful or beneficial effects upon the tissues, must of course be determined by the surgeon.

Dr. W. W. Keen said that, viewing the experiments from the practical side, the surgeon finds negative facts as important as positive results. The value of the paper lies in showing that the confidence of surgeons in Cargile membrane is largely misplaced, as it does not prevent adhesions. Dr. Keen would like to see the experiments continued and applied to several other materials. Silver and gold leaf both have been used in the cranial cavity, and found still present after long periods of time; can they be used elsewhere? The value of thin rubber dam and gutta-percha tissue should also be tested in this regard. Finally, the elastic rubber plaster employed by Brewer in his experiments to wrap arteries requiring repair of a solution of continuity should be tried to see if it would prevent adhesions. Good results were obtained by Brewer in the case of the arteries, though Dr. Keen is not sure that microscopic studies of the tissues were made. Continued studies will probably lead to the discovery of other substances that will be efficacious and more satisfactory in preventing adhesions.

Dr. John B. Deaver said he had used Cargile membrane quite extensively, in at least fifty or sixty abdominal sections, in covering denuded surfaces, stumps after hysterectomy, etc. His attention was first called to the material by the paper of Dr. Morris. All the patients upon whom Dr. Deaver used the membrane recovered, and, as reoperation was not necessary, the effects upon the tissues could only be surmised. The recovery of these patients was as uninterrupted as in case of those upon whom the membrane was not employed. Dr. Deaver never employs the membrane to cover raw surfaces if he can obtain a peritoneal or omental graft. From the manufacturer's stand-point, the membrane employed was in every instance aseptic.

Dr. Craig, in closing, said, in regard to the recovery of patients within whose abdominal cavity Cargile membrane was employed, that the material disappeared so rapidly it would probably not interfere with recovery. He has used the membrane in dispensary practice to cover open wounds, as ulcers, and in skin-grafting after the Reverdin method, and finds it is destroyed very rapidly over the raw surfaces.

RUPTURE OF THE TENDON OF THE BICEPS FLEXOR CUBITI.

A CASE OF RUPTURE OF THE LONG TENDON IN ITS CONTINUITY, AND ONE OF RUPTURE OF THE SAME TENDON AT THE GLENOID ATTACHMENT; OPERATION WITH SUCCESSFUL RESULT IN EACH CASE.

BY WILLIAM W. KEEN, M.D.,

OF PHILADELPHIA,

Professor of Surgery in the Jefferson Medical College.

CASE I.—Dr. John B., aged fifty-four years, who regularly practises athletic exercises, first consulted me, December 16, 1904. His father and mother suffered from rheumatism and neuralgia. He himself had had muscular pains from time to time, but never a distinct attack either of articular or muscular rheumatism. He has had several attacks of diarrhœa. Five years ago had a severe attack of pleuropneumonia. When twenty years old was only five feet tall and weighed ninety pounds; at twenty-four his height was five feet two inches and he weighed 106 pounds. After his attack of pneumonia he weighed but eighty-five pounds. At present his height is five feet six inches and his weight 125 pounds. When a young man, his health was so poor that he was advised to go to Colorado. His persistent athletic practices are readily explained as a means he has adopted, and very successfully, to obtain robust health. Even in the very cold weather of this winter, I found that he only wore an open meshed undershirt.

In June, 1902, a pupil by accident let an Indian club slip, striking Dr. B.'s right shoulder on the anterior surface while the muscles were tense. No ecchymosis followed, but for six months abduction of the elbow was impossible, not from pain, but from muscular inability to lift the elbow. Twice since then he missed catching a hand-ball and fell forward, striking on his right shoulder.

On December 8, 1904, in a violent muscular effort to catch a hand-ball, he suddenly felt a pain about the junction of the upper and middle thirds of the right arm, so severe that he stooped

and twisted his body to enable him to bear the pain. He noticed a lump on the arm, but paid little or no attention to it, as the pain quickly subsided. On December 13, he made a hand-spring, and again felt the pain at the same place.

On examination, December 16, I found that when he made forcible flexion of the forearm to a right angle and I resisted the flexion, the biceps' belly terminated at its upper portion suddenly, and I could not feel the tendon above that point. The upper end of the belly of the biceps also felt very flabby and soft, almost as if it were a hæmatoma, though not quite so soft.

My diagnosis was a rupture, more likely of the long head of the biceps. He had had but little pain, and his disability

FIG. 1.—The tortuousness of the tendon of the long head of the biceps.

FIG. 2.—Shows the fusiform swelling of the tendon below the bicipital groove and the mode of shortening the elongated tendon and suturing the two ends while held taut.

as a result of the accident both he and I estimated at about 25 per cent. The difference in outline of the two arms was more marked to the touch than to the eye, and hence I do not reproduce the photographs taken at the time.

In view of his athletic disposition, I advised and he accepted immediate operation.

Operation, December 18, 1904. I laid bare the biceps muscle and its upper tendons. The short head I found intact. The tendon of the long head lay tortuous like a snake (Fig. 1), extending from the body of the muscle upward. I had expected to find the tendon torn away from the belly of the muscle, but I found the two continuous. Traction on the tendon showed that

its attachment to the rim of the glenoid cavity was also firm. I dissected under the deltoid for a short distance upward till I reached the groove in the head of the humerus. About two centimetres below the groove began a fusiform swelling in the tendon extending downward about 1.5 centimetres (Fig. 2). This portion of the tendon was markedly discolored, almost black, evidently from blood effused within the sheath, but the sheath was intact. It was clear, therefore, that the tendon itself had been torn or ruptured within its sheath, and was much elongated, this partially destroying the function of the muscle. I severed the tendon just below the discolored portion, and, while each end was held taut overlapping the other about two centimetres, I sutured the two ends together with twenty-day chromicized catgut (Fig. 2). The arm was then placed on a rectangular splint so as to relax the biceps muscle. He went home, December 26, with the wound entirely healed.

January 26, 1905. He called to see me to-day. The splint was worn for two weeks after the operation, and the forearm was carried in a sling for two weeks more. At the end of that time he tells me he began doing athletic "stunts" with the arms, and has felt only the inconvenience which comes from weakness of the right biceps, due partially to non-use for a month. The muscular belly is quite flaccid as yet, and it is smaller than that on the right side by half a centimetre. The exercises he has taken have not been violent or prolonged, and presumably the biceps will improve very much in time.

[March 31. He is now practically as well as ever. The deformity of the biceps has almost disappeared.]

Case II.—Dr. J. Chalmers Da Costa has kindly given me the following notes of his case: "In May, 1904, a man, aged fifty-two years, while lifting a heavy bucket or pail, was suddenly seized with violent pain in the upper arm. He dropped the bucket, and for several days kept his arm bandaged and in a sling. I first saw him several days after the accident. Flexion of the forearm could be slowly executed, but was feeble, painful, and incomplete. On attempting flexion, the short head of the biceps contracted and the belly of the muscle became abnormally prominent, but the muscular 'bunch' thus produced was flabby and nearer the elbow-joint than normal. An incision disclosed the long head of the biceps curved like a snake. When pulled upon,

it came entirely out of the bicipital groove. A portion of the periosteum had been torn off with the tendon, evidently from the margin of the glenoid cavity. A portion of the upper end of the tendon was cut off and the tendon was attached to the short head by splitting the latter and suture. Primary union followed. At present, nine months after the accident, the arm and forearm are strong and active. He uses the arm for all purposes of hard work without pain. The biceps actively flexes the forearm; the short head is much enlarged."

Remarks.—Prior to the present cases there have been published only one case of operation for rupture of the belly of the biceps and one for rupture of the tendon.

Loos (*Beiträge zur klinischen Chirurgie*, 1900, Vol. xxix, p. 448) is in error when he states that Legueu operated. (See *Revue de Chirurgie*, 1895, Band xv, p. 897.) No operation was done by Legueu, and the cicatricial node in the tendon was not in the biceps, but the triceps tendon. The article of Loos just referred to and the earlier one by Maydl (*Deutsche Zeitschrift für Chirurgie*, 1882, Vol. xvii, pp. 306 and 513, and Vol. xviii, p. 35) covered most of the published cases up to 1900. These amounted to sixty-six in all.

I have not made further search of the literature than through my own card catalogue. This shows that there should be added to Loos's list the four cases reported by G. G. Davis (*Medical News*, 1895, Vol. lxvii, p. 121), Da Costa's, and my own cases herewith reported. These make a total of seventy-two cases. Loos states (p. 430, foot-note) that Petit has collected eighty-three cases of rupture, but that the paper had not been published in 1900, nor have I found it since.

It is a matter of surprise that a tendon should rupture in its continuity rather than that the muscular belly should yield or the tendon be torn loose from the muscular belly at the point of transition from the one to the other, or from the bony attachment of the tendon. There is, however, no doubt, as in my case, that this does occur.

I think Davis is, however, probably right when he says "the tensile strength of healthy tendon is so great that it is

my belief that true rupture is much rarer than is usually supposed, and that when a tendon does rupture, it is very likely to have been diseased." Yet, on the other hand, in a number of cases no prior disease was known. In the present case, in view of his prior history and later athletic life, there may or may not have been disease of the tendon.

Rupture of the biceps may take place at several points:

(1) In the belly of the muscle,

(*a*) Either that portion belonging to the long head;

(*b*) That belonging to the short head, or,

(*c*) The belly after union of these two portions.

(2) At the transition point between the muscular belly and one of the upper tendons.

(3) The transition point between the belly and the lower tendon.

(4) In the continuity of the tendon of the long head.

(5) At the point of insertion of this tendon to the rim of the glenoid cavity, or at least within the capsular ligament.

In some cases it is not easy to make an exact differentiation of the site of the rupture, hence all tables are to some extent unreliable. It is to be noted that *only in the operative cases has the exact* condition been verified by sight.

The combined cases of Loos, Davis, and this paper give for rupture of the muscle itself fifty cases as against twenty-two in the tendons, but of fifty-six cases in Loos's paper with more detailed histories to which Davis's four cases and these two are added, making sixty-two in all, there were forty-one of the muscle and twenty-one of the tendon. But from these twenty-one of rupture of the tendon six should be deducted as being at the point of junction of the tendon and the belly and the case of Legueu, which should not have been included. This leaves only fourteen cases of rupture of the tendon. The belly of the short head was only involved in two cases, and both of these were due to direct injury,—one in a threshing-machine, in which the tendon of the long head was also involved, and the other in an attempt at reducing a luxation of the shoulders.

In the larger series of Petit, the proportion is given as follows:

Rupture of the whole muscle, 21; of the long head, 9; at the transition point between belly and tendon, 7; of the lower tendon, 3; of the tendon of the long head, 43.

I think that there must have been some error in transcribing, for it would be extraordinary to have forty-three cases of rupture of the tendon of the long head and only nine of the muscular part of the long head. As stated, Petit's paper has not yet been published.

Besides the case here reported, there are only six cases of stretching or partial rupture of the long head similar to the present cases. Of all the cases reported by Loos, only four of rupture of the muscle and one of the tendon were caused, as in the present case, by muscular effort alone.

Of all the reported cases only two occurred in women.

The symptoms of rupture differ in rupture of the belly of the muscle and of the tendon. The muscular belly, either the whole of it, or (if the rupture involve, for instance, only the belly of the long head) a part or the whole muscle, becomes softened and loses its elasticity. Sometimes, in rupture of the belly into an upper and lower portion, there will be two tumors formed by the contraction of the two portions of the belly of the muscle, with a marked furrow between them from one to two fingerbreadths wide. At the bottom of this furrow, sometimes even the bone can be felt. If the rupture is at the junction of the tendon with the belly, this double tumor, of course, will not exist, but there will only be a tumor of the belly and none of the tendon. If the rupture be of the belly of the long head, the muscular belly of the biceps will be drawn towards the elbow. If the rupture be at the lower end of the belly of the muscle, the whole muscle will be drawn up nearer the shoulder.

In an excellent paper by White (*American Journal of the Medical Sciences*, January, 1884, p. 17), on dislocations of the long tendon of the biceps, the differential diagnosis between that lesion and rupture of the long head of the muscle is well

stated; and one other point of importance is mentioned, namely, that in rupture, the head of the humerus, not being held down by the long tendon, is approximated more closely to the acromion, and the shape of the shoulder correspondingly altered.

When the long tendon is ruptured completely or partially, the symptoms are less pronounced, partly because only a portion of the muscle is involved and partly because the sheath of the tendon to some extent replaces the tendon. Of course, there is much less ecchymosis and the discoloration is not pronounced. Only the portion of the muscle corresponding to the long head is flabby and has lost its tone, so that it feels like a cyst or a hæmatoma.

Unfortunately, in my case, I did not observe whether Hüter's symptom was present. He called attention to the fact that flexion of the forearm in supination when the biceps is relaxed is much less forcible than when the hand is in pronation, and the biceps is more tense and can contract to greater advantage.

Treatment.—The treatment in almost all cases has been either none at all, where patients have neglected to seek the surgeon till long after the accident, or by means of a bandage with or without a splint, massage, and electricity. I mention the latter only to condemn it save in the *later stages,* after the rupture is healed. Then it will do much good in restoring the functional activity of the muscle. Earlier than this it would but separate the two portions instead of approximating them.

In a few cases good functional results have been obtained, for it is possible sometimes, by manipulation and bandaging, to approximate the two parts of the muscle if the rupture be in the muscle, so that union will take place by fibrous tissue with but little loss of function. If the rupture be confined to one portion of the muscle, of course the chances of restoration of function are much better than when the whole of the muscle is involved. Yet, often in the cases of only partial rupture, loss of function is very marked. This is not only

due to the separation of the ends of the muscle or of the tendon and the lengthening of the muscle by the length of the scar tissue which fills the gap, but also from wasting of the muscle, from interference with its innervation.

It is strange that surgeons have so rarely operated. The cases in which operations have been done thus far are as follows:

1. Von Hochstetter (*Wien. med. Woch.,* 1890, p. 399). A very muscular man of forty-six years. Over two months after the injury, the upper end of the belly of the muscle and the tendon which had been torn loose from the belly were united with silk. After four months complete ability to work returned.

2. Bazy (*Bull. Soc. de Chirurgie,* 1895, p. 156). A man, aged forty years, in whom there was a complete rupture of the tendon of the long head within the joint or even detachment of the tendon from the glenoid cavity as a result of lifting a sack weighing eighty kilogrammes. The tendon was reflected upon itself so that the torn upper end was turned downward. Bazy resected the tendon and united the stump to the tendon of the short head and the coraco-brachial. The arm was placed in plaster at a right angle. After one month there was complete restoration of function.

3. In my own case, the patient at the end of a month resumed, to a moderate degree, his athletic occupation and is now quite himself again.

4. The case of Dr. J. Chalmers Da Costa. The lesion and the operation were identical with Bazy's case. The result was very satisfactory, entire use of the arm having been regained.

The most encouraging results from these four cases of operative interference and the poor result in many others not so treated, it seems to me, should lead to operative treatment of cases of rupture rather than to trust to the more or less uncertain results of the treatment by bandages and splints.

Dr. Gwilym G. Davis said that since reporting his series

of cases he had found one in a dissecting-room subject which supported the theory of the rupture of the tendon being due to disease of that structure. In the instance mentioned the tendon where it lay in the bony groove had almost entirely disappeared. Operation is indicated in cases of this injury in healthy individuals, provided they are seen early. Reasons why more cases of this injury are not operated upon are: 1. They are not seen early. 2. The disability often is comparatively slight, the other head of the muscle assuming the extra function. 3. The injury often occurs in people of rheumatic diathesis. It does not follow that severe trauma is necessary to cause rupture, as the tendon is often reduced to a mere thread. When such cases are operated upon, the tendon must be transplanted to the other head of the muscle.

Dr. Keen, in closing, said Dr. Davis's dissecting-room specimen was not subject to the criticism of specimens of supposed rupture of the muscle found in such bodies; the latter are more likely due to stretching, incident to moving the arms when rigor mortis is present, than to ante-mortem causes. In one case good results were obtained from operation three months after the injury, but if possible early operation is desirable. In cases not operated upon, the disability eventually is often quite marked. In the papers referred to are reported cases of laborers, porters, and soldiers who were rendered incompetent to perform their accustomed work. Only a few cases exhibit but little disability.

STATED MEETING, MARCH 6, 1905.

The President, Henry R. Wharton, M.D., in the Chair.

THE MATAS OPERATION FOR THE CURE OF ANEURISM.

Dr. John H. Gibbon presented a negro man, thirty-one years of age, whom he had subjected to the Matas operation for the cure of a popliteal aneurism. He stated that he believed this operation was as great an advance over the older ones as that of the Bassini operation for hernia is over its predecessors. The operation of Matas had been recently and completely described by the author in the Annals of Surgery for February, 1903. The possibility of performing this operation was suggested to Matas by the fact that the lining membrane of the aneurismal sac is the same as that of the vessel itself, and by the good results which have been obtained where arterorrhaphy has been practised.

In the case of sacciform aneurism where the sac is evacuated and the opening into the artery sutured without interference with the circulation, there can be no comparison between this operation and ligation. And even in fusiform aneurisms the advantages of this new method over the older one of ligation are paramount. Dr. Gibbon knew of no instance where the suggestion of Matas that it might be possible to reconstruct the artery by utilizing a portion of the sac in fusiform aneurisms had been done, but the method certainly seems worthy of trial. One of the greatest advantages in closing the arterial openings within the sac of an aneurism is the fact that the collateral circulation is not interfered with in the least possible way.

The Matas operation is applicable to all aneurisms in which there is a distinct sac, and in which the cardiac end of the main vessel can be thoroughly controlled.

The case reported by Dr. Gibbon was admitted to the Pennsylvania Hospital on October 27, 1904. At the time of his admission the aneurism was about the size of two fists, and could easily be seen projecting beyond the normal line of the leg on each side. The leg and foot were so enormously swollen as to resemble a marked elephantiasis. The patient said that he had been struck on the back of the leg eight or nine months previous, and he attributed the development of the aneurism to this injury; he denied syphilitic infection. A positive diagnosis of aneurism of the popliteal artery was made without difficulty, as all the typical signs were present. After two days' rest in bed the œdema of the leg greatly decreased, but no pulsation was ever detected in either the anterior or posterior tibials. Two days after admission, after elevation of the leg and the application of an Esmarch constrictor well up on the thigh, a long incision in the middle of the popliteal space over the aneurism was made. The sac was laid freely open from end to end and a quantity of liquid blood and clot in various stages of organization was evacuated. At the upper and lower part of the sac could be demonstrated the opening of the vessel. Dr. Gibbon thought for awhile that it was a sacciform aneurism, as he could not find the point of exit of the artery; but finally he was able to do so near the upper part of the lower end of the sac; in other words, the sac had developed posteriorly and extended under the inner head of the gastrocnemius. It was impossible, because of the shape of the sac, to re-establish the caliber of the vessel, and Dr. Gibbon therefore followed Matas's plan of closing the openings of the artery with a small chromicized suture carried on an ordinary curved intestinal needle. No openings of collateral vessels in the sac were found, and therefore the constrictor was loosened; as there was no bleeding even after this was done, he thoroughly cleansed the sac, rubbing its interior with weak bichloride solution followed with salt solution. The sac was then entirely obliterated with repeated rows of chromicized gut sutures. There was considerable oozing from the cut edges of the sac, but this was controlled by a whipstitch. The skin was closed entirely and a dressing applied. The patient did well after the operation, but on the second day his temperature rose to 103° F., and he complained of considerable pain in the leg; as he had had some temperature before the operation, it was not thought that this was due to infection; but this was an erroneous idea, as within a few days there was evidence of infection of the wound. The stitches of the skin were removed and a large quantity of pus evacuated, afterwards the temperature fell and the patient was much more comfortable. The circulation remained good in the foot. Some days after the operation there developed a necrotic area about the size of a silver dollar on the heel, which was undoubtedly due to pressure, which should have been avoided. This is now practically well, but has given the patient more trouble than the popliteal wound. There was considerable contraction of the leg after removal of the splint, but he is now able to extend it to nearly a normal degree. There still remains an irritated scar in the popliteal region, which is probably due to the want of care which the patient has given it since he left the hospital. During his convalescence he took very large quantities of potassium iodide with impunity, and he is now taking 30 grains three times a day. There is no evidence of a redevelopment of the aneurism.

It was stated that in a number of other cases which have been reported an infection of the wound had taken place, but in none of them has it interfered with the cure of the aneurism. The fact that suppuration seems to be frequently in these cases would lead Dr. Gibbon in another case to insert a superficial gauze drain not into the sac, but down to it.

SUTURE OF FEMORAL ARTERY.

Dr. Francis T. Stewart gave the details of a case of suture of the femoral artery. The patient was a young, robust man, whose femoral artery had been injured by a flying piece of steel, with the resulting formation of a large traumatic aneurism. At the operation, instead of applying a tourniquet, an incision was made directly over the sac and hæmorrhage from the vessel controlled from the wound. The sac was opened and the communication with the vessel sutured. There were no untoward postoperative effects, suppuration not occurring. The leg was kept elevated for two weeks. Pulsation in the artery was immediately restored and continued until the patient left the hospital. In answer to a question by Dr. Gibbon, Dr. Stewart said the length of time between the injury and operation was about eight days.

VARICOSE VEINS SIMULATING FEMORAL HERNIA; OPERATION; DEATH ON THE SEVENTH DAY FROM HEART-CLOT OF UNCERTAIN ORIGIN.

Dr. William J. Taylor reported the case of a young woman, aged thirty years, who consulted him first on May 21, 1904, stating that she had been ruptured, and had tried to wear a truss, but this had given her so much discomfort and uneasiness that she was unable to wear it. At the same time she complained of quite extensive varicose veins of the left leg and thigh. He found a swelling over the left saphenous opening which had every appearance of being a femoral hernia. This swelling was soft, and could be readily reduced with slight pressure; there was some impulse on coughing, and when she lay down the whole mass disappeared. In view of this history the conclusion was natural that she had a femoral hernia which could not be properly retained by a truss, and that the pressure of the truss was producing the varicose veins.

On May 25 he operated at the Orthopædic Hospital, and, upon cutting down upon the mass, found it to be an enormous varicose condition of the saphenous vein. The whole vein below this point was thickened and indurated, and she had evidently had a venous inflammation extending down the whole leg. There was no hernia. The mass felt was this varicose condition of the saphenous vein. He ligated the vein below the enlargement, very carefully emptying the vein, and then ligated it about three-quarters of an inch from the femoral vein. He ligated it also once in the centre. She did very well for three days, when she complained of a great deal of pain in the stomach and abdomen. Now, on carefully examining her, was elicited a very good history of gastric ulcer, extending back over several years, and particularly during the past year. Dr. Morris J. Lewis was asked to see her, and he agreed in the diagnosis. Nitrate of silver and opium were given, and she was fed entirely by the rectum. All this time the wound was doing perfectly well; the drainage had been taken out, and it was practically healed. She improved markedly, and at once after the rectal feeding was begun; but about half-past two, on June 2, she called out to one of the women in the ward that she was fainting. The head nurse saw her almost immediately, and found her in a condition

of collapse, blue, and in an excruciating agony. Dr. Taylor saw her himself within ten minutes of this seizure, and found her in a most distressing condition, although she had somewhat revived. The pulse was very rapid, and practically imperceptible at the wrist; she was blue about the lips, in profound collapse, and with intense pain in the region of the stomach. The first impression was that a gastric ulcer had perforated. She was given hypodermics of salt solution with adrenaline added to it, hypodermics of atropine, digitalin, and inhalations of oxygen. Dr. Lewis saw her later at half-past three. There was no abdominal rigidity, and, in view of this fact, it was concluded that the condition was one of heart-clot. She lingered on until Saturday, the 4th, at eleven o'clock, when she had a second collapse and died. During this whole time her pulse was always above 120, often 160, and she was kept alive simply by rectal stimulants, hypodermics, and oxygen. At no time was her general condition such that any surgical operation could have been attempted.

Post-Mortem.—Post-mortem examination was made by Dr. D. J. McCarthy. The examination, in brief, showed that she had a hæmorrhagic pericarditis and a clot in the auricle of the heart of the right side, which was dilated, and some myocarditis. There were no clots in either ventricle. The stomach showed an acute gastritis, evidently following upon an old and chronic condition, as there were two healed gastric ulcers, chronic gastritis at the pyloric, and acute gastritis at the cardiac end. The stomach was smaller than normal. The site of the wound was examined with care. The wound was entirely healed; there was no evidence of infection or of any untoward result; in fact, the wound was entirely well; but there was a small blood-clot removed from the left iliac vein just below the common iliac. The saphenous and femoral veins were normal. The etherization may have been a factor in producing excitement, which, added to her gastric condition, may account for the heart-clot.

Dr. John B. Roberts recalled an instance of unexpected death from a gastric condition not known to exist. Suprapubic operation for vesical calculus had been performed, and the patient was doing nicely, when abdominal pain developed and was shortly followed by death. Autopsy revealed a large gastric ulcer with cicatrized edges, perforation of which had caused the fatal peritonitis. There had been no symptoms of gastric ulcer,

and that condition was not suspected. The case, then, was one in which an operation wound was doing well, yet the patient suddenly died. A second case illustrates another point in Dr. Taylor's paper, that of mistaken diagnosis. Six or eight years ago Dr. Roberts operated upon a woman who, from the history and symptoms, was suffering from appendicitis. When the appendix was exposed it appeared perfectly normal, and, as it then was not customary to remove such appendices, the organ was allowed to remain. The patient recovered from the operation and was soon going home, when she sat up in bed and died instantly. Autopsy revealed fatty degeneration of the heart and kidney disease, although the urine had been reported as essentially normal. Cases of this nature belong to what have been termed the calamities of surgery. The patient died, although she did not have appendicitis as suspected. In such cases the friends, of course, attribute death to the operation, and thus make these occurrences doubly disagreeable to the surgeon.

PERFORATED GASTRIC ULCER.

Dr. Charles F. Mitchell exhibited a specimen of perforated gastric ulcer recently obtained at autopsy upon a patient whom operation had failed to relieve. The patient was a motorman, and was seen two hours after admission to the Pennsylvania Hospital. Two days previously he had been seized with sudden abdominal pain and fainted. The family physician sent the man to the hospital. There a diagnosis of peritonitis was made, and, because of the previous history of gastric catarrh, the origin was believed to be a perforated gastric ulcer; the entire abdomen was tender and rigid. Incision in the median line above the umbilicus was followed by escape of fluid under tension and the bulging of the omentum. Examination of the stomach showed a large opening in the anterior wall at a point supposed to be near the cardiac end. The stomach could not be drawn from the wound, and sutures introduced to close the perforation immediately pulled out. The man was in a desperate condition, so the lesion was packed off as well as possible and the abdomen washed out. The patient lived four days. At autopsy, two perforations of the stomach were found. The first, supposed to have been near the cardiac end, was near the middle of the anterior wall of the stomach, between the greater and lesser curvatures,

and the second in the greater curvature, and adherent to the pancreas.

CYST OF THE PANCREAS.

Dr. R. P. McReynolds presented a woman forty-nine years of age, who had been subjected by him to partial excision and drainage of a pancreatic cyst. The history was as follows: The woman had borne twelve children. Normal menstrual history. No inflammatory diseases of the pelvic organs. Two years ago, slight soreness in abdomen was first noted. Gradual enlargement of abdomen ensued, and finally prompted her to consult her family physician, Dr. Mitchell, who sent her to hospital, where she came under the care of Dr. McReynolds. She presented a tense, fluctuating tumor, which filled nearly the whole abdomen, which was symmetrically enlarged to the size of a full-term pregnancy. When the abdomen was opened, November 8, 1904, the omentum was found adherent to a large cyst sac which apparently filled the greater part of the peritoneal cavity. After the removal of eight or ten quarts of dark chocolate fluid from the cyst, the sac was partially drawn out through the abdominal wound, but its entire enucleation was found impossible on account of numerous adhesions, especially to the liver. Part of the sac having been cut away, the remains were stitched in the abdominal wound and its cavity packed with gauze and with rubber drainage-tubes. Though but little blood was lost, the shock manifested by the patient was very marked. From this, however, she was soon rallied, and she made thereafter an uneventful recovery. It was apparent at the time of the operation that the cyst had grown up between the stomach and transverse colon; the colon had been pushed down as far as the fibres. The fluid collected at the dressing the day after the operation showed the presence of pancreatic ferments.

Dr. W. W. Keen approved Dr. McReynolds's condemnation of puncture of the abdominal wall in order to get fluid for diagnostic purposes; this expedient is fraught with too great danger of perforating the stomach or colon. Dr. Keen was one of the first surgeons in this country to operate upon a case of pancreatic cyst. The patient was a girl of fifteen. The cyst was the size of a head and presented in the epigastrium. Good recovery followed operation by essentially the same method as detailed by

Dr. McReynolds. Dr. Keen believes that in very few cases is extirpation of the cyst justifiable.

Dr. George Erety Shoemaker saw a case of pancreatic cyst twelve or fifteen years ago in dispensary practice. The patient was a woman of twenty, who had a tumor eight or ten inches in diameter presenting in the centre of the abdomen. The diagnosis of ovarian cyst was made, but the patient refused operation. Later she went to the University Hospital, where she was operated upon by the late Dr. Goodell, who found a cyst of the pancreas. The two layers of peritoneum and the cyst wall were stitched to the abdominal incision, and the patient made a good recovery.

Dr. John H. Gibbon spoke of a case of pancreatic cyst under his care in the Pennsylvania Hospital fourteen months ago. The patient was a colored man who had been kicked in the abdomen three days before admission. There was no evidence of peritonitis or of any profuse hæmorrhage. At the time of admission he complained of pain in the left loin, and there was a distinct tumor in the left renal region. The day after admission this tumor had greatly increased in size, fluctuated, and was somewhat tender. During the previous twenty-four hours the patient had passed but fourteen ounces of urine. The tumor was flat on percussion and the colon was internal to it. Diagnosis was made of hydronephrosis and operation advised. An incision was made exposing the left kidney, which was perfectly normal. In front of the kidney, however, could be felt the fluctuating mass, which was thought to be within the abdominal cavity. The patient was therefore turned on his back and an incision made in the upper portion of the left semilunaris. The abdominal cavity was found normal, excepting for some thickening of the gastrocolic omentum. The stomach was pushed forward by the tumor. The lesser peritoneal cavity was opened through the gastrocolic omentum, and a large cyst extending far over into the left side of the abdomen discovered. The cyst contents were evacuated and the cyst walls sutured to the peritoneal edges. The cyst contained a large amount of bloody fluid, which, on being afterwards examined, was found to possess the characteristics of pancreatic juice. It was thought in this case that the man had probably had a cyst of the tail of the pancreas, which had given him no trouble until he received the blow in the abdomen, which resulted in profuse hæmorrhage into the cyst cavity. The wound closed and the patient left the hospital perfectly well. He has not been heard from since.

SARCOMA OF PELVIC ORGANS NOT CONTROLLED BY THE X-RAY OR BY COLEY'S FLUID.

Dr. George Erety Shoemaker said that some months ago he had occasion to report a sarcoma of the abdominal wall associated with an infiltration which united the rectum, uterus, left tube, and ovary, the growth not being considered removable after opening the abdomen. The wound was closed, and, after removing a generous piece from the superficial tumor for the microscope, the X-ray was applied for about nine months by Dr. William S. Newcomet. The total number of exposures was forty-nine. The after-result, one year later, was the total disappearance of the growth from the abdominal wall, the gain of sixteen pounds in weight, and the disappearance of all pelvic enlargement except a slight increase in the size of the uterus. The case was originally referred to him by Dr. M. B. Hartzell. The microscopical diagnosis was given by Dr. J. Dutton Steele. The case was reported before the College of Physicians. (*Transactions of the College of Physicians*, 1903; *American Medicine*, vol. vi, No. 26, December 26, 1903.)

He now reported another case which offered a contrast to the former favorable result, and though, from the circumstances which surrounded the patient, she was able to secure the very best conditions, and ample time was given to her treatment, no definite influence appeared to be exerted upon the progress of the disease either by the mixed toxins of Coley or by the prolonged use of the X-ray.

The patient was single, forty-six years old, and was referred to him by Dr. A. A. Long, of York, Pa., because of a tumor in the right side of the abdomen, from which a sharp nodule projected against the right internal inguinal ring. As a right inguinal hernia had existed for six years, the pressure of the tumor against the hernia gave rise to a persistent pain and nausea, and was the principal source of the patient's distress. The tumor, which she had noticed about a year, reached to within an inch and a half of the navel on the right side, was nodular, sharply defined through the very thin abdominal wall, was evi-

dently connected with the uterus, and was movable. The inguinal hernia when opened was found to contain a pea-sized growth in the sac, which afterwards proved to be spindle-celled sarcoma. Radical cure of the hernia was done by the Bassini method, using kangaroo tendon.

On opening the abdomen in the median line with the intention of doing hysterectomy, the tumor was found to be made up of a number of small, tense cysts, very dark in color, protruding prominently from a fine granular base which was firm and solid. The uterus was completely covered in and its outlines could not be differentiated. No right broad ligament or ovary could be demonstrated; the growth involved the bladder superficially, and the rectum low down to a slight extent, and was not considered to be removable in the interest of the patient, though the entire mass, including the uterus, was movable. A nodule in the omentum was removed for examination and afterwards proved also to be sarcomatous. There was no unfavorable reaction from the operation, and immediately after aseptic convalescence X-ray was begun by Dr. W. S. Newcomet, and continued with slight intermission two or three times a week for about three months. While the patient at first improved in nutrition, no definite effect could be produced upon the size of the growth. Because of the radical cure of the hernia, it was no longer pressed upon by the tumor, and a distressing source of pain and nausea was completely removed.

The systematic use of the mixed toxins recommended by Dr. Coley was begun with a half-minim dose and gradually increased one minim per day. Reaction first occurred with twenty-one minims of the undiluted preparation. After this was secured, the injections were continued for seventeen days under his own observation in the hospital, and for several weeks longer in the very careful hands of her physician at her home. Though typical reactions were produced and though every possible arrangement was made for surrounding the patient with the best possible conditions, no permanent effect on the tumor was produced by the treatment, while the long-continued series of reactions was somewhat exhausting. The greatest amount of Coley's fluid used at one time was thirty-two minims. Specific treatment of the tumor was now abandoned. The patient gradually lost ground and died from exhaustion fourteen months after operation.

The cystic degeneration of the sarcomatous growth probably rendered it less amenable to successful treatment by the X-ray. It was somewhat of a disappointment, however, to find that the toxin treatment failed to influence a sarcoma of the spindle-celled variety, which is the form most favorable for its use. Careful watch was maintained upon the blood condition during the use of both of the agents referred to, but no definite effect appeared to be produced upon the leucocytes. The lowest count was 6000 and the highest 10,600. The latter count was obtained during the period of X-ray treatment, and led to a cautious increase of interval so as to avoid breaking down the growth. The lowest hæmoglobin was 62 per cent. and the highest 79 per cent. The lowest red-cell count was 3,856,000 and the highest 4,960,000. Much of the improvement in the general condition of the blood occurred during the treatment with the X-ray, and may have been largely due to general hygienic and roborant measures, which were systematically carried out. Improvement in nutrition was also favored at this time by the absence of pain in the tumor and by its disappearance from the site of the former hernia.

Dr. John H. Jopson spoke of a round-cell sarcoma of the neck upon which the combined treatment was used with marked success. The tumor was situated above the clavicle, and was the size of an orange when operated upon in May, 1904. Operation was difficult and the tumor could only partially be removed. It extended below the clavicle, into the anterior mediastinum, and along the posterior triangle of the neck. The internal jugular vein was infiltrated, and was torn three times during the dissection. The prognosis was very bad, but under treatment by Coley's fluid and the X-ray the infiltration remained stationary for some months. The fluid was begun with minim doses and increased until thirty-five or forty minims were reached. Finally, the tumor again enlarged, and further operation was considered and also advised by Dr. Willard. In December, 1904, the second operation was performed, and this showed that the infiltration of the posterior triangle and of the mediastinum had disappeared, and what remained of the tumor in the old site was surrounded by fibrous tissue in the form of a capsule. This made removal of the entire mass comparatively easy. Now, ten months after the first operation, there is some limited induration at the site

of operation, but the patient's general health is good, and he is in excellent physical condition.

APPARATUS FOR RETAINING PATIENT IN ANY DESIRED POSITION.

Dr. W. W. Keen showed a posture retention apparatus, saying that it was demonstrated on board the Athos during their

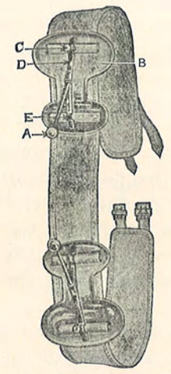

Fig. 1.—A. The retaining arm with ball attachment. B. The conformity supporting plate C. The thumb-clamp for adjusting plate, B, on the bandage for retaining the body at any angle or in any posture. D is a rib secured to the conformity plate; this rib possessed with elevations, E, under which the bandage (or belt) passes these elevations to allow of readily attaching and detaching the belt for washing.

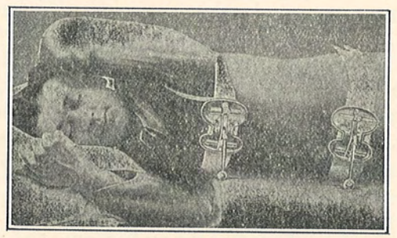

Fig. 2 shows patient being retained to the side during operation; two retainers (as seen in front resting against the operating table) are also on the back; thus the body is held rigidly to the lateral posture.

recent unfortunate trip to the tropics, by Mr. Lees, of the Physicians' Supply Company of Philadelphia. The apparatus is simply

a pair of broad bands of canvas, to each of which are attached two buckles carrying projections six inches long and terminating in spheres approximately three centimetres in diameter. It is used to retain patients in any position while sleeping, as, if properly applied, they cannot turn without first waking. While particularly to be used after operations, Mr. Lees believed it might also be of use in preventing nocturnal emissions. Dr. Keen also suggested that it would be useful in keeping patients in the lateral position during operations upon a kidney, the ilium, etc., as every surgeon knows the difficulty in keeping such patients from turning upon the back or face. He recently employed the apparatus upon a man from whom he removed a tumor of the buttock, applying one under the armpits, the other just below the hips. They retained the patient in the desired position throughout the operation without any difficulty, and were in every way satisfactory. The only objection to them is that they may cause pressure upon the chest, thus preventing free respirations. If modified by providing a slit for the arm or some similar device, they possibly might be employed for Estlander's or Schede's or other operations upon the chest requiring the lateral position.

STATED MEETING, APRIL 3, 1905

The President, HENRY R. WHARTON, M.D., in the Chair.

SCREW FIXATION IN CASES OF INTRACAPSULAR FRACTURE OF FEMUR.

DR. GWILYM G. DAVIS presented a man, forty-seven years of age, who, one year before, had fallen a distance of eight feet, striking on his right hip. The femur on the injured side had been fractured once before, when he was fourteen years old.

On examination, the right lower extremity was found to be shortened about 2.5 centimetres (1 inch). Pain on movement of the hip was very severe. The foot was everted, the fascia lata lax, and the greater trochanter moved with rotation of the leg. It was found to lie above Nélaton's line, and the base of Bryant's triangle on the injured side was shorter than that of the sound side. In short, there were present all the classical signs of a fracture of the neck of the femur. A skiagraph showed a line of fracture beginning above high up on the neck near the articular cartilage and running down almost vertically. The outer fragment was pushed up and was above the inner fragment.

On the sixth day after the injury an incision about 7.5 centimetres (3 inches) long was made over the greater trochanter, and an ordinary steel wood screw 7.5 centimetres (3 inches) long inserted up through the trochanter and neck into the detached head, traction in the meantime being made by an assistant. A plaster-of-Paris dressing was then applied, embracing the pelvis and down to the knee, and later the leg was placed on a sliding foot-piece to keep the foot from everting. The wound healed without trouble, but a sinus formed later at the site of the screw, and it was removed after having been in eight weeks. Two or three weeks later the patient was discharged, and now, a year after, he has apparently bony, or at least firm, union, very little shortening, almost normal movements, a slight loss of abduction,

and walks comfortably without any support, and only a slight limp due to the uncorrected small amount of shortening.

Dr. Davis further remarked that the results obtained by the various methods of treatment of fractures of the neck of the femur in those other than children and the aged are as yet so unknown that it is impossible to say which is best. That the methods usually pursued and the results obtained by the mass of the profession are unsatisfactory is evident from the frequency with which ununited fractures of this part are seen. In children, conservative treatment by splints and apparatus has been demonstrated to be efficient. In the aged, say, those over sixty years, bad results are accepted with a certain amount of resignation; but when an otherwise healthy man, from twenty to fifty odd years of age, is left with an ununited fracture of the neck of the femur, the distress and disability are so marked as to justify radical measures in order to avoid it. Many of these patients have more or less pain, a marked hobbling gait, and are often compelled to use a support, such as a cane or crutch. They are debarred from all active occupations, and perhaps relegated to the ranks of useless cripples. The most usual way of treating the injury is probably by weight extension, the same as if the fracture was lower down. The uselessness of this method is seen from the resulting ununited fractures. Of the value of other methods we have as yet too little data to judge. The treatment of this fracture in the aged by the method of combined weight extension and lateral traction has in his hands been far more satisfactory than by weight extension alone. The method of placing the limb in an abducted position in plaster-of-Paris is likewise better than using weight extension alone. He had recently had one good result from this method, but, to offset this, he recently saw a case in which the method had been equally faithfully applied without union occurring.

Having previously operated on several cases of ununited fracture, he decided to apply a modified form of the same method to recent fractures of the neck of the femur, and the good result obtained in the case shown had encouraged him to resort to the same plan in future cases.

DR. W. W. KEEN briefly detailed a case in which he had employed a device similar to that of Dr. Davis. The lesion dif-

fered, however, in being an old, ununited fracture which required an anterior incision to freshen the bone in addition to the lateral one for inserting the screw. The patient can now walk without the aid of crutches or a cane. Two screws were employed to unite the fragments in this instance, and they are still *in situ* after more than a year. The case will be reported in full later.

Dr. Robert G. Le Conte said that the proposition advanced by Dr. Davis, of immediate operation in intracapsular fracture of the thigh, was a very broad one. In these days of modern asepsis the ideal treatment of fracture of the femur is perhaps the open method, whether the break is intracapsular or of the upper portion of the shaft; and yet no one is quite bold enough to carry out this method in every case. In Dr. Le Conte's experience in patients whose ages range from forty years to extreme old age, the non-operative methods of treatment in intracapsular fractures result in giving useful and valuable legs in perhaps 80 per cent. of the cases; in about 20 per cent. this favorable result is not obtained. These statistics are not exact and are given from memory only. Granting that good results are obtained without operation in four out of five cases, why should we not continue the expectant method of treatment as opposed to the operative. If union fails to occur, operation can be later performed with little, if any, radical risk. It should be remembered that some of the cases of useless limbs following the expectant or non-operative treatment are due to osteophytes forming about the seat of the fracture and mechanically interfering with the motion of the joint, and not to ununited fractures. Dr. Le Conte would be very loath to indorse the statement of Dr. Davis that the majority of recent intracapsular fractures of the femur should be treated by the open method.

Dr. John B. Roberts did not believe the ideal method of treating fractures of the femur is by incision; in certain cases only is it advisable. In fact, the ideal method is treatment without incision, especially in fractures of the shaft. Unless the break is in the upper third, we expect good results from treatment by traction, elevation of the bed to secure counter-traction, and lateral support. He approaches such cases with utmost confidence that good results will follow this treatment, and in but few cases is there disappointment. Contrary to Dr. Le Conte, he would not call this expectant treatment. In the case of fracture of the neck of the femur we are not always sure that it is intracapsular; in the case exhibited, the skiagraph seems to indicate that it is partly outside the capsule, which is often the true condition present. In Dr. Roberts's experience, in a man of the age of Dr. Davis's patient with a fracture not entirely intracapsular, good results may be expected from treatment by weights, counter-traction, and lateral support. This he would not call the expectant, but the non-operative method of treatment. It is interesting to hear Dr. Davis speak of the sinus following the use of the screw, as that has been Dr. Roberts's experience with the use of nails. Suppuration nearly always occurs, and there is delay in closure of the sinus after the nail is withdrawn. Dr. Roberts has been surprised to find good results without operation in a few patients seventy or eighty years of age, with what were at least supposed to be intracapsular fractures. When the fracture lines are apparently through the base of the neck outside of the capsule, a good leg should be expected without operation.

Dr. Davis, in closing, said that an interesting point in these cases is the correctness of the diagnosis; it is often difficult to demonstrate whether the break is intra- or extracapsular. Anteriorly, the capsule extends downward to the anterior intertrochanteric line, and nearly every fracture is bound to be intracapsular at this point. Posteriorly, the capsule extends half-way to the intertrochanteric line, and in some instances even more. Hence many fractures are partly intra- and partly extracapsular. It is not possible to make a differential diagnosis with any degree of certainty. He supposes that Dr. Le Conte's statements refer to fractures of the neck alone, as it is well known that extracapsular fractures involving the trochanters unite readily and with an abundance of callus. As to fractures of the neck they are not so satisfactory. If Dr. Le Conte's figures embrace all the fractures of the aged, 80 per cent. of good results is a trifle high; he is not willing to admit this. Dr. Roberts' statements regarding the good results in fractures partly intra- and partly extracapsular are not capable of verification; as such diagnosis cannot be made, the absolute condition is unknown. As to the results of intracapsular fractures, it was held years ago that they almost never unite by bony union. When they are partly intracapsular and partly extracapsular, good results might be expected in young adults. Notwithstanding this, the experience of Dr. Davis is that

results in general are bad in fractures of the neck of the femur in young and middle-aged adults; this opinion is based on eight or ten cases seen during the past four years, all in individuals between twenty-five and fifty years of age. Ununited fractures during this period are not uncommon. Dr. Davis does not advise operative treatment in children nor in the aged. In the latter class, reparative efforts are slight; in children, conservative methods give good results. In certain other cases, as in the patient exhibited, disability from failure of conservative treatment is so great, and the occurrence of this result so frequent, that a more positive method of treatment is desirable. Dr. Davis does not, however, positively advise open operation in all cases, but would not hesitate to employ it in comparatively young adults, under sixty, otherwise healthy, who have intracapsular fracture. For treating these fractures there are now recognized two methods that are still largely untried. They are, 1, placing the thigh in abduction, and, 2, applying longitudinal traction and lateral traction combined. The use of these methods has as yet not been so extensively reported as to determine their true value. As a competitor of the two, to be tried out with them, Dr. Davis adds a third, the open incision and insertion of a screw as detailed in the reported case. The operation is simple, being little more than a straight incision with insertion of the screw while extension is made. Healing always readily occurs. When the screw loosens, an inflammatory focus forms beneath the scar and this tissue soon gives way, producing a sinus through which the screw may be removed. Operation does not appreciably add to the danger of the treatment and gives improved results.

ANTHRAX.

Drs. G. J. Schwartz and B. Franklin Royer presented, jointly, a man, aged twenty-four years; white; single; occupation, farmer, who was admitted to the Jefferson College Hospital, in the service of Dr. W. W. Keen, February 21, 1905, suffering from anthrax, and with the following history:

The farm on which he labored was situated at the head of a small stream, along the borders of which a number of cases of bovine anthrax occurred in 1899. Some of them were in the immediate vicinity of the farm. Since then this meadow land has been "out of the tide," so that it has been impossible to pasture cattle or cut hay. The farm being at the head of this stream has made the meadows drier and admitted of some pasturage, and last season considerable rough hay was cut upon it. Unknown to the health authorities, two apparently healthy mules belonging to the patient's father became suddenly sick, and died within two days of each other. The supposition was then that they were poisoned. Their carcasses were buried in this field. Later in the season, a crop of hay was harvested from the field. This hay comprised a portion of the fodder of the stock farm.

On February 12, 1905, two apparently healthy cows, which had been eating the hay harvested from the above mentioned field, were turned out in the morning and died during the day. The patient skinned the last cow which died and sold the hide to a dealer, who expressed it to this city. The patient noticed while skinning the cow that a bloody serum exuded from several sores on the hind quarters of the cow.

On February 14, 1905, two days later, the patient noticed a small red spot, which resembled a flea-bite, situated about one inch above the left wrist-joint on the posterior external surface on a line passing through the first metacarpal bone. The next day two papules appeared on flexor surface of the same wrist. These papules gradually became larger and were accompanied by slight itching and burning. During the next day a small blister containing a yellow serum streaked with blood and surrounded by an inflammatory band, œdematous, with overlying skin of livid hue, appeared.

On February 18, six days after skinning the cow and four days after the lesion appeared, the patient complained of slight headache and cough; by this time œdema had involved the hand, wrist, and was rapidly extending up the forearm; blisters had become blebs, were tense, and contained a distinctly blood-tinged, yellowish serum.

The following day, February 19, he became alarmed about his condition and went to bed. The headache became very severe. Cough became productive, pain in arm throbbing, swelling extended rapidly to the arm. Now, for the first time, the patient sent for his family physician. Local applications were made.

During the night the patient was restless, could not sleep, and felt much weaker.

On February 20, condition was much worse, and his physician decided to send him to the Jefferson Hospital, where he arrived February 21.

His condition on arrival was as follows: Facial expression was that of a person suffering considerable pain and mental anxiety; face was flushed, and there was slight sweating about the forehead; pupils dilated, tongue slightly coated and dry, slight nausea with no vomiting; temperature, 100.4° F.; pulse, 82, soft, compressible; respiration, 24. A brief physical examination of chest showed heart and lungs apparently normal with the exception of a few râles posteriorly on both sides. The left hand, forearm, and arm to within 10 centimetres of the shoulder-joint were immensely swollen. The swelling pitted on pressure, and there was an entire absence of emphysematous crackling. The overlying skin was of a slightly dusky red color, and pressure caused the redness to slowly disappear, but it returned slowly when pressure was removed. The axillary lymph glands were not palpably enlarged, but on palpation the spleen seemed to be enlarged. Situated along the forearm on the flexor surface were several medium-sized blisters containing a cloudy, yellowish serum, and just above the wrist-joint over the line of the artery was a large bleb the size of a half-dollar, filled with blood-stained serum.

Smear preparations, cultures, and a blood examination for the anthrax bacillus made, and within one hour's time a verbal bacteriological report confirmed the clinical diagnosis.

The report, from a later more exhaustive examination, was that the bacilli obtained in spreads from the blebs of the left forearm possessed the morphological and tinctorial characters of the Bacillus anthracis. In cultures, a bacillus, possessing the morphology, tinctorial, and biological characters of the Bacillus anthracis in pure culture. The blood taken from the right arm developed no growth, indicating in all probability that the infection at the time of examination was local in nature.

The following treatment was carried out: The patient was etherized and five drachms of a 3 per cent. solution of carbolic acid was injected into the skin and superficial fascia, so it would completely encircle the arm one and one-half inches above the

infiltrated tissues. The bullæ over wrist and back of forearm and a ring of healthy tissue around each of these were excised down to the deep fascia. The infection did not seem to go below the deep fascia except over the radial artery just above the wrist. This suspicious tissue was removed, and in doing so the radial artery was wounded. After tying both ends of the artery, several syringefuls of a 3 per cent. solution of carbolic acid were deeply injected into the tissues around the areas removed. After this was completed, long multiple longitudinal incisions were made into the œdematous tissues, allowing a large quantity of clear yellow serum to exude.

The tissues, on incision, presented a yellowish color, gelatinous and very friable. At no point was any pus found. The limb was then wrapped in hot antiseptic fomentations, placed on a pillow, and surrounded by hot-water bags.

At the end of the operation the patient was severely shocked and intravenous infusion of salt solution was then given by Dr. Anderson.

The patient received free stimulation-strychnia and atropine, and every three hours, while he remained in the hospital, received a hypodermic injection of 30 minims of 3 per cent. carbolic acid.

The patient was transferred to the Municipal Hospital the following morning after the operation. His condition on removal was fair.

On February 23, 1905, was received a report from the State Board of Veterinary Medical Examiners, stating that the body of the cow skinned by the patient showed lesions of anthrax.

Dr. Schwartz said that most authorities advise excision[1] of the malignant pustule and cauterization with pure carbolic acid.[2] Tillmans, of Leipsic, holds that anthrax remains local longer in man than in animals; hence, excision and cauterization should be employed in human anthrax. He excises the area of infection, going well into healthy tissues, and cauterizes it, then injects in and about it a 1 to 1000 solution of bichloride of mercury and a 5 per cent. solution of carbolic acid. By this treatment,[3] Lenoyel and Koranyi lost but thirteen cases out of 142. Müller,[4] in opposition to the above treatment, says that it is impossible to destroy the disease by excision of the seat of inoculation. In guinea-pigs, amputation of a limb performed a few hours after inoculation fails to prevent the disease. His belief is that treat-

ment should aim to make the cells about the inoculated area prevent dissemination of the bacteria and protect the body. The products are injurious, if absorbed, but they also tend to destroy the bacteria, hence excision is harmful.

Müller's treatment is as follows: Immobilize the parts, and elevate, if an extremity, apply mercurial ointment and give alcohol internally in large doses. He describes thirteen cases successfully treated by the above method. Notwithstanding the above, the majority of reports lean towards excision with cauterization of the infected area.

Cauterization with cautery, pure carbolic acid, caustic potash, hydrochloric acid, acid nitrate of mercury, and, in fact, every caustic substance known, has been either tried or suggested.

Medical Treatment.—Muskett [5] notes the treatment of fifty cases by simple applications of ipecac to the area of infection without excision, and without a fatal result in any case.

Laboratory experiments have shown that powdered ipecac will destroy the anthrax bacillus, but has no effect on the spores, and in the body sporulation does not take place.

Injection Method: Scharnowski [6] reports the treatment of fifty cases by carbolic acid injections, with a mortality of 2 per cent.

Graef [7] reports the treatment of 384 cases by cauterization with caustic potash, with a mortality of 5 per cent.

The treatment by caustics is, however, very painful, and, after all, it seems impossible to say which treatment is best for all cases, for each individual case must necessarily be considered as standing absolutely alone.

Dr. B. F. Royer stated that on admission of the man to the Municipal Hospital, smears made from scrapings from the floor of the extirpated areas, and smears of blood made from a finger prick, failed to show anthrax organisms. The blood count at this time showed: Leucocytes, 19,400; erythrocytes, 3,210,000.

Hæmoglobin not estimated.

Differential count (600 cells count); polynuclear leucocytes, 87.68; large lymphocytes, 7.66; small lymphocytes, 2.66; eosinophiles, 2.00.

Urine Analysis.—Chemical Examination. Amber, acid, 10.12, no sugar, albumen.? Microscopic Examination. Leucocytes. Numerous hyaline, epithelial, and granular casts. Urine

centrifuged, and the sediment examined for anthrax organisms with negative result.

Smears and cultures made at this time from the nasal secretions from the saliva and from the fæces failed to show anthrax germs.

Second day after admission, tenth day of the disease, physical condition improved; pleuritic pain less marked; pulse of better volume; temperature normal; urine loaded with hyaline and granular casts.

Eleventh day of disease, third after operation, abdominal distress and frequent desire for stool suggests mercurial poisoning. Salt solution substituted for the arm. Blood culture made second day after admission negative.

From this time on nothing of very great interest resulted. Leucocyte count, sixth day after admission, fourteenth day of disease, is 20,400. Erythrocyte count, 3,400,000. Urine still filled with hyaline and epithelial casts. Anæmia probably due to nephritis. For the next few days the kidneys were somewhat erratic, 111 ounces being voided on the seventh day after operation and 128 ounces the ninth day after operation. General condition seems to be good.

Blood culture made nine days ago still showed no growth.

From this time until the forty-fourth day of his disease nothing worthy of special consideration occurred. He was detained at the Municipal Hospital thirty-five days, while the wounds from operation were healing. On being discharged, he returned to Professor Keen's clinic, where he was shown to the students.

Dr. Royer remarked, further, that the most marked advance in the treatment of anthrax has been made in Italy. In America, where the disease but infrequently occurs, we are apt to lose interest in the disease, or we may fail to keep in touch with the most recent advances in its treatment. This disease has long been considered a surgical affection. The day seems to have dawned, however, when a more scientific treatment is available. This newer method of serum treatment was introduced by Professor A. Sclavo, of the University of Siena, in 1897. The underlying principle with this therapy, and in fact with nearly all serum therapy, is to get from a susceptible animal the substance manufactured by that animal in acquiring a tolerance to many times its fatal dose of toxin.

Sclavo's [8] method of producing this serum is based on vaccination and upon immunization by toxin injection. He first vaccinates an ass with an attenuated anthrax culture, and in ten or twelve days with a more virulent culture. So far, then, the process is like vaccination in principle. The object is to protect against a dangerous disease by deliberately inoculating with a harmless disease. This is the method practised by veterinarians in immunizing herds. The next steps are to use virulent cultures of anthrax in increasing quantities until enormous doses can be tolerated. This is comparable to the process in making diphtheria antitoxin, but differs from it as follows: In inoculating horses, to make antidiphtheritic serum the toxin only is used. This germ can readily be separated from its toxin. Not so, however, with anthrax. Here we have an intracellular toxin. (At least it appears to be intracellular in artificial media.) For this reason it is necessary to inject the entire culture. The process and results, however, are very similar to that of making diphtheria antitoxin. After a period of several months of such treatment, the ass is bled, and the serum separated from clot is preserved by adding ether to the extent of 3 per cent. of its bulk. The serum is now tested on rabbits by first inoculating a series for controls and an equal number for treatment with 5 cubic centimetres of a suspension of a culture of anthrax grown on agar for two days. The test rabbits are given at the same time 10 cubic centimetres of the prepared serum, usually by injection in an auricular vein. This testing, you see, is similar to the test for diphtheria antitoxin. If the controls all die and the treated ones are all protected, the serum is regarded as high grade. As yet, Sclavo seems to have no method of standardizing as we have in the production of diphtheria antitoxin.

Sclavo's [8] present contentions are as follows: (1) The serum is innocuous even in large doses; (2) it can be well borne, even when introduced into the veins; (3) no case taken in an early stage and of moderate severity will be fatal if treated with the serum; (4) by its means some cases may be saved when the condition is most critical (he narrates one case in which a woman recovered after bacilli were found both in the blood and urine, and another in which they were present in the urine); (5) when injected into the veins it quickly arrests the extension of the œdematous process, so as to reduce notably the danger of suffocation which is present in many cases when the pustule is situated on the face or neck; (6) if used early enough, it reduces to a minimum destruction of the tissues when the pustule is localized, and thus diminishes risk of deformity; (7) persons attacked appear to become convalescent almost at once. The dose of serum recommended in ordinary cases is 30 to 40 cubic centimetres subdivided into three or four injections, subcutaneously into different parts of the abdomen, and followed in twenty-four hours, if there has been no improvement, by further injection of 20 to 30 cubic centimetres. In very grave cases he recommends intravenous injection, preferably into one of the superficial veins on the back of the hand, of 10 cubic centimetres, followed in an hour or two, where no improvement is shown, by another similar dose.

Bandi [9] reports two cures. In one cauterization had failed. There was œdema of the entire arm, the glands in the axilla were as large as a hen's egg. Fever, 104° F.; pulse rapid and intermittent and patient in coma. Anthrax organisms were found in blebs surrounding the cauterized areas and in the blood by culture. In this case 150 cubic centimetres of a serum, prepared by using a sheep and Sclavo's methods, were given intravenously, and followed later on the same day by 50 cubic centimetres intravenously.

In his second case, with temperature 103° F., rapid, irregular pulse, swelling and œdema of the arm, and with a positive blood culture, cauterization, and 80 cubic centimetres intravenously and later 30 cubic centimetres subcutaneously, promptly cured the patient.

Recently, Lockwood [10] and Andrews treated a case of malignant pustule of the cheek with 40 cubic centimetres. Sclavo's serum injected subcutaneously. No other treatment was given; the œdema increased, the enlarged glands subsided. Recovery most satisfactory.

Bowlby and Andrews [11] report a case of malignant pustule of the forehead treated with Sclavo's serum and recovery. In this case the glands at the angle of the jaw were much swollen. They rapidly subsided. The œdema extended for a time after treatment was begun. Recovery was satisfactory in every particular. No other treatment was given.

Legge [12] has studied a series of cases treated by Sclavo and others in Italy, and those treated in England since July, 1904.

His study, reported in his Milroy Lecture, would encourage one to recommend anti-anthrax serum as almost a specific against this dreaded disease if given early. If given late, it may be necessary to practise excision or free drainage in addition to serum therapy.

From the data presented by Legge, Bandi, Soberheim, and Sclavo it would appear that the time had come when we in this country should have a supply of anti-anthrax serum kept by health boards or research laboratories where it might be gotten in a few hours by those called upon to treat anthrax.

When this case was sent to the Municipal Hospital, he communicated with Parke, Davis & Co., H. K. Mulford & Co., the Marine Hospital Laboratory, and through Dr. Cairns, of our health office, with the Bureau of Health of New York, but could find no serum in this country. This patient's treatment consisted of stimulation with whiskey, strychnine, and quinine, carefully looking after the emunctories and diet, and flushing him with large quantities of water. When evidence of mercurialism developed, the bichloride dressing was omitted. Salt solution was used for twenty-four hours, and then potassium permanganate, 1 to 5000, as a wet dressing. Later, a 1 to 8000 bichloride dressing was used until the arm was nearly healed. Where the indurated areas were dissected out, curettement was required, and, later, stimulation with silver nitrate brought granulations to the surface.*

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Dr. W. W. Keen said that when the resident physician notified him by telephone of the patient's admission, he at once suspected some animal disease, as anthrax or actinomycosis, and directed that a bacteriological diagnosis should be made at once. The subsequent history shows that we now possess a thorough means of prompt diagnosis, as within one hour the examination had been made and anthrax bacilli found. Dr. Keen saw the man one and one-half hours after admission. A slight pimple had been present on the wrist, but no pustule. The most conspicuous features were a number of large blebs and an enormous œdema of the arm. At the deltoid insertion the arm was fully one and one-half times as large as immediately above that point. The case then was one of anthrax œdema. The communicability of the disease to others demands attention. This patient was isolated, and the operation performed in the same room rather than in the operating-room. Afterwards the bacilli were repeatedly recovered from the room, five separated disinfections being required to remove them; removal of the floor was at one time seriously contemplated. This shows the great importance of investigating rooms where fluids have fallen during operation, as otherwise subsequent patients might very easily obtain anthrax infection. Dr. Keen has communicated with Dr. Abbott, of the Philadelphia Bureau of Health, who has taken steps to secure from Professor Sclavo, of Italy, some of the serum which has been used with such good results. It is hoped that the serum may be kept on hand to use in future cases.

Dr. De Forest Willard believed that even when serum treatment is employed, the original point of infection in anthrax should be excised in order to get rid of all the infection possible. He detailed a very severe case that occurred in a wool-sorter. There was a pustule with blebs and an ulcer of the cheek; anthrax bacilli were present in great numbers. Immediate diagnosis was followed by immediate removal of the pustule and by cauterization. Though there was great local œdema, speedy amelioration of the local symptoms followed. The patient, however, apparently infected his food, and in two or three days there was enormous distention of the abdomen with tormina and tenesmus, twenty or thirty stools occurring daily. Suppuration followed, and three quarts of pus were removed from the abdomen and several ounces from the scrotum. For weeks the patient was

almost at the point of death, but he finally recovered. Antistreptococcic serum was employed during a week or two, but incision appeared to do the most good. The patient was isolated and none of the attendants became infected. The room was thoroughly disinfected, and no other case developed.

Dr. John H. Jopson spoke of the frequency of anthrax in Philadelphia; he regards it as more common than most physicians suppose. He saw and reported a case some years ago from the Episcopal Hospital dispensary, it being the first of a small series of cases occurring among the morocco workers in that neighborhood. Mutchler, Miller, Willard, and Given have also reported cases, at least eight, occurring during the past ten years. Three were treated in their own homes by hypodermic injections of carbolic acid and recovered.

Dr. Royer, in closing, said the precautions taken with the patient at the Municipal Hospital consisted in keeping him in a tent and disinfecting the discharges with 3 per cent. solution of carbolic acid for one-half day. The nasal secretions and sputum were collected on gauze and immediately burned. The linen was soaked one-half day in 3 per cent. carbolic acid, then steam sterilized, boiled, and washed. The question of disinfecting the outfit when the patient left the hospital was solved by placing the tent, bedding, and other contents in the large steam sterilizing apparatus used in disinfecting clothing for the city and subjecting them to live steam, under five pounds pressure, for one hour on each of three days. Three test objects containing anthrax bacilli were also exposed, one being removed at the end of each sterilization; the bacteria were all destroyed. The bedding has since been used with no untoward result.

FILLING DEFECTS IN THE SKULL BY BONE CHIPS FROM THE OUTER TABLE OF THE NEIGHBORING BONE.

Dr. W. W. Keen reported the case of a man, aged twenty-four years, first seen by him September 15, 1903.

Three years previously he had received a violent blow from a golf-stick on the forehead just below the border of the hair and about 1 centimetre to the right of the median line. The golf-stick was broken and a portion of it was left sticking in the wound. He was knocked down by the blow and stunned. With assistance, in a few minutes he got up and walked to the house.

He was never unconscious, was never sick enough to be in bed. A local doctor who was called seized the bit of golf-stick, pulled it out, and sewed up the wound. Healing took place by first intention, and the wound never gave him the slightest trouble in the way of headache, pain, or other disturbance until about a month ago, when a small abscess formed at the site of the accident and discharged a little pus. The day after the accident he went with a party of young people on a "hay ride." Neither he nor his doctor or friends had the least idea that his skull had been fractured.

Examination revealed, just below the border of the hair, a scar about 3 centimetres long and at its middle a sinus, the result of the old abscess. A probe discovered some bare bone.

An incision was made in the line of the old scar, which disclosed an unsuspected triangular bit of wood 1.5 centimetres long, 8 millimetres broad, and 4 millimetres in thickness. As soon as this was removed, it was apparent that it had filled up a depression which was 1 centimetre deep. At the time he received the blow, the skull had been fractured with depression of the fragment, and implantation of two pieces of the golf-stick in the wound. One piece had been removed, and this second piece of wood, together with the tissues about it, filled up the depression, so that no irregularity existed on the surface.

Inasmuch as Dr. Keen had seen two cases of fibroma and sarcoma result from such a depression of the skull, and epilepsy in many other instances, he deemed it essential that the depressed portion of bone should be removed. Accordingly, he carefully chiselled the depressed portion through until he reached the dura, and then by means of the rongeur forceps removed all of the depressed bone. The depressed portion exercised considerable pressure on the dura. In removing it he had to uncover the superior longitudinal sinus. The opening that he made was 3 by 2 centimetres.

The patient made a prompt recovery without any rise of temperature whatever.

A second operation to fill in the aperture in the skull was done February 23, 1904. He first made a flap, including the old scar and the scalp on each side of it, by a semicircular incision with its convexity posterior, the ends of which barely reached the border of the hair; the rest of it being therefore covered by the

hair. From this first incision he made a second directly backward. Dissecting these flaps away, he was able finally to lay bare the dura and the healed margins of the opening. By the rongeur forceps he made the margin raw all around the opening. He then chiselled a number of pieces from the outer table of the skull under the flap that he had turned back and filled in the opening in the skull entirely. The flaps were then replaced and sewed together, a small bit of folded rubber dam serving as a drain for twenty-four hours.

The man made a perfectly smooth recovery without any rise of temperature. On the ninth day he went home. The ugly depression on his forehead which had existed prior to this operation had entirely disappeared, and, with the exception of one point where there was a very slight prominence of one of the bone chips, his forehead was entirely normal.

In the autumn of 1904, six or seven months after the last operation, he was seen, and it was found that the inequality in the surface of the skull had entirely disappeared.

Dr. Keen remarked that this case was worth reporting on account of the entirely unsuspected nature of the injury, for no one examining his skull would have supposed that there was a depressed fracture. In addition to this, the mode of filling up the aperture is one which he first proposed probably eight or ten years ago. He had now practised it in fully a score of cases. This is the smallest opening he had filled by these bone chips chiselled from the neighboring outer table. In other cases he had filled in areas 6 to 7 centimetres by 3 to 5 centimetres, in other words, large openings. The skull becomes in time very solid and strong, reproducing practically a normal skull so far as both outline and protection are concerned. The margins of the opening, of course, should always be made raw by the rongeur forceps, and the pieces of bone which fill in the opening should not be too large. He had found the best instruments for procuring them are a gouge and mallet. Never in a single instance had he had any of the pieces of bone undergo necrosis, and so to require removal.

EXCISION OF THE TIBIA.

Dr. Francis T. Stewart said that he was indebted to Dr. Le Conte for the privilege of operating upon and reporting the following case:

The patient is a Polish boy, aged ten years, from whom it was difficult to obtain any definite history. About seven months ago the right knee and leg suddenly swelled and became excessively painful. The patient was confined to bed for several weeks with marked constitutional symptoms, and has not been able to use the leg since. There is no history of injury. At the time of operation, the entire tibia and the lower end of the femur were markedly thickened, and the knee was ankylosed at an angle of about 40 degrees. Along the course of the tibia were numerous sinuses leading down to necrotic bone. Under ether a feeble attempt to straighten the knee resulted in a fracture of the femur just above the condyles, thus allowing the limb to be fully extended. An incision was made down to the tibia from the knee to the ankle and the entire diaphysis excised subperiosteally, leaving the lower epiphysis and a shell of the upper. In curetting the upper epiphysis the instrument at one point entered the knee-joint, which was found to be filled with hard, fibrous tissue. The entire wound was packed with sterile gauze and the limb placed in a fracture-box. Bacteriological examination of the specimen showed the infection to be that of the Staphylococcus pyogenes aureus.

Dr. Stewart said that he had had two other similar cases, one concerning the tibia and the other the fibula. The tibial case was a boy of twelve years who developed an acute osteomyelitis following a trivial injury. The limb was treated for four weeks with poultices, at the end of which time he saw him and excised the bone subperiosteally, saving the upper and lower epiphyses. At the end of six months the tibia had regenerated and was much thicker than normal. There was a little flexion of the knee and a slight varus of the leg, but withal a useful limb. In the fibular case, a boy of nineteen years, a contusion of the outer side of the leg was followed within a few days by marked constitutional disturbance, which was diagnosticated typhoid fever. Four months later he saw the patient, and removed the bone subperiosteally, excepting a small portion of the upper and lower ends. The infection in this case proved to be the Staphylococcus pyogenes aureus. The bone regenerated promptly, and the patient returned to his work as a laborer at the end of six months.

At the 1904 meeting of the American Surgical Association, Dr. Johnson read a paper on this subject, and among other points

emphasized the following: Regeneration in all his cases, six in number, was rapid and complete. Deformity never results where a disc of bone is left between the shaft and the epiphysis. The companion bone invariably takes on compensatory hypertrophy. During the operation the periosteum should be spared as much as possible, and the curette should be used very cautiously. The leg should be immobilized in a fracture-box and frequent and rough dressings avoided. The part should be moulded with bandages or adhesive strips as bone tissue develops, and the young bone should be protected by means of plaster of Paris.

Nichols (*Journal of American Medical Association*, February 13, 1904) states that the reason the regenerated bone is at first much larger than the original shaft is that the bone is not completely ossified. In time the size decreases almost to normal, and, judging from skiagrams, a new medullary canal develops. He thinks the best time for operation is about two months after complete drainage of the acute infection.

In regions, such as the thigh or the arm, where there is no companion bone to act as a splint and maintain the length of the part, one should wait until the periosteal shell of regenerating bone is sufficiently advanced to preserve the contour and bear the weight of the limb. Roughly, this stage is reached when the periosteal shell, as determined by the X-ray, is equal to one-fourth of the diameter of the original shaft.

Dr. Robert G. Le Conte said that he had operated upon six cases of osteomyelitis where the whole shaft of the tibia was involved in the disease. These cases varied from the very acute to the very chronic stages of necrosis, the duration of the disease being from five days to seven or eight months. He believes that the deposition of bone from the unremoved periosteum depends upon the length of time the disease has lasted. In the chronic cases, months after the onset of the acute symptoms, the regeneration of bone is reduced to a minimum, while in the acute stages, say two or three weeks after the onset of the disease, the periosteum is in an active state for bone regeneration. In the personal cases mentioned, more or less good bone was formed in four of the patients with useful limbs; partial deposit occurred in one, and in the other no bone whatever was formed.

Dr. De Forest Willard said his experience had not been so favorable, since regeneration of bone is slow and imperfect in old

cases. Osteomyelitis should be treated as is appendicitis, by early diagnosis and early operation within forty-eight hours if possible, not waiting until the case has been treated for months for other diseases, as rheumatism, typhoid fever, etc.

Dr. John H. Gibbon referred to the report of a case by Dr. Huntington, of San Francisco (Annals of Surgery, February, 1905), in which the entire shaft of the tibia had been removed and the shaft of the fibula substituted. After the removal of the tibia the result was not completely satisfactory, and the author divided the fibula near one of its extremities and attached it to the corresponding epiphysis of the tibia. A few months later the other end of the fibula was also divided and attached to the other epiphysis of the tibia. The result of this transference was most satisfactory.

Dr. Stewart, in closing, said that several cases of bone grafting had been reported. The bone is obtained from the same individual or from animals. Morton used in one case bone from a dog, and Senn has employed a similar expedient, using bone from the same individual.

TRANSMESENTERIC HERNIA OF THE APPENDIX VERMIFORMIS.

BY ALFRED C. WOOD, M.D.,

OF PHILADELPHIA.

Assistant Professor of Surgery in the University of Pennsylvania; Surgeon to the University, Philadelphia, and St. Timothy's Hospitals.

A MALE, aged twenty-two years, student, was admitted to the University Hospital, January 7, 1904. He had always enjoyed good health, with the exception of two occasions, viz., the first, four years ago, when he had an acute attack of obstinate constipation and generalized abdominal pain, lasting several days and causing him to remain in bed; the second was a similar attack, nine months before admission to the hospital, associated with influenza and lasting ten days.

About two weeks before the present illness the patient was writing almost all day, and he found, while sitting at the table, that he was comfortable only when the right side was "kinked up," as he expressed it. In this position he did not feel any unusual sensation, but as soon as he assumed a normal posture he was conscious of a distress in the abdomen. Without any other premonitory symptoms he became distinctly ill on the afternoon of January 1, about a week, therefore, after the attack just mentioned. He had headache, nausea, vomiting, and moderate pain in the epigastrium. After retiring in the evening he had a pain in the back and felt chilly, but had no distinct rigor. On the following day there were three bowel movements; the pain in the abdomen continued. There was no definite change on the third day; the bowels moved once. On the fourth day the pain was distinctly in the right lower quadrant of the abdomen. It had been continuous with occasional attacks of general abdominal pain. There was no change on the fifth and sixth days. On the seventh day, after saline purges, there were six watery stools.

The notes made on January 8 are as follows: Pulse, 88; respiration, 20; temperature range 100° to $102^{2}/_{5}$° F. The abdomen is not distended, and there is no rigidity. A rounded tender

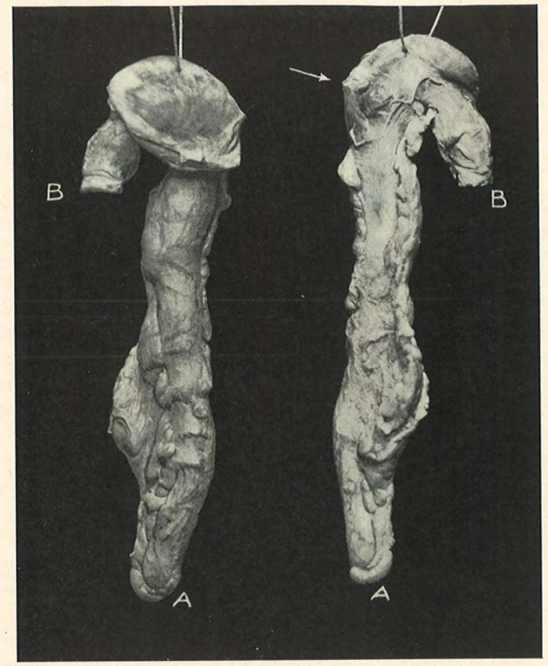

FIG. 1.—Hernia of appendix vermiformis through abnormal opening in mesentery, with strangulation. *A*, The free extremity of the appendix; *B*, the cæcal extremity; the arrow points to the perforation indicated by the small dark spot. The crown, composed of lymph, covers the portion that had protruded through the mesenteric opening.

mass is felt in the abdomen, approximately two inches wide and four inches long, in the line of the ascending colon; the lower border of the mass corresponding with McBurney's point. The leucocyte count is as follows: January 8, 2 P.M., 14,640; 9 P.M., 17,920; midnight, 17,000; January 9, 9 A.M., 16,080. The urine is normal.

Although some of the features were unusual, the condition was thought to be appendicitis, with an abscess. An operation was performed, the peritoneal cavity being opened by an incision over the mass. The latter occupied the normal position of the ascending colon and had the general shape and size of this structure. It was firm to the touch and had a very deep red color. At three or four points areas of softening were seen, suggesting the beginning of breaking down in the mass. While no anatomical structure could be recognized through the incision, the mass was thought to be the colon, altered by inflammatory action and lymph formation. As the appendix could not be found, it was supposed to be in the mass described, but a careful search failed to disclose a trace of this structure. The areas of softening were found to be suppurating, epiploic appendages. By enlarging the incision the survey was extended, and finally the cæcum recognized firmly fixed in its position. The longitudinal bands could be seen here, but were obscured above. The anterior band led backward and upward, and seemed to be lost beneath the mesentery. On inspecting the opposite surface of the latter, after displacing a portion of adherent omentum, a small rounded structure was seen projecting from it. The condition at once became clear; the appendix had slipped through a hole in the mesentery and had become strangulated. It was reduced with some difficulty, owing to adhesions and the firm constriction of the ring. As soon as the appendix was liberated the unusual fixation of the cæcum was relieved. The process was removed. The opening in the mesentery, which comfortably admitted the tip of the little finger, was closed by sutures. A Mikulicz drain was inserted and the wound closed. The patient made an uncomplicated recovery.

As will be seen by consulting the illustration, the appendix was strangulated at its base, the organ having doubled upon itself and slipped into the hole in the mesentery. It had ruptured at the point of constriction. The meso-appendix was unusually large and fleshy.

In addition to the rarity of the condition, the case was interesting on account of the presence of an inflammatory mass quite two inches from the affected portion of the appendix, and an apparently healthy area between. This misleading evidence prolonged and complicated the operation. The minute perforation of the appendix permitted very slow leakage, which, owing to the position of the patient, or other causes, collected on the anterior and outer aspect of the colon, and caused an inflammation of the structures with which it came in contact.

I have not been able to find any reference to similar cases, although instances of strangulation of the intestine in the same manner are recorded.

APPENDICULAR FEMORAL HERNIA, WITH NOTES OF ONE HUNDRED CASES.

BY ALFRED C. WOOD, M.D.,

OF PHILADELPHIA.

In the summer of 1900 the writer operated upon a woman, about 70 years of age, for a painful, fluctuating swelling in the right groin which was supposed to be a suppurating inguinal adenitis. (See Case 99.)

The incision revealed a cavity, containing a small, offensive, gangrenous mass, which proved to be the vermiform appendix. The cavity was found to be the sac of a femoral hernia. The distal half of the appendix was gangrenous; the proximal portion was nearly normal. This was a case of gangrenous appendicitis occurring in the sac of a femoral hernia. Although this case excited a deep interest, no investigation of the subject was undertaken at the time.

In August, 1904, I saw, in consultation, a woman who had a lump in the right groin, which had been present for three weeks. The diagnosis of femoral hernia had been made by her physicians, an opinion in which I fully concurred. (See Case 100.)

At the operation, the swelling was found to consist chiefly of serum, but the sac also contained the entire appendix vermiformis, the base of which was so tightly grasped at the neck of the sac that reduction was impossible until the constriction had been divided.

Although this is a rare condition, I have been able to collect 100 cases, including these two personal experiences, in which the appendix alone occupied the sac of a femoral hernia. All those in which any other portion of the intestine was reported as being present, have been excluded. While an

effort was made to include every case, some, undoubtedly, have been overlooked.

It would be a difficult task to determine who first noted the presence of the vermiform process in the sac of an external hernia. Such observations, however, are not confined to recent times, having been recorded by Garengot (Traité des operations de Chir., 1731, i, 237), and by Sandifort towards the end of the eighteenth century. Tritschler wrote on hernia of the cæcum and appendix in 1806. Rust described (Handbuch der Chir., 1832) hernia appendicularis. Among other contributors to this subject are Klein (1886); Brieger (1893); Bajardi (1895); Spurrier and Corner (1902); Vesignie (1903), and Wassiljew (1904).

In addition to the papers devoted to a more or less formal discussion of the subject, there are a large number of individual cases recorded. This is especially true with reference to "cæcal" hernia, in connection with which the appendix is often found. Hernia of the appendix occurs in both the inguinal and femoral varieties, and either alone or in conjunction with other portions of the abdominal viscera.

The following figures show the relative frequency of the appendix in abdominal hernias: Of 250 cases of radical cure of hernia by the Bassini method, reported by Hoffman, from the Albert Clinic, Vienna, the appendix was found in the sac 9 times. Of 1586 hernias operated upon in the clinic of Professor Colzi, Florence, the appendix was present in 27. Wassiljew reports 106 Bassini operations, in which the appendix was found 3 times. Coley met with the appendix, alone or with other viscera, 16 times in 1003 operations for the radical cure of hernia. Bundschuh (Heidelberg clinic) met with the appendix 3 times in 109 consecutive operations for strangulated femoral hernia. Combining these figures, the appendix was found 58 times in 3054 hernias,—once in about 53 cases. No figures are at hand to show the proportion of hernias in which the appendix alone is found in hernial sacs.

The relative frequency of pure appendicular inguinal and femoral hernias might be expected to preserve about the same

ratio as that which exists between the usual forms of these two varieties, but the few figures at hand lead to a rather different conclusion. In Brieger's collection of 35 cases of hernia of the appendix, 20 were inguinal (19 right and 1 left), and 15 were femoral. In 98 cases, Bajardi found 54 inguinal and 44 femoral. Of 145 hernias containing the appendix alone and with other viscera collected by Spurrier and Corner, 71 were inguinal and 69 femoral.

In Gibbon's collection of 63 "cæcal hernias," 56 were inguinal and 7 were femoral. Of the latter, 4 (3 right and 1 left) contained in addition to the appendix, other portions of the bowel, while 3 (all right) contained the appendix only. Of the 56 inguinal hernias, 32 (28 right and 4 left) contained intestine in addition to the appendix, and in 9 (8 right and 1 left) the appendix alone was found. It will be observed that the appendix was present in all the femoral hernias, but was absent in 15 of the inguinal hernias. In this collection of "cæcal" hernias the ratio of the femoral to the inguinal variety is as 1 to 8; of pure "appendicular" hernia it is 1 to 3; in Spurrier and Corner's, it is about equal. In Brieger's collection (appendicular) it is 3 to 4; in Bajardi's (also appendicular) it is 4 to 5. It must be borne in mind that different collections of cases do not always lead to the same deductions, but as far as these limited figures may be accepted, they show that cæcal hernia is about 8 times as frequent in the inguinal variety as in the femoral, while in pure appendicular hernia, the proportion is nearly equal.

Another interesting point concerns the relative frequency of cæcal and appendicular hernia in the two sexes. Of Gibbon's 56 cases of inguinal hernia, but one occurred in a woman, and that was a pure appendicular hernia; therefore the table does not contain a single example of inguinal "cæcal" hernia in the female. The seven cases of femoral hernia all occurred in women. Spurrier and Corner's cases include only those in which the appendix in a hernial sac gave rise to at least a part of the symptoms. Including both the inguinal and the femoral varieties, there were 52 males and 61 females.

Of the 100 cases of appendicular femoral hernia appended to this paper, 81 were in women, and 7 in men; the sex not being given in 12.

An important difference between cæcal and pure appendicular hernia concerns the age of the patients. Gibbon quotes the combined experience of Coley and Halsted (1898), a total of 642 herniotomies, in which the cæcum or appendix was found in the sac 21 times, and in but 3 of these was the patient over 15 years of age. It should be stated that 16 (but 1 being over 15 years of age) of these were reported by Coley, whose work has been largely among children. Of Gibbon's 63 cases, 36 were under 15 years of age, 5 between 15 and 40, 7 between 40 and 50, and 15 past 50 years. Over one-half, therefore, were less than 15 years of age, and 60 per cent. were under 40.

In marked contrast are the cases of appendicular hernia here reported. The age is given in 77 instances. The youngest patient was 19 years of age, five were in the third decade, five in the fourth, twenty-five in the fifth, eighteen in the sixth, thirteen in the seventh, nine in the eighth, and one in the ninth; the latter patient being aged 87 years. More than one-half of the patients were over 50 years of age, and over 85 per cent. were past 40 years. This varies slightly from the statement made by Spurrier and Corner, that the maximum frequency occurs in the sixth decade, although this refers to cases accompanied by intestine in the hernia.

Any consideration of the etiology of appendicular hernia must first admit a low position and a definite degree of mobility of the cæcum and appendix. Given these conditions, the subsequent steps will probably be determined by the attending circumstances. It is certain that all do not develop in the same way. From a study of the appended cases, it seems permissible to assume the following types:

1. The hernia (probably cæcum and appendix) develops in the usual manner,—*i.e.*, it is either congenital, or a freely movable cæcum and appendix is situated low down, in contact with a weak internal abdominal ring, when some severe strain or jar, or a series of such accidents, develops the rupture. The hernia is at first reducible, and usually returns to the abdomen when the patient is in the recumbent position. If the hernia is not kept up by a truss, sooner or later the appendix becomes adherent to the sac. In this condition the hernia is but partially reducible, the bowel escaping from the abdomen to the hernial sac and returning, according to the position of the individual, while the appendix remains fixed. In these cases the patient frequently notes that "the lump gets smaller on lying down, but does not entirely disappear." Either as a result of wearing a truss, or of contraction of the neck of the sac from natural causes, the cæcum may cease to descend, leaving the appendix as the sole structure involved in the protrusion. The neck of the sac may continue to contract, causing incarceration or strangulation of the appendix, or the latter may become the seat of inflammation. In either of these conditions, acute symptoms develop promptly.

2. It is conceivable that a congenital hernia, or one occurring early in life, may appear to have cured,—that is, may cease to come down, but yet leave a sac and small, but patulous canal in which the appendix could engage under favorable circumstances. In some of the cases the abdominal symptoms,—pain, constipation, and vomiting,—indicating incarceration or strangulation of the appendix, occurred before the hernia was observed; in others the lump appeared some days or even weeks before the onset of acute symptoms. In either event, it would appear that there must have been a hernial sac present, or the appendix could not have escaped so freely and suddenly from the abdomen.

3. One is led to ask if a hernia is ever appendiceal primarily? The history of some of the cases appears to justify an affirmative reply (*vide* Cases 4 and 82.) Whether an incomplete hernia exists, which suddenly becomes complete; or whether the appendix, lying either in the inguinal or femoral fossa, is suddenly and forcibly protruded through the respective canal, carrying the adjacent parietal peritoneum before it, must probably remain a matter of conjecture. The writer believes the former is the more reasonable explanation.

The symptoms of appendicular femoral hernia as noted in the following cases, vary greatly: A lump was present in the groin in every instance. In some it had existed previously; in others, it first appeared with the onset of acute symptoms for which the operation was performed. An impulse on coughing was rarely noted at the time of onset of the acute symptoms. In a number of cases the lump was the only symptom, but the majority exhibited in addition one or more of the following: Fever, loss of appetite, nausea, vomiting, in some cases stercoraceous, constipation, colicky pains, violent hypogastric pain, distention, frequent and difficult micturition, drawing sensation in lower part of the abdomen, pain in the right hip joint, restricted movement of the thigh, and flexion of the thigh.

It seems worthy of mention that involvement of the appendix alone, in some instances, gave rise to symptoms characteristic of strangulated intestinal hernia,—*e.g.*, nausea, vomiting (even stercoraceous), constipation, and distention. This is evidently the result of reflex nerve action, as it is improbable that any organic obstruction is caused by the incarceration of the appendix. An unexpected manifestation was flexion, and restricted movement of the thigh. This condition is probably due to contraction of the appendix after it has become adherent to the sac, so that full extension of the thigh would make undue traction on the cæcum.

The duration of the acute symptoms was stated in 50 of the cases. It varied from a few hours to five weeks. The majority was less than three days; and three-fourths, five days or under. Of the more frequent symptoms, nausea is noted eleven times, vomiting twenty-five times, and constipation fifteen times.

The condition of the appendix was said to be normal, or nearly so (mere congestions included) in eleven, inflamed in four, adherent in seventeen, incarcerated in twenty-two, strangulated in eighteen, perforated in sixteen, ulcerated in five, gangrenous in twenty. It will be understood that two or more of these conditions were sometimes noted in the same case.

In 52 instances the appendix was removed; of these, three died. In 17, the appendix was reduced; all recovered but one. There were 8 other fatal cases, but in these the disposition of the appendix is not given.

In his work on appendicitis, page 186, Sonnenburg says he does not accept the view that a "normal" appendix becomes strangulated. The latter condition, in his opinion, is always due to inflammation. Wulff takes the opposite view, claiming, in his case, that the appendix was perfectly normal except for the constriction and its results. I believe the weight of the argument is against Sonnenburg. Some difference of opinion may arise from the rather confusing and sometimes indiscriminate manner in which the terms "incarceration" and "strangulation" are employed. But as the second condition is simply an advanced stage of the first, no sharp distinction need be drawn in the present discussion.

One may well imagine a small hernial orifice barely large enough to admit the appendix into which the latter may become engaged during some violent effort of the individual. Owing to the dependent position and perhaps the pressure of organs above, the circulation of the appendix is somewhat embarrassed, and slight swelling ensues. This causes a little constriction at the neck of the sac, and still greater swelling results, each condition aggravating the other. In the presence of marked congestions, as is well known, inflammation of the appendix is easily established. In this way the inflammatory cases are explained. It is equally obvious that an appendix in the sac of a hernia may become inflamed from other causes, resulting in swelling and subsequent strangulation.

That it is unsafe to assume that every case of incarcerated or strangulated appendix is inflamed, appears from a reference to the cases. In 17 instances the appendix was returned to the abdomen, and but one death followed. This was reported by Dieffenbach in 1848. In this case the appendix was clearly not in a condition suitable for reduction. If the naked-eye appearances may be trusted, the appendix was normal in a number of instances; it is also significant that no trouble resulted in

the 16 cases in which reduction was performed. Surely some of them would have given symptoms if they had been returned to the abdomen in an inflamed condition.

There appears to be no signs by which appendicular hernias may be recognized. In my first case the conditions suggested an abscess: in the second, the sac was so tense that no information as to its contents could be obtained. Coley has been able to recognize the appendix in the hernial sac by palpation, but this would manifestly be possible in but a few of the cases. Usually tension, fluid or inflammation would interfere with this test. Both Koelliker and Muus are of the opinion that the presence of the appendix in the hernial sac causes the patient to walk with the body inclined forward, and that this posture is an important aid in making the diagnosis. This symptom can be explained only by assuming that the appendix is adherent to the sac and that when the patient attempts to take the full, erect attitude, traction is transmitted from the mesocolon, through the cæcum, to the appendix. This condition was noted in a few instances, but so infrequently that it cannot be looked upon as a symptom, except in those cases in which adhesions, incarceration, or strangulation exists. It is not probable, therefore, that many of these cases will be recognized before operation.

The treatment of hernias in general is divided into the palliative and the radical, and the appendicular hernia if recognized would be treated upon the same lines as the other forms.

The proper disposition of the appendix, when found at operation in the sac of a hernia, must be decided by a consideration of both the general and local conditions.

In discussing treatment, the cases may roughly be divided into three classes:

First.—Those in which the appendix is normal or but slightly congested from mild constriction. In this class, removal of the appendix is to be preferred, if the attending conditions are favorable; that is, if the entire process and its attachment to the cæcum can be exposed in the wound, rendering the operation easy, and free from risk to the patient. This

is much more apt to be the case in inguinal than in femoral hernias. When the base of the appendix cannot be exposed, the hernial canal may be enlarged by a small incision, if the patient's general condition justifies prolonging the operation. (See Case 99.) Cases will be met with in which this additional interference will be contraindicated, as in Case 99. In such instances, the appendix may safely be returned, if in a normal condition, as pointed out above. In older subjects the danger of subsequent appendicitis is much less than it is before middle life. A radical cure should be attempted whether the appendix be returned to the abdomen or removed.

Second.—Cases in which the appendix is firmly adherent to the sac, or is the seat of distinct inflammation. In these instances the organ must be removed, as the danger of returning it would be greater than the risk attending its removal. Great care is necessary, in the highly inflammatory cases, to avoid infecting the peritoneal cavity. A radical cure should conclude the operation, unless the amount of infection present demands free drainage.

Third.—Cases in which the appendix has perforated and fecal mater has escaped into the sac, or in which an abscess has formed. In this class the greatest nicety of judgment and precision of operative technique will be required to deal effectively with the conditions and yet avoid infecting the peritoneum. When the distal portion only is involved, it may be possible to ligate at the base and remove the affected part. In the particularly bad cases the sac should be laid open widely and sponged out carefully; the appendix should then be drawn out as far as possible and held in this position by sutures. In this way, the abdominal cavity is shut off. Of course, this presupposes that the peritoneum has not already become infected. In these cases the external wound must not be sutured, but should be allowed to heal by granulation. In many instances the wound will heal leaving the cæcum adherent at the internal hernial orifice, which, as a rule, will cause no inconvenience; or a fecal fistula may remain, which can be closed by operation at an appropriate time subsequently.

A study of the cases that follow will show that:

1. Appendicular hernia is more frequent than has been supposed.

2. When occurring in conjunction with the cæcum, no special considerations may be involved; but when occupying the sac alone new problems of treatment are introduced.

3. The appendix is more apt to be found in femoral than inguinal hernias. It has occasionally been observed on the left side.

4. A herniated appendix is apt to become adherent and inflamed, and, as a matter of clinical experience, this danger appears to be greater when it occupies the sac alone than when it is accompanied by other portions of the intestine.

5. The diagnosis of appendicular hernia has not been made, as a rule, before operation.

6. In all cases operated upon it is desirable to remove the appendix unless the patient's general condition or safety contraindicates this course.

REFERENCES.

1. Aly (Münch. Med. Woch., 1898, 45, 1656) reports a case in which the vermiform appendix had a perforation at its apex. The entire appendix was found in the sac of a femoral hernia. Result not stated.

2. Annandale (Lancet, London, March 30, 1889, page 627). Mrs. M., aged 60 years, noticed a swelling in right groin twenty years before, but it gave no trouble. Thirteen days ago the swelling increased in size, became tender, and caused a little fever. Soothing applications were applied. A diffuse inflammatory swelling was present in right groin and all signs of diffuse suppuration; some nausea, but no obstruction. Operation: Free incision, keeping in view history of hernia. Cavity, not markedly circumscribed, contained pus and blood. Well-defined round tumor, size of a mandarin orange, exposed. This proved to be sac of a femoral hernia; walls much thickened by inflammation. Sac opened; pus and blood flowed out. Only other object was appendix, thickened and congested. Base firmly adherent to inner aspect of neck of sac, and thoroughly plugged it. Base of sac and appendix firmly ligatured with catgut and cut away. Base of stump sutured by two or three subcutaneous sutures as in radical cure. Wound soundly healed January 19.

Appendix removed measured three and a-half inches. Small perforation about one inch from tip.

3. Bajardi (Lo Sperimentale, 1895, 330) reports the case of a woman of 42, with a right femoral hernia and the phenomena of incarceration and inflammation. Herniotomy was performed; the sac was found to be one mass of exudate, in the midst of which was an adherent appendix. This was excised, the sac sutured, and drainage inserted. The patient recovered.

4. Barth (Deut. Zeit. f. Chir. 1902, 149) reports the case of a woman of 80, who had been suddenly taken with pain in the upper part of the right thigh while lifting a heavy load. There were neausea, loss of appetite, vomiting, absolute constipation, and inability to pass flatus; also colicky pains, especially in the lower part of the abdomen. Eight days after the appearance of these symptoms, a diagnosis of incarcerated femoral hernia was made. At that time the mass was the size of a pigeon's egg. The skin was slightly movable and not reddened. The tumor was hard, and swollen lymph-glands surrounded it. Palpation was painful. There was some distention of the abdomen. The patient had never suffered with a rupture before. The operation was performed on the eighth day, under Schleich's anæsthesia, and some swollen lymph-glands were removed. Upon opening the hernial sac, turbid fluid escaped. The only structure in the sac was a loop of the vermiform appendix, 10 cm. long, gangrenous, and much distended. The incarceration was so tight that it was difficult to pass a probe alongside of the appendix. There were no adhesions except in the neighborhood of the internal ring. By breaking these up, a small abscess, containing foul-smelling green pus, was opened. The appendix was amputated. The resected appendix was 16 cm. long, 10 of which were incarcerated. The patient died some weeks later, of senility.

5. Battle (Lancet, 1899, 1, 1223). Woman, aged 59; swelling in right groin for five years. It caused some difficulty at one time, which subsided in three weeks. Ten days ago it reappeared without apparent reason. Pain, no vomiting, no constipation, mass irreducible, pressure in right iliac fossa caused sensation of dragging on swelling, no fluctuation. Operation: Some inflamed glands; appendix in sac. Appendix and adherent sac removed. Recovery.

6. Bayer (Centralbl. f. Chir., 1876, vol. xxxi, page 689). Appendix strangulated in right femoral sac. Local pain and swelling. (Quoted by Eccles.)

7. Bayer (Prag. med. Woch., 1886, xi, 221) reports the case of a woman of 27 years, who complained of having had a small mass in the right groin for several weeks. Its origin was unknown. There was pain radiating along the right limb and the right side of the abdomen. The patient was able to pass gas and stools. She could not move the right leg as freely as usual; the mass enlarged gradually. A diagnosis of hernia was made. The hernia was irreducible and inflamed. An incision was made over the mass, and the hernial sac was found to contain bloody, serous fluid. The hernial contents consisted of fibrin and a small piece of intestine, circularly constricted at the hernial neck. The loop was the size of the little finger, and not movable. The crural ring was split, the adhesions severed, and the loop of intestine found to be a

small portion of the vermiform appendix. This was reduced, and the patient recovered. The wound was permitted to granulate.

8. Bender (Bull. et Mem. de la Soc. Anatom. de Paris, 1900, vol. lxxv, 756). The patient was a woman, with a tumor the size of a nut on the inner side of the right thigh. It was hard, painful, and dull on percussion. There was no impulse on coughing. A diagnosis of inguinal adenitis was made; hernia being excluded by the absence of impulse.

Suddenly, violent abdominal pain was felt, followed by distention and absolute constipation. The diagnosis of strangulated femoral hernia was then made, and operation performed. The sac contained a quantity of yellowish fluid and the appendix. The latter, which was ligated and removed, measured 12 cm. In the tip a little pus was found. The patient recovered.

9. Bennet (Med. and Surg. Reporter, Phila., 1882, vol. 47, 396). Man, aged 64 years; lump in right groin for three years. On February 9, 1881, violent pains in hypogastrium. Called physician, who found lump size of hen's egg in right groin. Not painful; felt like large glands. Supposed to be hernia.

Taxis. laxatives, enema, etc., all ineffectual, but latter caused pain. Vomiting set in and became stercoraceous on 11th. Operation on 12th: Free end of appendix in *gangrenous* condition in femoral hernia. Patient recovered.

10. Bidwell (Trans. Clin. Soc. 1897, xxx, 186). Woman, aged 50; reducible right femoral hernia for seven years; for past fourteen days it was irreducible; no symptoms of strangulation. The hernia was tense, the size of a hen's egg, and slightly tender. Hernial sac contained clear fluid, one and a half inches of normal appendix in the sac; reduction, radical operation. Recovery.

11. Ibid. Woman, aged 60; right femoral hernia for five weeks; came down suddenly; irreducible, tense, hernial sac size of hen's egg; contained clear fluid. One inch of normal vermiform in sac; reduction; radical operation. Recovery.

12. Briancon (Thèse de Paris, 1897). Woman, aged 42; an irreducible, incarcerated, painful right femoral hernia, developed suddenly. At operation the sac was found to contain an ulcerated appendix. The patient recovered.

13. Ibid. Woman, aged 45 years; had a right femoral hernia for two years, which suddenly became incarcerated. At operation the hernial sac was found to contain an incarcerated appendix, 15 cm. long. It was obliterated below the point of incarceration. The appendix was removed. The patient recovered.

14. Ibid. A woman had had a right femoral hernia for a few years. Symptoms of strangulation developed suddenly. At operation the inflamed appendix was found in the hernial sac. Appendectomy. The patient recovered.

15. Brieger (Archiv. f. klin. Chir., 1893, xlv, 892) reports the following case: A woman had pain, with frequent and difficult micturition. In the right groin there was a mass the size of a walnut. The skin

was not changed. The operation showed within the hernial sac a cord 2½ cm. long. When pulled out, this was found to be the vermiform appendix. It was removed, and the patient recovered. It was somewhat thickened and pale-red. The amount of constriction was very slight.

16. Brohle (Münch. med. Woch., 1887, xxxiv, 506) reports the case of a woman of 72 years, who had had a small hernia of the right femoral region for several years. It had always been irreducible. It was as large as a hen's egg and painful to touch. Incision over the mass evacuated ill-smelling pus. The pus came from glands that had broken down. One of the glands was attached to a string, which passed through the femoral canal and seemed to be continuous into the peritoneal cavity. The hernial sac was opened and the string was found to be the vermiform appendix. It was adherent to a gland. It could be torn, and from its interior, foul-smelling pus was evacuated. The appendix was removed and the stump reduced. The patient died 23 days later.

17. Brunner (Beitr. z. klin. Chir., 1889, iv, 18) reports the case of a woman of 59, who complained of having had colicky pains for six years. The cause of these was not known. They came, as a rule, suddenly, remained several hours, and disappeared after she had vomited a quantity of bile. She had had for the same length of time a tumor of the size of a walnut over the upper part of the right thigh. It was not completely reducible. When seen by the author, she had had for two days intense pain associated with bilious vomiting. The small mass was swollen and not very tender. The skin over it was red and infiltrated. Through the skin there could be felt a cord passing upward into the abdomen. A diagnosis of suppurating, incarcerated femoral hernia was made. Incision over the mass revealed, after cutting through some strictures, a space lined with a greenish membrane. A fecal odor arose from it. Along the mass the finger entered the abdominal cavity. The mass was found to have an opening the size of a pea, through which fecal masses were escaping. Close examination showed it to be the vermiform appendix. It was removed and the hernial opening was packed. The patient died.

18. Bundschuh (Beitr. z. klin. Chir., 1901, xxxi, 425) reports the case of a woman of 53, who had had a right femoral rupture since childhood. While lifting a heavy tub, she experienced pain in the groin. The hernia was incarcerated for eight days. She vomited once, and there was inability to reduce the hernia. Herniotomy and a radical operation were performed. The hernial sac was thickened; the vermiform appendix was adherent to the upper part of the hernial sac; the lymph-glands were adherent; and there was some omentum, which was replaced. The patient recovered.

19. Ibid. In the second case, the patient was a woman of 60, who had had a right femoral hernia for two years. She had suffered much from coughing. While carrying a heavy bucket, incarceration took place. There was violent pain and nausea, and a mass the size of a nut appeared. The incarceration lasted three days. Herniotomy and resection of the adherent vermiform appendix, which was 6 cm. long, were per-

formed; also a radical operation. The hernial fluid was turbid. Some hemorrhagic omentum was resected, and the patient recovered.

20. CABARET (Jour. des connaissances medico-chirurgicales, 1842, x, 54) reports the case of a woman of 60, who, without any known cause, began to vomit and had colic. There was no history of any hernia. The abdomen was tender and tense, and the next day a right-sided femoral hernia suddenly appeared and could not be reduced. It was the size of a pigeon's egg, and very sensitive. The hernia sac was opened, and in it was found the appendix, which was three fingers' breadth long, swollen, reddish-brown, and strangulated. The strangulation was produced by the femoral ring. Gimbernat's ligament was cut through, and the appendix was reduced. The patient recovered.

21. CRUVEILHIER (Anat. pathologique, 1835, Liv., xxxvii, Planché 6) reports the case of a woman, 50 years of age, who had a fluctuating phlegmonous tumor of the right groin, the size of an orange. The skin over it was inflamed. An incision over the tumor evacuated a large quantity of very offensive pus. The intestine [appendix] was gangrenous. Improvement followed the operation, but the patient died two months later. Autopsy revealed the cæcum to be attached to the crural ring, in which the appendix was engaged. The latter was adherent to the posterior wall of the sac and was perforated near its apex.

22. DANZEL (Zeit. der Aerzte zu Wien., 1859, 209) reports the case of a woman of 61, who, for three days, had had symptoms of strangulation. The abdomen was distended; there was absolute constipation, and vomiting. Taxis had been performed for some time. The author found a large, right-sided femoral hernia, tensely distended and painful. The skin was reddened. An incision over the region of the hernia revealed fetid pus. The cavity was drained and the patient put to bed. An improvement was noticeable within a few days. On the twelfth day, a grayish-black mass was removed from the wound in the course of dressing, and was found to be the vermiform appendix. In addition to this, small masses of fæces were discharged. The patient recovered with a small fecal fistula.

23. DAVIES-COLLEY (Guy's Hospital Rep., 3d Series, vol. 27, 1884). Woman, aged 38 years, admitted to Guy's Hospital October 2, 1883; married; eight children, youngest two and a-half years. Twelve months ago while lifting a heavy basket she felt a sudden pain in right groin, followed by vomiting. Symptoms soon subsided, but recurred from time to time. On a second occasion she felt a small lump in groin; always able to return lump, and pain never lasted over one hour. Sometimes the hernia would not come down for two or three months. September 30, in chapel, 6 P.M., sudden attack of pain, and felt lump in groin; on arriving home unable to return lump as before. Vomiting at 9 P.M., and continued next day. Taxis, evening of October 1, unsuccessful. Taxis applied unsuccessfully a second time. Bowels moved on 30th, twice October 1, and once (slightly) on 2d.

Swelling over right femoral ring, globular, one to one and a quarter inches in each direction. Rather movable; no impulse on coughing.

Thought to be gland, or strangulation of omentum, or part of calibre of bowel.

Sac was incised. Appendix found, coiled up, three inches long, normal thickness, and little altered in appearance, except that there was a blood-clot under the peritoneal coat, one inch from tip. Internal border of femoral ring was notched, and the appendix returned. Sides of sac brought together with catgut and wire sutures in skin. No fluid or omentum in sac. Recovery.

24. IBID (page 436). Woman, aged 47 years, admitted to hospital, May 14, 1884. Married; fourteen children. Lately had a sensation of weakness over abdomen and chest.

December 24, 1883, after day's hard work, noticed a swelling in right groin which came down suddenly and caused great pain. Swelling reduced by doctor. No more trouble until May 9, when lump again appeared while she was walking and coughing; 11th, bowels opened and taxis applied twice; 13th, taxis again applied. Vomiting began. In the right groin below Poupart's ligament an ovoid swelling two inches in circumference. No impulse on coughing; abdomen tender. On opening what was thought to be sac, two ounces of serous fluid escaped. A knuckle appeared, and on scratching surface a second flow of fluid having fetor, but no color. In the sac was an object covered with gray lymph which proved to be the appendix. Appendix ligated at base and the swelling caused by inflammation. Recovery.

25. DIEFFENBACH (Die operative Chir., 1848, ii, 600) reports the case of a man about 60 years of age, with no history of ever having had a rupture. He suddenly became ill. There was nausea, belching, and a drawing sensation in the lower part of the abdomen. The bowels were regular. The hernial region was free. By pressing over the right femoral ring, dull pain was elicited. Laxatives, leeches, and applications were used without improving the condition. Operation disclosed at the femoral ring a very small mass, the size of a small bean, protruding from the ring, and resembling peritoneum. The membrane was opened and was found to be connected with a blackish-gray, folded body. When loosened, this was seen to be the end of the vermiform appendix. It was adherent. Gimbernat's ligament was cut through, and the appendix was reduced. The patient died.

26. ECCLES (St. Bartholomew's Hospital Reports, vol. xxxii, 1896), Woman, aged 48, hernia, right femoral, for eleven years. Admitted to hospital for an irreducible swelling in the right groin. No impulse on coughing, but fluctuation was present. Skin tender and inflamed. Patient never had vomiting, but was constipated.

Herniotomy: One inch of appendix, dark and thickened, was adherent to mouth of sac. Ligated and removed. The strangulation was due to the swelling caused by inflammation. Recovery.

27. IBID (Trans. Path. Soc., London, 1896–97) reports Gee's case. Man, aged 41 years, died from carcinoma of stomach. At postmortem the appendix was found to be five inches long; four inches within abdomen, and the distal inch in sac of right femoral hernia, adherent

at its mouth, and the free extremity somewhat dilated. No previous history in the case.

28. Floel (Deut. Zeitschr. f. Chir., 1891, xxxii, 587) reports the case of a woman of 50, who was suddenly seized with violent pain in the upper part of the right thigh. The pain continued, and a small mass appeared. There was no vomiting. The mass was found to be a hernia, which was irreducible and incarcerated. It was tender to touch and the size of a pigeon's egg. The skin over it was not changed. An incarcerated crural hernia containing omentum was diagnosed. A longitudinal incision was made, and the mass rendered free on all sides. It was found to be continuous with a pedicle through the femoral canal. This pedicle entered the mass, the centre of which was found to be a hernial sac. The pedicle was found to be the vermiform appendix. It was incarcerated, was brownish-black, and had a fetid odor. No fluid escaped. The femoral canal was dilated; the appendix was removed. It was 6 cm. long and not perforated. The patient recovered.

29. Good (British Med. Journal, 1898, ii, 876). Woman, aged 39; tense swelling in right groin; existed for 24 hours; pain and vomiting. Diagnosis: Irreducible, strangulated, femoral hernia. Operation: Hernial sac opened; it continued the vermiform appendix, strangulated and congested; five inches of the process were in the sac and two inches in the abdominal cavity; one inch was gangrenous; this was resected. Patient recovered.

30. Guinard (Bull. de la Soc. Anat. de Paris, 1896, lxxi, p. 451). Woman, aged 45 years, who had had a small femoral hernia, was suddenly seized with abdominal pain, and the hernia became irreducible. There were no symptoms of intestinal obstruction. Celiotomy was performed, and the appendix doubled upon itself was found to occupy the femoral canal and hernial sac. The proximal and distal extremities of the appendix remained in the abdominal cavity. The patient recovered.

31. Heusinger (Mag. f. d. Gesammte Heilk., 1820; quoted by Bajardi) reports the case of a man complaining of colicky pain that had come on suddenly. The patient died four days later. At the autopsy, a suppurative peritonitis was found in the crural canal; the vermiform appendix was discovered, adherent and surrounded with a mass of pus.

32. Hevin (Cours de Path. et de Therap. chirurgicale, 1785, p. 407) reports a case of right femoral hernia with symptoms of incarceration. The femoral sac opened and pus with a fecal odor escaped. In the sac was a gangrenous piece of intestine. The patient died, and the autopsy showed the intestine to be the vermiform appendix.

33. Honsell (Beiträge zur klin. Chir., 1903, xxxvii, 208) reports the case of a woman of 46 years, who had had a small hernia in the upper part of the right thigh, which had been reducible until two days before. There had been violent pain since that time, but no vomiting. The mass was the size of a walnut, and it was painful, tender, and irreducible. An operation was performed under local anæsthesia. A vertical incision was made, and the hernial sac isolated and opened. It contained a clear yellowish fluid. In the sac, the bluish-red, slightly swollen vermiform

appendix was found. Poupart's ligament was severed, relieving the constriction. Reduction was then accomplished. The cyanotic discoloration of the peripheral portion disappeared after the reduction. Radical operation for the cure of the hernia was performed, and the patient recovered.

34. The second patient was a woman of 53 years, who had a hernia that had developed suddenly in the right side of the thigh while she was loading hay. There was violent pain, and a small, tender mass appeared. There was repeated vomiting, and flatus, but no stool could be passed for some days. An incision was made over the mass, the hernial sac was opened, and the constricting ring divided. The opening of the sac disclosed bloody fluid. Within the sac was the appendix, together with its mesentery. The strangulation was from 1½ to 2 cm. from the cæcum. A distinct constriction of the appendix and of the mesentery was present. The strangulated part was brownish-red and covered with hemorrhagic spots. The appendix was resected and a radical operation for the hernia was performed. The patient recovered.

35. In the third case, the patient was a woman of 54, who had had a right-sided femoral hernia for many years. It could be easily replaced until four days before, when, while ploughing, the hernia became irreducible. There was violent pain about the thigh; no stool or flatus was passed for several days; no vomiting. The mass was the size of a walnut, fluctuating and tender. It could be traced beneath Poupart's ligament. The skin over it was perfectly normal. Under local anæsthesia an incision was made, and the tumor freed. The hernial sac was only about the size of a cherry. It contained several drops of serous fluid, and a folded black structure, which passed through the narrow hernial opening. Poupart's ligament was incised and also the hernial neck. The structure mentioned was found to be the vermiform appendix with its end twisted on itself; 5 cm. of the appendix was gangrenous, 2 cm. normal. Between these two parts was a deep constriction-ring. The appendix was resected; a radical operation for the hernia was performed, and the patient recovered.

36. The fourth patient was a woman of 55, who had had a right-sided femoral hernia for several years. It had been easily reducible. For eight days it had been painful and could not be reduced; and neither stool nor flatus had been passed since. There was a tumor the size of a hen's egg, tense, elastic, and painful. The skin over it was slightly edematous. Resistance could be traced below, beneath, and above Poupart's ligament. Under local anæsthesia the hernial sac was isolated and opened. A tablespoonful of turbid, foul-smelling fluid was found. A tough incarcerated piece of tissue, the size of a bean, lay on the floor of the hernial sac. Poupart's ligament and the abdominal covering were severed, and the peritoneal cavity entered. The insertion of the appendix lay above the hernial ring, as did also its tip; but the central portion was within the femoral canal. The mesentery acted as the constricting element. The constricted portion was from 2 to 3 cm. long, and showed two deep furrows. It was blackish and looked gangrenous. No per-

foration could be found. The appendix was resected, and a radical operation performed. The patient recovered.

37, 38, 39. HUETER (Chir., 1882, ii, 559) says he has seen three cases of right-sided femoral hernia containing the vermiform appendix.

40. JACKLE (Diss. Marburg, 1888) describes the case of a woman of 37 years, with a small strangulated and gangrenous-appearing hernia of the right femoral region. There was no fecal vomiting. The skin over the hernia was reddened. An incision was made, and brown, ill-smelling fluid escaped. A small perforated intestinal loop was found. It was partly adherent to its surroundings and covered with pseudo-membrane. The femoral ring was narrow. A close examination revealed the fact that the incarcerated portion of the intestine was the beginning of the appendix. The point of strangulation was 2 cm. from the apex. The appendix was ligated and removed, and the patient recovered.

41. JACOBSON (The Operations of Surgery, 1897, 637). Woman, aged 43; irreducible femoral hernia; radical cure. Hernial sac contained much fluid; in sac a thick fleshy body, tubular at end; constricted near Gimbernat's ligament. Incision of ligament; reduction of appendix. Recovery.

42. KASINOWSKI (Diss. Greifswald, 1871). Woman, 35 years of age, awoke two days previously with vomiting, pain in the right side, and obstruction of the bowels. A right-sided incarcerated femoral hernia the size of a walnut was found. It was tender on pressure. At operation a small amount of fluid and a healthy appendix was found in the sac. The appendix was reduced. The patient recovered.

43. A second case reported by the same author, and quoted by Bajardi, is that of a woman of 44 years, with a right femoral hernia, which had been incarcerated for two days. There was a right-sided vaginal hydrocele, and vomiting occurred. Herniotomy was done. The sac was found to contain a quantity of turbid fluid having a fecal odor. The appendix was reddish, long, and partly within the peritoneal cavity and partly within the sac. The sac and a part of the appendix were removed. The patient recovered.

44. KEETLEY (Med. Press and Circ., 1890, vol. i, page 85). Woman, aged 53 years. Appendix strangulated in right femoral sac. Patient vomited three times. Herniotomy four days later. No definite peritoneal sac found. Appendix thickened, white, and contained much pus. Ligated and removed. Good recovery.

45. KOELLIKER (Cent. f. Chir., 1901, xxviii, 792) reports the case of a woman of 69, with the right limb flexed at the hip-joint, resembling a patient with coxitis. She could walk only with the aid of a cane; and all attempts to straighten the limb, even while lying on her back, produced violent pain in the lower part of the abdomen on the right side. Her femoral hernia could not be reduced. Operation showed the sac to contain a thickened omentum, adherent to the neck of the sac. In the base of the sac was a very long appendix, adherent at its free end. The appendix was very tense during narcosis, as the limb was straightened. No other intestine was found in the sac. The appendix and the omentum

were resected and a radical operation for the hernia was performed. Recovery (not stated, but apparent).

46. KOERTE (Deut. med. Woch., 1901, xxvii, 176, v.) remarks that twice within a year he has operated on incarcerated appendices in small, narrow, crural herniæ. He has no doubt whatever that in each case an incarceration existed, without inflammation. In each case the appendix had a distinct furrow, and the mesentery was hemorrhagically infarcted. There was no suppuration; neither was there a foreign body, a fecal, stone, or anything else of that sort. In one case, the patient was an old woman, who had had an adherent omental hernia for some time. An acute incarceration forced operation three days after the beginning of the symptoms, and in the hernial sac the appendix markedly altered, was found.

47. The second patient was a young woman, who did not know anything concerning the existence of a femoral hernia. Suddenly, one morning, she had an incarceration. She was operated on twelve hours after the incarceration, and from the signs, it was evidently a very recent condition. The author is therefore convinced that these cases were pure incarcerations of appendices, and not inflammations of appendices situated within the hernial sac. Result not stated in either case.

48. KOERTE also reports the case of a woman who had had a rupture for some time. It had not been replaceable for several days. She came to the hospital complaining that she had some belching, but no pain. Distinct symptoms of strangulation were missing; but at the operation the author found an appendix sharply strangulated, with its apex on the point of becoming gangrenous.

49. In another case operated on by him, a gangrenous appendix was found in the hernia. Result not stated in either case.

50. LANGDON (St. Bartholomew's Hospital Reports, 1891, page 179). Woman, aged 46 years; appendix in right femoral sac; sudden onset of symptoms twelve hours before operation; vomiting, but loose motions. Herniotomy; sac much thickened. Appendix ulcerated and perforated; removed. Patient recovered.

51. LANGENBECK (quoted by Israel, Deut. med. Woch., 1901, xxvii, v. 177) operated upon a femoral hernia on account of symptoms of incarceration, and found in it, to his astonishment, a strangulated incarcerated appendix. Result not stated.

52. LEVY (Arch. provinciales de Chir., 1903, xii, 393) reports the case of a woman of 63 years, who had had a small, right-sided femoral hernia for thirteen years. A short time before, after a violent attack of coughing, the hernia had become painful, the pain not permitting the patient to sleep during the night. The mass grew and was found to be irreducible. It was the size of a hen's egg. The skin was tense and very tender, but there was no œdema. An incision was made, and the sac was opened. Serous liquid of a reddish color escaped. The contents of the hernial sac were found to be the appendix, which was very long, swollen, congested, and curved upon itself. It was found to be strangulated at the femoral ring. The appendix was resected and the patient recovered.

53. The second case was that of a woman of 73 years, who had had a small mass in the right groin for two months. It had been gradually increasing in volume, and was the size of a large chestnut. It was not reducible. There had been pain until the last four days. The mass was hard and tender, and the patient had been vomiting several times a day. There was no constipation. Fluctuation was noted and also mobility. A longitudinal incision was made; upon opening the sac a yellowish liquid escaped. The hernial contents were a small piece of intestine, which was gangrenous. The crural ring was stretched, and the piece of intestine escaped into the abdominal cavity. Celiotomy was performed. The gangrenous piece of intestine was found to be the appendix. It was removed and the wound was drained. The patient recovered.

54. LINDNER (Deut. Med. Woch., 1900, xxvi, 259 v.) reports a right femoral hernia that, upon opening, was found to contain a small piece of intestine, which was discovered to be the appendix. It was easily liberated and replaced. On sewing up the femoral canal, fæces suddenly entered it from the abdominal cavity. A laparotomy was performed, and the appendix was discovered to contain two perforations. It was distinctly necrosed and had evidently perforated only a few moments before. The patient died. It was evident that, as the result of the incarceration, a nutritional disturbance developed, and that this produced the ulceration.

55. LOEBKER (Griefswald, 1884, quoted by Bajardi) reports the case of a woman of 41 years, with an old, right femoral hernia that had been incarcerated for two days. Herniotomy revealed a partially gangrenous appendix in the lower angle of the sac. The appendix was ligated and removed, and the patient recovered.

56. LUCAS (Guy's Hospital Reports, 1884, p. 436) reports the case of a woman of 47, who for the last five months had had a right-sided femoral hernia the size of a walnut. Repeated attempts at reduction were futile, and vomiting began soon afterward. She had had no movement of the bowels for several days when seen; the tumor was egg-shaped, having a circumference of two inches. On opening, it was found to contain two ounces of serous fluid, and in the sac was the perforated appendix, which was as thick as the little finger. It was ligated and removed; the patient recovered.

57. LUSCHKA (Virchow's Archiv., 1854, vi, 409) examined the body of a woman of 50 years, who had died of pneumonia, and found that she had had femoral hernia on the right side. Within it was found the appendix, twisted on its axis and constricted at its cæcal end.

58. MICHAILOW (Russki Chirurgitscheski, 1895, No. 2) reports the case of a man of 48 years, who had developed sudden pain three weeks before, while lifting a heavy weight. A tumor appeared below Poupart's ligament. At first there was vomiting, and no stool was passed for seven days, after which time the bowels acted. The tumor was the size of a walnut, and extending upward from it an oval mass could be sharply defined. An operation was performed. The hernial sac was opened, and a black body resembling intestines was found. When separated from the

hernial walls, this ruptured; and from it came pus smelling like fæces. An incision 10 cm. into the abdomen was made, and the body was found to be the inflamed and perforated appendix. It was resected, and the patient recovered.

59. MORSE (Wien. med. Woch., 1882, xxxii, 431) reports the case of a woman of 42 years, who had had a right-sided femoral hernia for three days. There was violent pain and a tumor, which gradually increased in size and was irreducible. Symptoms of incarceration occurred. The skin was not reddened. The mass was quite tender. An incision over it was made, and the femoral sac exposed. The femoral canal and sac were opened and inside was found the reddened appendix, which was gangrenous. This was resected. The patient recovered.

60. MOTTA (Ital. med., 1882, xvi, 57; quoted by Bajardi) describes the case of a woman of 76 years, with a right femoral hernia that had been incarcerated for three days. There was vomiting; the bowels were moved by means of enemata. In the femoral region there was an elastic tumor, painful and tense. Along the horizontal ramus of the pubis was a tight cord, prolonged upward into the abdominal cavity. Herniotomy was performed. The sac contained a resistant cord, grayish, about the size of the thumb, and terminating in an expansion the size of a nut. The constriction was relieved by incision. The dilated part was excised. The peduncle was found to extend up into the abdomen. The patient died seven days later, of general peritonitis. The autopsy showed the cord to have a central canal, which communicated with the intestine.

61. MUELLER (Diss. Muenchen, 1891). Woman, 75 years of age, three days ago developed a right femoral hernia, at stool. There was violent pain, and a tender elastic swelling in the groin. Diagnosis: Incarcerated femoral hernia. At operation the hernial sac was found to contain the appendix, which was of a bluish color. The appendix was returned to the abdomen. The patient recovered.

62. MUENCH (Korrespondenzblatt f. schweizer Aerzte, 1902, xxxii, 237) reports the case of a woman of 73 years, who had had a right-sided femoral hernia for many years. It had always been irreducible. There had been no disturbance, however, until a few days before the author saw her. Since then it had become larger and painful; there was no vomiting; flatus, stools, and urine, were evacuated regularly. A round, hard mass was noted in the upper part of the right thigh; it was tender to touch; the skin was almost adherent; there was no fluctuation. Local anæsthesia with eucaine was administered. While trying to liberate the hernial sac, ill-smelling pus was evacuated from the posterior surface of the mass. After opening the hernial sac it was found that its only contents were a 12-cm.-long appendix, which passed through the femoral canal. This was resected at a point as high as possible. The patient recovered. A pathological examination showed the appendix to have been perforated.

63. MUUS (Cent. f. Chir., 1901, xxviii, 1037) reports the case of a woman of 64 years, who for years had had a right femoral hernia, which was always easily replaced. A small tumor was always present, prevent-

ing the wearing of a truss. During the last month, the hernia had become more painful, forcing the patient to walk in a bent position. When lying on her back the right limb was flexed about 30°; and, on account of pain, she could not stretch it any more. There was very little pain on direct pressure. Operation showed a small lipoma in front of the hernial sac, which contained a healthy, adherent appendix. This was resected; radical operation was performed, and the patient recovered. From this time on she could stretch her limb perfectly.

64. Newbolt (British Med. Journ., 1867, i, 781). Woman, aged 21, painful swelling in right groin; had a femoral hernia for two years; always easily reduced. Incarceration for 48 hours; swelling size of hen's egg, hard, tense, tender, irreducible. No bowel movement for three days. Operation: Hernial sac contained vermiform, thickened, congested. Resection of congested part. Reduction of stump. Radical operation. Recovery.

65. Nicoll (Glasgow Med. Journal, 1903, lx, 432). Woman; right femoral hernia for many years; for past three days strangulated; painful, tense; constipation, vomiting, abdominal distention, bowels moved with enema. Sac contained feculent pus; the perforated appendix was adherent to neck. Resection. Recovery. Inflammation apparently occurred in appendix which had previously been in sac.

66. Owen (Lancet, 1899, i, 1222). Woman, aged 65; painful swelling existed in right groin for two weeks, increasing in size; bowels regular; no vomiting. The swelling was as large as the fist, hard, but fluctuating in lower part. Abscess opened and contents cleared out; at the bottom the vermiform was found, strangulated at femoral ring; adhesions at that point. Ligation of appendix. Recovery.

67. Pollosson (Lyon med., 1893, lxxiii, 75) reports the case of a woman of 71 years, in a condition of cachexia and delirium. No history was available. In the right iliac fossa above Poupart's ligament was a fluctuating mass, which could be traced down the thigh into the triangle of Scarpa, in front of the femoral vessels. An incision was made above Poupart's ligament. The patient died a few days afterward. The autopsy revealed a purulent collection situated within the peritoneum above Poupart's ligament and a counter opening made on the thigh. Fetid pus was evacuated. It was limited by adhesions to a point about the cæcum and the appendix. The later was gangrenous and perforated. The purulent collection was traceable into the triangle of Scarpa, and was surrounded by a peritoneal diverticulum forming a sac for a crural hernia.

68. Ibid. In a second case, the patient was a woman 37 years old, who had had a small tumor in the crural region for five years, but had never worn a truss. During the last two days, without any effort on her part, the tumor had become larger and painful. She had had colic and vomiting. During the last twenty-four hours she had not been able to pass either gas or stool. A diagnosis of strangulated hernia was made, and an operation performed. The patient was anæsthetized, and the operation was conducted as for an ordinary hernia. The sac was incised. It contained an abundance of reddish liquid; but in the interior, instead

of intestine or omentum, there was found a reddish cord, 5 cm. long, and of the thickness of the little finger. The neck of the hernia was cut through, and the strangulated portion pulled out. It was found to be the appendix. This was resected, and the patient recovered. A distinct ring of strangulation could be seen below the colon.

69. In a third case, the patient was a woman of 32 years, who had had a right femoral hernia for two years. She had had strangulation once before but recovered. Since that time she had worn a truss. For the last eight days, the hernia had been down, painful, and gradually increasing in size. There was some nausea and constipation. A diagnosis of strangulation was made, and an operation performed. The sac was dissected out and opened, and serous fluid escaped. Within the sac was to be found a small, hard tumor, the size of a terminal phalanx. This was reddish, and was found to be the appendix. The strangulated portion of it was resected and a radical operation was performed. The patient recovered.

70. Puchelt (quoted by Merling; Diss. Heidelberg, 1836; L'Experience, 1837, i, 337) reports the case of a woman of thirty years of age, with a right femoral hernia that had never before given her trouble. Suddenly, and without external cause, the hernia became strangulated. There was slight pain on mere touch, some vomiting, and fecal retention. An operation was performed, and the vermiform appendix slipped back in the abdomen spontaneously. Patient recovered.

71. Quenu (Bull. et Mem. d. l. Soc. de Chir., 1903, xxix, 801). Woman, aged 42; right-sided irreducible femoral hernia for nine days; pain, swelling; no vomiting; no obstruction; fluctuation. Hernial sac contained appendix, which was congested and red and strangulated about its centre.

72. Riese (Deut. med. Woch., 1900, xxvi, 259 v.) reports the case of a woman of 51, who for several years had had a right-sided femoral hernia, easily reducible. While lifting a heavy kettle, the hernia came down, and with this was noticeable a drawing sensation of the navel. The mass became larger and the patient had nausea and belching. When she entered the hospital she had had no movement for 24 hours. In the right femoral region there was a tense mass. The abdomen was distended and tympanitic. The skin over the mass was red. An incision was made, and the hernial sac was opened. A turbid fluid ran off, and in the sac was a bluish-black mass, the size of a thumb, which was recognized to be the appendix. It was not adherent to the hernial sac. It was impossible to reduce the appendix, because of the thickness of its mesentery. The abdominal muscles were split for a short distance. The process was then reduced and amputated, and the patient recovered. The appendix showed a furrow 3 cm. below its base, being bluish-black on the other side. The mesentery was swollen. The author believes that during the effort made the appendix entered the sac and became incarcerated.

73. Romm (Deut. Zeit. f. Chir., 1895, xli, p. 249). Man, 48 years of age; had a small reducible swelling in the left groin. Four days ago it became irreducible and painful. The overlying skin was red and œdema-

tous. There was no vomiting or other obstructive symptoms. At operation a small amount of foul pus was found in a gangrenous hernial sac. The appendix was also in the sac in a gangrenous condition. It contained a small fecal concretion. The appendix was removed. The presence of the appendix on the left side was due to a long mesocolon, and the mobility of the appendix. The patient recovered.

74. Rose (Deut. Zeit. f. Chir., 1892, xxxv, 51) reports the case of a woman of 54, that had had a femoral hernia the size of a hazel-nut, which, however, gave her no trouble. She wore no truss. Suddenly she developed pain in the hernial sac and began to vomit. She traced this condition to the lifting of a heavy tub. During the next two days she vomited from three to four times a day. The pains became more violent and colicky, and both stools and flatus ceased to pass. The hernia was on the right side. It was tense and tender. Fifty-five hours after the beginning of incarceration an operation was performed. The hernial contents were found to consist of a blackish-red piece of intestine no greater than the size of a pea. It was firmly incarcerated. The operation was very difficult. Upon closer examination, it was found that the incarcerated portion of bowel was a part of an appendix that was itself five inches long. The non-incarcerated portion was very pale; the incarcerated, blackish-red, and probably twice as large as the other part. The patient recovered. The appendix was not removed.

75. Rotter (über Perityphlitis, 1896, p. 57) reports the following three cases:

The first patient was a woman of 68 years, who had had an irreducible hernia the size of a hazel-nut for four years. It was occasionally painful. Five days before operation, she had experienced violent pain over the hernia, which became larger, and finally grew to be as large as a hen's egg. There was no vomiting. The bowels were moved regularly. The hernial sac was opened and brownish hernial fluid was discovered. The remaining contents consisted of a dark red node, the size of a hazel-nut, entering through the crural ring. There was a tight constriction. The incision was elongated, Poupart's ligament was divided, and the incarcerated portion of bowel was found to be a knee-shaped part of the vermiform appendix. The tip lay free in the abdominal cavity. The appendix contained pus, but there was no perforation. The cæcum was adherent to the apex of the appendix. The appendix was resected, and distinct constriction was found. The patient recovered.

76. The second case was in the person of a woman of 25 years, who did not know that she had a hernia; suddenly became nauseated, vomited, and had violent pelvic pain. The next day there appeared in the upper part of the thigh a mass the size of a pigeon's egg. It was painful. The bowels were moved regularly, and there was no sign of incarceration. The opening of the hernial sac revealed pus and an appendix that was bent on itself. It was dark-brown, its serous coat was smooth, and there was no perforation. Poupart's ligament was severed, the appendix was removed, and the patient recovered.

77. The third patient was a woman of 60 years, who, shortly after slipping, felt violent pain in the right femoral region. She had never had a hernia before, but she then noticed a distinct swelling. This was followed by vomiting, and the pain continued. The mass grew to be the size of a pigeon's egg. The skin was inflamed, but there were no signs of incarceration. At the operation the hernial sac was made free; Poupart's ligament cut through, and the abdominal cavity opened. The hernial mass had a central constriction, this being due to Poupart's ligament. Within the hernial sac was found some darkly discolored intestine, reaching into the abdominal cavity. This was discovered to be the gangrenous appendix. There was no perforation. The appendix was removed, and the patient recovered.

78. Sauvage (Thèse de Paris, 1893) reports the case of a woman with a strangulated right femoral hernia. Its contents were found to be the vermiform appendix, which was reduced after dilating the hernial orifice. The patient recovered.

79. Schede (Deut. med. Woch., 1893, xix, 451) reports the case of a woman of 60 years, with a right-sided femoral hernia. Herniotomy was performed. The hernia contained a gangrenous appendix, which was resected. The hernial sac was sutured, and the patient recovered.

80. Shands (Annals of Surgery, September, 1904) reports the case of a woman 29 years of age, who first noticed a swelling in her right groin in 1899. It developed very gradually, gave no pain or inconvenience, and always disappeared when the patient assumed the recumbent position. In October, 1903, the lump increased rapidly in size, became very painful on pressure, and did not disappear on lying down. There were no symptoms of strangulation of the bowel. A diagnosis of incarcerated femoral hernia was made, and an operation performed on November 3. Upon opening the sac there was a gush of peritoneal fluid; there was neither intestine nor omentum in the sac, but firmly adherent on the side was the appendix ceci, with the distal end ulcerated and much enlarged. The appendix was amputated in the usual way, and the wound closed as for a radical cure for femoral hernia. The patient made an excellent recovery.

81. Sonnenburg (Deut. Zeit. f. Chir., 1894, 38, 269) reports the case of a woman of 65 years, who had never had a rupture until eight days before operation. While lifting a weight, she had suddenly experienced pain in the right groin, which became swollen and painful. She had had no bowel movement for four days; there had been no vomiting. The patient was very fat. The swelling in the groin was tender to pressure and infiltrated. At operation, pus with a fecal odor was evacuated. The pus-cavity continued upward into a long channel, which corresponded to the crural canal. The patient improved. The pus was plentiful and always had a feculent odor. The pus cavity contained a long cord, dark-gray, with a narrow lumen. This was evidently the vermiform process. After this cord was cast off the secretion became less and the fecal odor disappeared. The patient died some years later, and the autopsy showed the vermiform process to be only 3 cm. long, its free end being adherent

to the peritoneum. This showed that a portion of the appendix must have been cast off, after the opening of the hernia. The portion cast off was 8 cm. long. The hernial sac closed within four weeks. The case was evidently one of acquired (not congenital) incarcerated, gangrenous, pure hernia of the vermiform appendix.

82. Ibid (Path. u. Therap. d. Perityphlitis, 1900, p. 184). The second case was that of a woman of 74 years, who had had a hernia on the right side of the thigh for two years. It had gradually become larger, and during the last two weeks had been irreducible. There was vomiting, but no fecal obstruction; and violent pain in the lower part of the abdomen was felt. The mass was the size of a goose-egg; the skin over it was infiltrated and inflamed. Fluctuation was present. As soon as the skin was incised, pus with the odor of fæces and containing gas poured out. The hernial sac was found to be thickened and gangrenous, and within it was the black appendix, which was perforated. This was resected, and the patient recovered.

83. Spanton (British Med. Journal, 1889, p. 126). Single woman, aged 62 years; in October, 1888, had a painful abscess in right groin. Two years before, while carrying a basket, felt something give way in the right groin. It caused pain and a small swelling soon developed, but caused only slight inconvenience. No further notice was taken of the swelling.

August, 1888, surface of swelling became red and inflamed, and skin shortly after broke down, followed by discharge of thin, dark pus.

At examination, erysipelatous blush over upper part of thigh; two sinuses; dirty looking discharge.

Operation: Carefully proceeding, some enlarged glands were removed and appendix exposed; the latter had come down behind the peritoneum; it had no peritoneal covering,—*i.e.*, a retroperitoneal hernia of the appendix. The patient recovered.

84. Spurrier and Corner (St. Thomas's Hospital Reports, N. S., Vol. xxxi, 371) relate the following case:

Woman, aged 70 years; one week before coming to the hospital had a bilious attack, accompanied with retching and straining, which caused the appearance of a lump in the right groin. This lump caused very little inconvenience at first, but it gradually increased in size and gave rise to great pain. The patient was well otherwise, and the bowels acted regularly. The diagnosis of strangulated epiplocele was made.

When the sac was opened, it was found to contain the distal inch of the appendix. Gimbernat's ligament was incised, the appendix brought down, amputated, and the stump invaginated with cæcum. Prompt healing followed. The specimen showed a well-marked ring dividing the injured from the healthy parts. The distal portion was blackish-brown, with thickened œdematous walls.

The authors make the following comment: As there was no pain at the time of the formation of the hernia, and not for some hours after, it seems improbable that the appendix was strangulated at once. Again, at the operation the appendix was easily pulled down, though it was

swollen far too big to be returned to the abdomen without a "herniotomy." Consequently it seems reasonable to assume that the apparent strangulation was the result and not the cause of the appendicitis.

85. Staatsman (Münch. med. Woch., 1904, li, 603) reports the case of a woman of 42 years, who had never noticed that she had a hernia until five days previously, when, without special cause, she had developed sudden pain in the right femoral region. She continued to work; and the next day she noticed a tumor, which gradually increased. There was violent pain in the region of the navel, and the mass could not be reduced. The tumor was the size of a walnut, hard, and elastic. The skin was not reddened. The region was painful to pressure. At operation the lymphatic glands were removed and the hernial sac opened. Within the sac was found a greenish discolored piece of intestine, folded on itself. It passed through the femoral canal, and was found to be the appendix, already gangrenous. Drainage was inserted and the treatment with opium continued. The appendix gradually broke down and sloughed off, and the patient recovered.

86. The second case was that of a woman of 74 years, who had never known that she had a hernia until she had suddenly developed a painful tumor in the right groin three days previously, while carrying a heavy weight. It gradually enlarged, but there was no vomiting, and the bowels were regular; the tumor became more painful. A diagnosis of incarcerated right femoral hernia was made. At operation there was found lying in the femoral canal the incarcerated appendix. There was no hernial fluid. The femoral ring was divided, and the appendix resected. The patient recovered. The appendix was 5½ cm. long.

87. Swasey (Med. Record, N. Y., 1881, p. 706). Woman, aged 67 years, spare; while lifting, six years before, felt a peculiar sensation in right Scarpa's space; and later, while bathing, found a compressible tumor, size of a walnut, at saphenous opening. Has worn a truss, but hernia never completely reduced.

January 28, tumor size of hen's egg, painful and irreducible; some abdominal pain and nausea. This sudden trouble followed heavy lift. Operation thirty-six hours after: Sac exposed and clear fluid seen. This was withdrawn by hypodermic needle, and appendix could be seen and felt within sac. It was returned to abdomen by manipulation. Sac not opened. Patient recovered.

88. Tacke (Beiträge z. klin. Chir., 1901, xxix, 72) reports the case of a woman of 54 years, who developed pain in the lower part of the abdomen suddenly. This pain gradually increased, and a mass developed below Poupart's ligament on the right side. It turned out to be a hernia, which could not be replaced. There was constant nausea, but no vomiting. The mass was about half the size of a hen's egg, and somewhat painful. It could be traced upward above Poupart's ligament into the abdominal cavity, where it was more tender than further down. An operation was performed on the third day. The hernial sac was found to be the size of a small walnut, and, when opened, was found to contain a grayish tumor of considerable length, which closed the hernial neck

completely and continued upward into the tumor of the abdomen. A large opening of the peritoneum was made. The tumor was found to be the vermiform appendix with a swollen mesentery. It was but 10 cm. long. The peritoneum was inflamed. The peripheral end of the vermiform appendix was bent on itself and above the bend a black discolored constriction-ring was found. The lower part was necrotic. The appendix was ligated and the patient recovered.

89. Tape (Arch. provinciales de Chir., 1904, xiii, 479) reports the case of a woman of 67 years, who had had a strangulated right-sided femoral hernia fifteen years before. At the time of its first appearance, she was operated upon, and some intestines were found in the hernia. This was reduced and the hernial sac was closed. Six years later the hernia recurred; but, as it was easily reducible, she wore a truss. During the last two years the truss was not worn, and the hernia soon became irreducible. It had been gradually increasing in volume. Suddenly it became very painful, and colicky attacks occurred. The patient began to vomit and was soon in the state associated with intestinal obstruction. Examination showed a hernial tumor, very hard, painful, and tender. It was irreducible. An incision over the crural arch was made, and the adhesions were dissected. An incision was made into the hernial sac, in which was seen a strangulated cylindroid mass. This was found to be the appendix. It was from 12 to 15 cm. long, and very much swollen. The constriction-ring was liberated and the appendix reduced. The patient recovered.

90. Tilanus (Nederl. Tigdschr. f. Geneeskunde, 1855, Sept.) reports the case of a woman of 65 years, with a tumor of the right thigh, which had been present for nine days. The cause was unknown. The mass gradually increased in size; it was painful, and walking was almost impossible. There was constipation, but no nausea or vomiting, and no abdominal pain. The skin was red and tense. The right labium was hard, and fluctuation was present. An incision revealed a gelatinous exudate. Beneath this was a cavity containing foul pus and fibrin. In the femoral canal was found a piece of intestine 2½ inches long, with the blind end dark blue. It was not perforated and was filled with gas. The femoral ring was incised and the constriction was overcome, but the hernia was not reduced. Exudate was found within the labium. Drainage was inserted. The piece of intestine was found to be the appendix. Peritonitis subsequently developed and the patient died. Half an inch of the appendix was found still within the abdominal cavity, and the cæcum was gangrenous.

91. The second case was that of a woman of advanced age, with a femoral hernia containing the appendix. The patient died of general peritonitis.

92. Thoren (Hygiea, 1887, p. 762) reports a case of incarceration of a vermiform appendix in a femoral hernia. The patient recovered after herniotomy.

93. Carrez (Lyon med., 1900, xciv, 493) reports the case of a woman, 70 years of age, who had an easily reducible right femoral hernia. She

was seized with sudden pain during sleep, when the hernia was found to be hard, painful, and irreducible. There was bilious vomiting.

At operation the sac was found to contain the appendix which was strangulated in the crural ring. The tip was gangrenous, the base was normal.

94. Vulliet (Revue Médicale de la Suisse Romande, 1900, vol. xx, p. 336). Woman, 54 years of age; hernia for fourteen years. She had never worn a truss as the hernia did not cause any inconvenience, and was always easily reducible. One month ago, for the second time recently, violent abdominal pains were felt, the hernia became irreducible and increased in size. There was some nausea but no vomiting; tongue dry, bowels regular. The lump was aspirated and a glass and a-half of clear fluid withdrawn, after which the hernia was reduced. Three weeks later there was a relapse, the same symptoms being repeated. Diagnosis: Strangulated omental crural hernia. Under local anæsthesia the sac was opened; a large quantity of yellowish fluid escaped. The hernial sac was hemorrhagic. The appendix, rigid and turgid, was seen projecting from the crural canal. It was incarcerated, but was reduced after the ring had been dilated. The sac was resected and radical cure performed. The patient recovered.

95. Waring and Eccles (St. Bartholomew's Hospital Reports, vol. 27, 1891, page 179). Woman, aged 46 years; first observed a right femoral hernia in 1879. It was easily reducible. She never wore a truss. Confined in 1887. Swelling did not reappear until January, 1890, when it was irreducible and painful. Replaced by a doctor, and truss worn since. In usual health until evening of January 18, 1891, at 7 o'clock. Had severe griping pains, loose motions, and passed flatus by mouth. Later vomiting. Next day taxis under chloroform; unsuccessful. Operated: Sac contained only appendix. Stricture divided; appendix pulled down, and ulceration and perforation at site of constriction. Appendix ligated with silk above, and cut away. The patient recovered.

96. Wette (Inaug. Diss., 1889, Aachen; quoted by Bajardi; also by Brieger; Arch. f. klin. Chir., 1893, xlv, 892) reports the case of a woman of 87 years, with a right incarcerated femoral hernia. Herniotomy was done. The sac contained clear liquid, and an appendix with a relatively long mesentery. The appendix was reduced and radical operation was performed. The patient recovered.

97. Wölfer (Arch. f. klin. Chir., vol. xxi, p. 432). Man, aged 19 years; appendix strangulated in right femoral hernia; constipation, nausea and vomiting. Herniotomy. The adherent appendix was left in the sac. The patient recovered.

98. Alfred C. Wood. (Author's case.) In the summer of 1900, a woman about 70 years of age was admitted to St. Agnes's Hospital at the request of her physician on account of what was thought to be a suppurating inguinal bubo.

Upon examination a swelling about as large as an egg was

found beneath Poupart's ligament on the right side. It was somewhat irregular in outline, painful on pressure and soft to the touch. The surface was of a dark red, almost livid color. According to the history, the swelling developed suddenly, ten days to two weeks before, without any cause that could be assigned. If a hernia existed previously it had not been observed. The temperature was between 101° and 102° and the pulse correspondingly accelerated. The tongue was furred and dry. The whole picture resembled quite accurately a late stage of suppuration of the vertical chain of inguinal lymph-nodes, although no lesion was found on the foot or leg to account for such a condition. The very soft character of the swelling noted was accounted for by the fact that hot flaxseed poultices had been applied for several days.

When the skin was divided a necrotic mass was exposed in which there was but very little fluid, and that was turbid and watery rather than purulent. After the necrotic structures had been removed as far as possible, the appendix was found in the bottom of the wound, the distal half being gangrenous. After cleansing the cavity the incision was extended upward until the base of the appendix was exposed. The tissues being healthy at this point a ligature was applied and the diseased part was removed. The incision was only partially closed by sutures, free drainage being provided, as there was great probability of peritonitis following. The wound did not do well; the inflammation, which was already present, spread, and took on an erysipelatous character. The patient's tongue became more dry and coated, the bowels moved only with the greatest difficulty, the temperature and pulse gradually rose, and the patient died about a week after the operation, from sepsis.

99. (Author's second case.) Mrs. B., aged 65 years, was seen by the writer in consultation with Drs. Bellows and Reckefus, August 10, 1904, on account of a lump in the right groin. Her attention was first drawn to this condition after retiring on the evening of July 19, 1904, during a stay at the seaside. She discovered, quite by accident, during full extension of her thigh, a lump about the size of an egg, in the right groin. There was a very slight diffused pain about the front of the thigh, but otherwise no inconvenience was felt. On the following morning she consulted a physician, who told her the swelling was a femora.

hernia. Nothing was done for the condition until she returned to her home on 3rd of August, when she called upon her family physicians, who arranged for the consultation, which was held on the date mentioned.

Upon examination, a swelling about as large as half an orange was observed in the right groin, below the inner half of Poupart's ligament. It was almost painless, presented an elastic sensation to the touch and gave a flat note on percussion. There was an indistinct suspicion of an impulse on coughing. The mass could not be reduced. It was the unanimous opinion that the condition was an irreducible femoral hernia. That the sac did not contain intestine was evident by the entire absence of obstructive symptoms, as well as the dull note on percussion. It was, therefore, supposed that the hernia consisted of omentum,—an incarcerated femoral epiplocele.

About two years ago the patient had an illness which was thought to be "grip." Since this time she had not been well. She was unable to exercise as usual on account of feeling weak and short of breath, although previously strong, and still of robust appearance.

In the general physical survey, the condition of the heart at once attracted attention. The action was very irregular; some beats were very feeble and imperfect, while others were loud and tumultuous. The rhythm was entirely upset, the intervals between the impulses varying greatly. The pulse could not be counted at the wrist, as only the stronger contractions of the heart were registered, nor could the heart-beats be definitely counted by auscultation over the precordia, owing to the extreme irregularity spoken of, but as nearly as could be estimated they were about 120 per minute.

The urine was scanty in amount, but otherwise normal. The other organs appeared sound.

An operation was advised in spite of the condition of the heart, as it was manifestly unsafe to permit an irreducible hernia to remain in that condition, even if composed of omentum only. The patient entered the University Hospital August 15. There had been no change noted in the meantime.

The operation was performed on the following day, the patient having been prepared in the usual manner. As the chief cause of anxiety was the anæsthetic, specific instructions were

given as to the administration of the ether, and arrangements were made in advance to carry out each step of the operation with the least possible delay in order to shorten the time of operation.

A vertical incision, three inches in length, was made over the swelling and the mass fully isolated. The sac was thickened and opaque and under such extreme tension that it was impossible to distinguish the nature of its contents. It was therefore carefully opened, when a considerable quantity, estimated at between two and three ounces, of slightly turbid straw-colored fluid was forcibly discharged. The sac then seemed to be empty, but on enlarging the opening and inspecting its interior the vermiform appendix was observed protruding from the neck of the sac, probably one-half of its length being external to the latter. There was not a trace of omentum or other structure in the sac. The appendix appeared perfectly normal in color, but was slightly swollen and œdematous. It did not show any evidences of acute inflammatory change, but either from constriction or adhesions, was held firmly in its new position. The problem of the proper disposition of the appendix at once came up. Its removal would have necessitated extending the original incision into the abdominal cavity, or the making of a second incision at the usual site for reaching the appendix. Both of these procedures were highly objectionable on account of the patient's physical condition, already referred to. On the other hand was the appendix so damaged that its return to the abdomen would subject the patient to the risk of peritonitis, or the inconvenience of a second operation? While this problem was being weighed and discussed, the appendix which was held by the constriction of the neck of the sac, and also by the adhesions, was being liberated by the finger. A final examination of the process led me to decide to accept what I considered to be the remote risks mentioned, rather than prolong the anæsthesia and thus add to the danger of the present operation, an opinion which was shared by both of the patient's physicians. The appendix having been returned, the sac of the hernia was ligated as high as possible and excised. The operation was concluded by performing a radical cure according to Bassini's method.

The patient made a satisfactory recovery in every particular, the wound healing by primary union, and the general condition

was quite as good as before the operation. She was discharged from the hospital on the 3rd of September. The patient has constantly improved in health since leaving the Hospital.

100. WULFF (Deut. med. Woch., 1901, xxvii, 175, v.) reports the case of a woman who had had an easily reducible femoral hernia for a year. Four days before admission, while bending forward, she suddenly experienced violent pain in the region of the hernia. Two days after this, there was nausea and the hernia could not be replaced. At the time of admission, she showed a rounded mass below Poupart's ligament, covered with normal skin, and somewhat tender. There was a slight rise of temperature; no peritoneal irritation; but a slight drawing at the umbilicus. Operation showed the hernial sac to contain a clear, slightly bloody fluid, in which was the hemorrhagic free appendix. Its mesentery was rich in fat, and discolored. At the hernial ring there was a distinct furrow; and on the other side of it the appendix was perfectly normal. Resection of the process and closure of the wound were followed by the recovery of the patient. The appendix was 12 cm. long. There was no pus, fecal mass, or mucus in its lumen; and no stenosis. The appendix was not gangrenous below the constriction, even though there was a hemorrhagic infarct. The condition was due to a pure incarceration.

OBTURATOR APPENDICULAR HERNIA.

Although the subject of obturator appendicular hernia is foreign to this paper, I have included the report of a single example. It is introduced here because it is nearly or quite unique, none of the writers quoted having mentioned the subject except Spurrier and Corner, but their collection did not include any illustration.

The case is described by Bary (Dissertation, Greifswald, 1893) and is as follows:

A woman, 42 years of age, had a painful mass in the region of the pectineus and adductor muscles. It gradually became larger and fluctuating. Operation was refused and the patient died. At the autopsy, an abscess was found beneath the pectineus and between the adductor muscles. The pelvic cavity behind the obturator foramen was filled with pus. The foramen was sufficiently open to permit the index-finger to pass through. Within it and adherent to it lay the perforated apex of an appendix four and a-half inches long. There were no symptoms of incarceration. The peritoneum was free from signs of inflammation.

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STATED MEETING, MAY 1, 1905.

The President, HENRY R. WHARTON, M.D., in the Chair.

ACUTE GANGRENOUS APPENDICITIS IN TYPHOID FEVER SIMULATING PERFORATION.

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CARRIE C., aged twelve years, was admitted to the Medical Wards of the Presbyterian Hospital on March 6, 1905, under the care of Drs. Musser and Talley. Her history was as follows:

Family history negative. Previous medical history included a severe attack of diphtheria seven years ago. For two years she has suffered with attacks of what were called "indigestion," which were accompanied by vomiting and severe abdominal pain lasting for from several days to a week, and of increasing severity. In view of her subsequent history, their relation is of importance. About the middle of January she was observed to be very languid, had no appetite, and complained of pain in the head and back, sometimes also in the abdomen. She developed a cough, and the sputum was said to have been blood-tinged. For several days before admission she had been quite ill.

On admission her face was rather pale; tongue clean; lungs negative; heart, first sound not entirely clear, valvular sounds sharp; spleen palpable; a few rose spots on abdomen; abdomen soft, flat, and not tender. Temperature, 102° F.; respiration, 36; pulse, 112. Urine negative and normal.

For the next few days the temperature ranged from 100⅖° to 103⅗° F., with marked daily remissions. The diazo and Widal examinations were positive. The treatment consisted of liquid

diet, sponges, and hot mustard foot-baths for the control of fever. Whiskey, ℥ i q. d., was added on the 9th of March. So far the case had pursued the course of an ordinary typhoid of moderate severity. Abdominal symptoms of severity had been absent. There was no diarrhœa.

On the 9th of March the temperature reached 104⅘° F. at 11 P.M., and then began to drop after a sponge. At 5 P.M. of the 10th it was 103° F. Another sponge was given, bringing it down to 101⅘° F.; and at 8 A.M. it was 100⅗° F., an assisted drop of 4⅕ degrees in nine hours. In the meantime, however, at 6.30 A.M., she was suddenly seized by violent pain in the right side of the abdomen, extending from ribs to pelvis, and had a slight chill. The pain, which was paroxysmal, continued for about two hours, when she vomited, and had a bowel movement, after which she was more comfortable. The abdomen was not distended but slightly rigid, more so on the right than on the left side, and there was a point of marked tenderness in the right iliac fossa.

When seen at noon she was quiet, not complaining of spontaneous pain, tender over the abdomen on both sides, especially the right, with a rigidity also generalized, but most pronounced in the lower right quadrant, and increasing its area from hour to hour upward towards the costal region. At 11 A.M. the temperature was still as low as 101° F.; respirations, 48; pulse, 156, but of fair volume and strength. The facial expression was good. A leucocyte count made on the 8th, two days previous, showed 3600. Four hours after the onset of the pain, the count was 10,800. A diagnosis of perforation of the intestine was made from what seemed fairly typical symptoms. The sudden onset of pain, the vomiting, the increasing abdominal tenderness and rigidity, with a rising leucocyte count, and rapid pulse seemed to warrant such diagnosis. The drop in temperature was not as rapid or as extensive as is often seen in perforation. Vomiting had ceased, and pain was not complained of except on examination. Peritonitis, however, was evidently spreading.

The patient was operated upon eight hours after onset of pain. Ether anæsthesia. Lateral incision, outer border of right rectus. Much free cloudy fluid in peritoneal cavity. The ileum was hooked out and rapidly gone over upward and back again for perforation, but none was found. Mesenteric glands much enlarged. The appendix was then brought into view, seen to be

gangrenous in its distal portion, removed, and found to be perforated and containing a concretion. Free abdominal washing with salt solution brought much cloudy fluid from the pelvis. Tubular and gauze drainage was inserted in pelvis and loin space. The time of operation was twenty-five minutes, some time being lost in examining the ileum, and more consumed in careful washing.

At the conclusion of the operation the pulse was 180, but the patient soon reacted under free stimulation and hypodermoclysis. The temperature continued to decline until 4 A.M. of the following day, when it touched 98° F. Thereafter the surgical condition gave little anxiety. The wound did well, draining freely at first, later granulating slowly. Abdominal symptoms quickly ameliorated. The patient's general condition improved rapidly at first, and then continued typical of a typhoid infection. The temperature rose again and was 102⅗° F. on the evening of the second day after operation, and then ranged between 99° and 102° F. The pulse continued good under free stimulation. On the 18th the temperature touched 98⅗° F., and then declined to normal more rapidly. Fourteen days after operation it became and remained normal.

The appendix when examined was found to be much inflamed, gangrenous for about two-fifths of its length in the distal portion; the mucous membrane inflamed throughout, and with a large concretion incarcerated in the gangrenous tip. At this point there was a small perforation. No typhoid ulcers of mucous membrane. Cultures gave abundant staphylococci.

The influence of typhoid fever on the appendix, and the occurrence of inflammations of that organ during and after typhoid fever, have attracted considerable attention, especially during the last few years, and it seems to be well recognized that the appendix often shares with the intestine in the pathological lesions, although in a varying degree. Among the pathological lesions noted are swelling and rigidity of the organ, congestion, peritoneal exudate of fibrinous character, infiltration with cells typical of the typhoid process, various lesions of the mucous membrane of an inflammatory or ulcerative nature, from simple swelling to superficial, deep, and perforating ulcerations, and complete necrosis. In addition to

those cases of "typhoid appendicitis" in which such typhoid lesions are present, and in which the symptoms depend upon them alone, there seem to be one or more varieties of appendicitis which occur in the course of typhoid fever, in which the pathological process is practically identical with that observed in appendicitis occurring in the otherwise healthy individual. Kelly and Hurdon, in their book on the "Vermiform Appendix and its Diseases," have entered rather thoroughly into a study of the subject, and have attempted to classify the cases pathologically and clinically. In their pathological classification they make the folowing three types:

1. Those in which the appendix participates in the typhoid lesions.

2. Those in which a secondary infection with pyogenic organisms is engrafted upon the typhoid infection.

3. Those in which a simple appendicitis develops, the appendix not being involved in the typhoid infection, but in which it is probable that the attack is often precipitated by the congestion which accompanies it, without necessitating any specific typhoid lesions.

As to the frequency of these lesions, they add that the appendix is involved in one-third of all cases of typhoid fever, and that of the perforative cases there is a perforation in the appendix in 5 per cent. (Some statistics give a little higher, others a lower percentage than this.) They believe that the second class, viz., that due to typhoid lesions, associated with a secondary infection, furnishes a large proportion of the cases of acute perforative appendicitis occurring in typhoid fever. As to the third type, they cannot estimate its frequency, but point out the deleterious influence which the hyperæmia attending the disease might be expected to exert upon a kinked, stenosed, chronically inflamed organ, perhaps containing a concretion.

The clinical classification which Kelly and Hurdon make differs a little from the pathological classification. It is as follows:

First group. Accidentally associated appendicitis, or a rousing into activity of a latent or chronic inflammation by typhoid fever.

Second group. Appendicitis of mild or severe type arising from typhoid infection of the lymph-glands, or ulceration of the appendix.

Third group. Appendicitis following typhoid fever within such a brief time as to suggest strongly a chance relation.

Kelly's and Hurdon's studies have apparently led them to the belief that the large majority of cases so far reported have been cases in which the typhoid process has been the main feature in exciting the appendiceal inflammation. They have encountered no case in a child where the appendicitis has developed in the course of typhoid fever. In our case, the history of recurring attacks of a painful type of so-called "indigestion" within the last year, the appearance of the appendix at operation, the presence of a concretion, and the results of the examination by the pathologist, make it very probable that it was one of the chronic or relapsing variety roused into activity by the hyperæmic and favoring conditions of the enteric attack, but not depending for its origin on any special typhoid lesion.

The question of diagnosis is of some interest. This case was mistakenly diagnosed as one of typhoid perforation. Perforation it was, but of another type, and which would presumably be associated with its own peculiar train of symptoms. We have already described the symptoms present, and mentioned one or two in which it differed in degree or kind from those typical of perforation. The condition, however, called for operation as strongly as if an anatomically and pathologically correct location of the lesion and its character had been arrived at, information desirable to obtain beforehand where possible, but of infinitely less importance here than the procedure for its relief. We believe that the rapidity of the process in this case is exceptional, even for appendicitis in a child, in whom we know by recent studies that the process is

apt to be more rapid and more insidious than in adults. There is not usually much difficulty in distinguishing between appendicitis and perforation in typhoid fever, as Deaver emphasizes. As he states, the shock is not so great, the change in pulse-rate is not so rapid, the fall of temperature is infrequent, and the course when watched and not operated upon is not so rapidly to a fatal termination. In our case, there was a fall of temperature, but it came about the same time that the daily decline usually occurred, and it did not drop as suddenly nor go as low as the temperature usually does during perforation, and hence, while it was pronounced enough to invite further study, it lent one of the few doubtful features to an otherwise apparently clear case of perforation. In every other respect the distinguishing features between the two conditions, as cited by Deaver, would have lamentably failed.

The advisability of operating for appendicitis during the course of typhoid fever is one which naturally has the keenest interest for the surgeon. We often hear it stated in discussions on typhoid perforation that laparotomy is well borne in typhoid fever. But certainly since, and possibly before, Maurice Richardson pointed out the difficulty of diagnosing between some atypical cases of typhoid fever, especially at the beginning of the attack, and some cases of appendicitis, and the humiliation involved in a needless operation for the one, as well as the dangers of a delayed operation in the other, and since the same distinguished surgeon has asserted the truth of the statement that operations in typhoid fever, even those of themselves comparatively slight, have a high mortality, we find some of our most radical surgeons emphasizing the necessity of caution in this field. In the early stages of the disease operation is nearly always successful; but even here it may form a complication which later on will seem to be unfortunate. Hence it is that we find Kelly advising a waiting policy unless the symptoms are exceedingly urgent; Murphy counselling against operation unless perforation has taken place; and Deaver, in his latest word on the subject, saying that, while in the early stages the result of operation is nearly

always favorable, later the operation may be a serious complication, and even cause a fatal result. Hence he favors temporizing where possible where appendiceal inflammation develops after the third week is under way, and operation after recovery from the fever. Deaver strongly advises against operating during the height of the disease, except for pus or perforation, and quotes Harte's and Ashhurst's statistics of operation for typhoid appendicitis. Of twenty-six cases which they collected, seven died, the mortality being heaviest from the second week onward.

Dr. Richard H. Harte said every one recognizes the gravity of typhoid fever and also of appendicitis; when they occur together, the combination is most serious. At times it is impossible to differentiate between appendicitis and typhoid perforation. If the case is seen early and the course of the disease traced, then one may usually tell the difference, and also be able to operate early; this, however, the surgeon rarely has the chance to do. Symptoms in typhoid perforation are usually more marked, coming on with flash-like rapidity, while appendicitis is commonly more insidious. Both demand immediate operation. Concerning rules for waiting in these cases as quoted and endorsed by Dr. Jopson, Dr. Harte is not in accord. Waiting is a rather dangerous procedure. Marked irritation in the right iliac fossa developing during typhoid fever is often attributed to appendicitis, and the physician waits in the hope that these symptoms will subside. But if, instead of appendicitis, typhoid perforation has occurred, the abdomen should be opened immediately; every fifteen minutes means the loss of chances for saving the patient's life. Dr. Harte has noted that, in cases operated on immediately after perforation, the recovery rate is much greater than when intervention is deferred. For this reason a waiting policy possesses elements of danger. If appendicitis be actually present, the uncertainty is still greater. Hence, if during typhoid fever the diagnosis of appendicitis is made and the symptoms of perforation develop, the abdomen should be opened as soon as possible. Unless he misunderstood Dr. Jopson's quotation of Kelly's statements regarding the frequency of appendicitis in typhoid fever, Dr. Harte does not find them supported by his experience. He has operated in quite a large number of cases of typhoid fever, and does not consider appendicitis so frequent as some writers would lead one to believe. The surgeon cannot say absolutely that appendicitis is present during typhoid fever unless he operates. Dr. Harte has found very few instances of appendicitis among the cases of typhoid for which he has operated, although he and his colleagues at the Pennsylvania Hospital have operated for this condition during the course of typhoid. In thus speaking about operation, it is recognized that every operator knows the gravity of opening the abdomen of a typhoid patient, and desires to avoid it if possible. All the existing conditions are such as to render operation a very grave procedure. In twenty-six abdominal sections for typhoid perforation, Dr. Harte has made the error of operating in two cases when perforation was not present; fortunately, both patients recovered.

Dr. John H. Gibbon said that he had operated upon two cases of appendicitis during typhoid fever. In one case it could not be demonstrated that the condition was the result of typhoid ulceration of the appendix. In the other, however, there were three distinct typhoid ulcers of the appendix, one being at the base and completely occluding the lumen of the organ. It is thought that in this latter case there might have been no cause for operation had there been no obstruction of the appendix. The first case was operated upon for one of perforation, but in the second case it was not thought that a perforation was present, but the symptoms were sufficiently marked to warrant the opening of the abdomen. In the case reported by Dr. Jopson, a noticeable fact is that, although the temperature dropped, the pulse fell from 144 to 128, which does not usually take place in a perforation of the intestine. Dr. Gibbon believes that a differential diagnosis of appendicitis during typhoid fever and perforation of the bowel is extremely difficult, yet in the former condition the symptoms are never so sudden and severe as in the latter.

Dr. W. Joseph Hearn endorsed the statements of Dr. Harte regarding the need for early operation. If the general symptoms usually accompanying perforation are marked, whether they are due to typhoid perforation or gangrenous appendicitis, the sooner operation is performed the better it is for the pa-

tient. Dr. Hearn usually gives intravenous infusion of saline solution and then at once operates. In a proportion of cases this is successful, though he has also lost many cases. Operation will be successful if performed in time. The rule to be followed is not to wait.

Dr. Jopson, in closing, said the figures relating to involvement of the appendix during typhoid fever needed explanation. In 119 cases of typhoid reported from Boston and Baltimore, there was macroscopic evidence of involvement of the appendix in 19. The other statement that one-third of the cases was involved referred to the microscopic picture afforded by the appendix. As to the diagnosis of appendicitis from perforation, many cases of appendicitis come on early in the course of typhoid when irritation in the right iliac fossa is greater than can be attributed to the latter disease. Operation is then safest and intestinal perforation can be excluded because of the early stage of typhoid. Waiting at this time is also more justifiable than at any other. At this stage most mistakes in diagnosis are made. Differential diagnosis in cases such as the one reported is not necessary, even though desirable. There is no way of distinguishing the two conditions except by the preceding history, and even that is liable to lead to mistake as in this case, where symptoms of appendicitis came on as rapidly as they do in perforation during typhoid fever; gangrene and rupture seemed to be almost simultaneous with the pain. The age of the child and the generally bad condition of the intestine doubtless favored gangrene.

FRACTURE OF THE HEAD OF THE TIBIA.

Dr. Henry R. Wharton reported the case of a man, aged fifty-five years, who was admitted to the Presbyterian Hospital, June 24, 1902, having fallen from a bicycle and injured his left knee. When seen by the reporter, a few hours after his admission, the left knee and upper portion of the leg were swollen and painful. An examination revealed a fracture involving the outer portion of the head of the tibia. There was marked effusion into the knee-joint and adjacent bursæ. The patient suffered great pain, which seemed entirely out of proportion to the extent of the injury, and was probably due to the associated synovitis. He stated that when he fell from his bicycle he landed

upon the left foot, and his body was rotated, when he felt something give way in the region of the knee. An X-ray examination showed that there was a separation of the triangular piece of the outer portion of the head of the tibia, with upward and outward displacement of the fragment, necessarily involving the knee-joint.

The limb was placed in a long fracture-box and the region of the fracture was treated by the application of lint saturated with lead-water and laudanum, and after a few days, when the swelling to a certain extent had subsided, a plaster-of-Paris dressing was applied. This dressing was used for six weeks, and after this time the patient began to use his crutches, and at the end of ten weeks was able to walk with the aid of a cane. He had at first very limited motion of the knee-joint, but this improved with use, and finally he regained good use of the limb.

An examination of this case eighteen months after the injury showed that he walked well, but still had some impairment of joint motion at the knee. Extension was perfect, but he could not flex the knee beyond a right angle.

A second case was as follows: A baggage-master, in throwing a bundle of papers from his car while the train was upon a curve in rapid motion, was thrown from the car, striking upon both feet, receiving injuries of both legs which prevented him from rising from the ground. He was admitted to the Presbyterian Hospital, May 29, 1904, several days after the accident. An examination showed that the right leg and knee were greatly swollen; there was also marked swelling in the region of the left ankle. A fracture was located at the outer portion of the head of the right tibia. There was also marked effusion into the right knee-joint and adjacent bursæ. Great pain was complained of in the region of the knee, which was much increased by pressure and attempts to move the joint. An X-ray examination showed fracture of the outer portion of the head of the tibia, involving the joint; no injury of the bones could be discovered at the left ankle.

This patient was treated by a plaster-of-Paris bandage extending from the toes to the upper portion of the thigh. The patient left the hospital at the end of a month, still wearing the plaster-of-Paris dressing.

An examination of this case nine months after the accident

showed firm union in the fracture, but still some impairment of the joint motion in flexion. The patient, however, has a useful limb.

A third case of the same injury was as follows: A man, aged forty years, was admitted to the Presbyterian Hospital, February, 1905, having sustained an injury of the left leg in wrestling. He stated that he fell from a step a distance of a few feet and struck upon his left foot, his body twisting as he struck the ground, and he felt something tear in the region of the knee, and fell over helpless.

When seen by Dr. Wharton, a few hours after his admission, he was suffering intense pain in his left limb, which was very much swollen, and the knee-joint and adjacent bursæ were swollen and tense. An examination disclosed crepitus at the head of the tibia, near the knee-joint. An X-ray examination revealed fractures of the external portion of the head of the tibia and of the internal tubercle of the tibia, with involvement of the knee-joint, and upward and outward displacement of the external fragment of the tibia.

The limb was treated in a long fracture-box for a few days, with the application of lead-water and laudanum. For the first few days the pain was so great that morphine had to be freely used to give him any ease. At the end of this time, under anæsthesia, attempts were made by manipulation to press the displaced fragments inward and downward. The limb was then put up in a plaster-of-Paris bandage, including the foot, and extending to the upper portion of the thigh. The patient was more comfortable with this dressing, but suffered at times from severe attacks of pain, which he said came on suddenly, the pain radiating from the knee, up the thigh, and downward to the leg. These attacks were so severe at times that morphine was required.

At the end of seven weeks he was allowed to get up on crutches, but after being up for a day he noticed that the foot became hot, and presented a superficial, burning sensation. On inspection it was found that the toes on the dorsum of the foot were markedly discolored, and were hot and painful to the touch. Upon removing the plaster-of-Paris bandage, it was found that the redness extended well up upon the dorsum of the foot, and to some extent involved the skin over the ankle, the plantar surface

of the foot being neither painful nor discolored, and there was no swelling of the foot. There was no paralysis, the patient being able to flex and extend the foot. He also suffered from severe attacks of pain in the region of the fracture, which passed from the patella to the inner portion of the thigh and also the leg and foot. These paroxysmal attacks of pain were so severe that no relief could be obtained until morphine was given hypodermically.

From the distribution of the pain and the location of the trophic disturbances, it was thought that the external popliteal nerve was probably caught by the displaced fragment, or was pressed upon by callus, and after consultation with Dr. Willard, it was decided to expose the nerve for the relief of this condition. The patient was anæsthetized, and upon examination of the joint it was found that the knee could be flexed to a little more than a right angle. The nerve was then exposed by an incision, and the trunk laid bare for about three inches. It was found that it was not pressed upon by the fragment nor pinched by callus. The upper half of the exposed nerve was normal in appearance; the lower half, to a point where it passes over the peronæus longus muscle, was enlarged and of a deeper color, and the sheath was thickened and contained some reddish serum. The sheath was opened and the nerve was thoroughly stretched. The wound was closed and dressed, and the limb was placed in a posterior binder's-board gutter.

The pain after the operation was very slight, one dose of morphine only being required. The discoloration of the foot and ankle has gradually diminished, and at the time of the report, more than two weeks after the operation, the foot has resumed its natural color.

Dr. Wharton remarked that fractures of the head of the tibia involving the articular surface present several points of interest. First, as regards the mechanism of these fractures. As far as he could learn, they usually result from a fall upon the foot, in which there is a rotation of the body, with twisting of the knee. Another point of interest is the extreme pain accompanying these fractures, probably due, in fractures involving the external tubercle, to injury of the external popliteal nerve and the rapid effusion which occurs into the knee-joint and adjacent bursæ. The pain and trophic disturbances may occur immedi-

ately upon the reception of the injury from injury of the nerve at the time, or may follow later from pressure upon the nerve by a displacement of the fragment, or by callus. In the last case reported, it is interesting to note that the trophic disturbance seemed to be confined to the distribution of the musculocutaneous nerve rather than to that of the anterior tibial nerve, as there was at no time paralysis resulting in foot-drop. Stimson states that fractures of the head of the tibia are slow in repair, and quotes seven cases recorded by Poncet in which the average time of union was about four months.

Restoration of function after these fractures is seldom complete, the occurrence of synovitis and arthritis, with backward displacement of the fragment, interfering with the normal joint motions of the knee. Extension is usually normal, but there is generally more or less interference with complete flexion of the joint. Repair is probably much less prompt than in fractures involving other portions of the tibia.

Dr. John H. Jopson briefly described a case now under his care which corresponds very closely to those reported by Dr. Wharton. The patient is a railroad man, who, while superintending the shifting of cars in the dark, stepped out of a door, six feet from the ground, in the direction the train was moving. He lighted on his feet on loose ballast, and one leg immediately went from under him; there was severe pain in the knee and inability to rise. The mechanism evidently consisted in turning and twisting the leg at the time it struck the ground with considerable force. There was effusion of blood into the joint and underneath the bursa of the quadriceps. When seen several hours later, the patient still complained of severe pain, and there was tenderness over the knee, especially on the outer side. Crepitation could not be elicited, and there was neither shortening nor irregularity. The condition was thought to be laceration of the lateral ligament, but a week later the X-ray showed a small oblique fracture of the outer part of the head of the tibia running down from the joint, and thus splitting off a fragment of the bone. Pain in the knee persisted for three or four weeks until a final immobilization with plaster-of-Paris dressing. Now, at the end of six weeks, there is no pain, and the patient appears to be doing well; the final result cannot of course be predicted.

SUTURE OF THE FEMORAL ARTERY.

Dr. Edward Martin reported the case of a man, twenty-three years old, who was admitted to the University Hospital, May 18, with a history of having been wounded the day before by a piece of steel chipped off from a side set by the blow of a ten-pound hammer. There was an immediate profuse bleeding, the blood spurting to a distance of two inches. This was controlled by means of a tourniquet. There was found a wound about half an inch in length at the junction of the middle and lower third of the left thigh directly over the course of the femoral artery. On the removal of the tourniquet there was no further bleeding; the wound was thoroughly cleansed and a sterile pad was held in place by means of a tight bandage. During the night there was a moderate degree of oozing, and examination the following day showed a tumor about the size of a man's fist, fusiform in shape, giving an expansile pulsation and a harsh bruit. Popliteal and tibial pulsations were absent. A tourniquet was applied at the level of the perineum and a 17-centimetre incision was made with its centre of the wound of entrance. On opening the deep fascia a large thrombus was found, to the outer side of which lay a small jagged piece of steel. There was in the anterior surface of the femoral artery a ragged wound 2 centimetres in length opening into the lumen of the vessel. The artery was freed above and below and a loop of large gut was thrown about it in each position. The tourniquet was then removed, bleeding being controlled by traction upon the loops, which also rendered the vessel more accessible to suture. Fine curved-faced needle had No. 0 chromicized gut and No. 8 silk were employed for the sutures, five of which were applied. On relieving tension, there was a spurt of blood at the most ragged part of the wound, requiring the insertion of a sixth suture. On removal of the traction ligatures the artery pulsated below. The fascia was sewn above it with chromicized gut sutures. Drainage was inserted, since it was quite certain that the wound had been infected by the foreign body. The external wound was closed. The patient made an uninterrupted convalescence, pulsation being detected in the popliteal artery on the following day, and remaining thereafter.

Dr. Martin said that the interest attaching to cases such as this is incident to the fact that the opportunity of suturing a

large artery rarely occurs in the course of surgical practice, since such wounds when accidentally inflicted are in themselves unusual, and when they do occur are likely to be attended by bleeding so profuse as to be fatal before aid can be rendered.

Although medical literature contains a number of instances of attempts at sewing both arteries and veins, Murphy was the first to thoroughly popularize the method by a series of brilliant experiments, and, finally, by a clinical experience which still remains the most striking practical demonstration of the practical utility of the method. The common femoral artery had been almost completely severed by a bullet. This vessel was resected, and the proximal end was invaginated into the distal for a distance of one-third of an inch by means of four double-threaded needles which penetrated all the coats of the artery. A row of sutures was then placed around the distal end, penetrating only the media of the proximal portion, after which the adventitia was drawn over the line of union and sutured. A wound of the vein inflicted at the same time was also sutured. Convalescence was uninterrupted, the patient making a complete recovery.

In the experimental work on this subject, there has been more or less insistence upon the need of avoiding the intima in the placing of sutures. This, however, seems to have no bearing upon the formation of clot, which is always possible, and which, perhaps, in the majority of cases may be expected, though Dörfler, in a collection of forty-three experimental cases in which the intima was included in the suture, noticed that there was thrombosis in but five.

Brewer, in attempting to close a wound in the femoral artery, noted that the sutures tore out, and was led to a suggestion which has been attended with considerable success, namely, the application of rubber adhesive plaster about the vessel, the outer wall of which is previously dried by swabbing with ether. Experimentally, this method served admirably, though it is noteworthy that thrombosis occurred at times.

In the application of sutures to a wounded artery, the needles should be round, pointed ones, and of such diameter that the thread which they carry fills the holes made by them. The immediate bleeding of the suture points is overcome by the use of catgut, though silk is the suture material of choice. No effort should be made to avoid the intima, though the inclusion of this

coat in the suture does not add materially to the strength of the union. In attempting to prevent the entrance of the needle into the lumen of an artery, there is danger that the tough media may not be included, and thus the line of union may almost immediately tear out from the effect of blood-pressure. For a partial cut or tear the continuous suture is preferable.

The likelihood of thrombosis is in direct proportion to the amount of damage done to the intima, hence the artery should be handled gently, and the least possible mechanical interference compatible with its proper stripping and exposure, and the application of the suture should be the rule. Infection is almost certainly followed by thrombus, and of course exposes the patient to the danger of secondary hæmorrhage. Of this, however, there is now little fear. The line of suture should be reinforced by stitching the adventitia closely about the artery, and moreover additional support should be given by a suture of the overlying soft parts.

For end-to-end closure the invagination method of Murphy has proven successful. Its application is also easy.

Perhaps the most surprising feature of these artery sutures is the fact that there has been no case of aneurism yet reported, though more than two dozen clinical cases are on record. There are comparatively few positions in which such a procedure as suture of an artery is absolutely essential. In all the smaller vessels complete ligature would be the method of choice. When the carotid artery is wounded, its ligation is so often followed by secondary cerebral degeneration that an attempt at suture is clearly indicated. The common femoral is also a vessel which should be sutured, though even in this case, providing the vein remains intact, the danger of gangrene is comparatively slight. The abdominal aorta is essentially a vessel fitted for suture in case of wound. Theoretically, at least, a suture or invagination of the renal artery, or of the superior mesenteric, may at times be feasible, or in the latter case even the implantation of the divided end of the vessel into the aorta. The possibility of closing a wound of the artery also suggests for consideration the desirability of opening these vessels in cases of threatened embolic gangrene.

Dr. Francis T. Stewart reported the case of a man, aged thirty years, who was struck on the inner side of the right thigh

by a small piece of steel, which penetrated the tissues, leaving a slit-like opening in the skin about one-fourth of an inch long. When admitted to the Germantown Hospital shortly afterwards, there was still considerable bleeding, although a tight bandage had been wound around the limb. When Dr. Stewart saw the patient the following day there was no bleeding and no swelling of the thigh. Several X-ray pictures failed to locate the piece of steel. Eight days after the accident, during the night, the patient was awakened by severe pain in the region of the wound. The thigh rapidly swelled, and pulsation soon became evident both to the eye and to the hand. There was no external bleeding, no thrill, and no bruit. Pulsation could be felt in the anterior and posterior tibial arteries. Twelve hours later a long skin incision was made along the course of the femoral vessels. The upper end of this incision was deepened until the femoral artery could be compressed between the fingers of an assistant. The artery was then traced downward to the middle of Hunter's canal, where a ragged opening about one-eighth of an inch in diameter was found. The artery was then grasped distal to the wound by the second hand of the assistant, and the wound was closed by a continuous silk suture penetrating all the coats of the vessel, an intestinal needle being employed. A second continuous suture of silk involving the sheath of the vessel was applied for a reinforcement. No leakage being detected after the removal of compression, the muscles were sutured with catgut and the skin closed with silkworm gut, drainage being omitted, although the tissues were extensively infiltrated with blood. The leg was maintained in an elevated position for two weeks. The wound healed without infection. The anterior and posterior tibials pulsated with undiminished force from the time of the operation until the patient left the hospital.

Dr. Stewart added that it was interesting to note that in 1759 Hollowell successfully closed a wound in a brachial artery following venesection by passing a needle through the lips of the wound and tying a silk ligature beneath the needle. In 1762, Lembert proposed arterial suture and experimented on the horse. Following this, however, repeated experiments on animals seem to demonstrate that uncontrollable bleeding from the stitch-holes would occur, that a thrombus would form at the point of suture, or that sepsis and secondary hæmorrhage would follow. It was

also feared that an aneurism might develop at the line of suture, or that a clot embolus might be washed into the circulation. In 1889, Jassinowsky showed by a large number of experiments on dogs and calves that these accidents were not to be feared. Most operators have followed his plan of operation, which is as follows: Control of the circulation. Isolate artery and push the sheath back. Suture the media and adventitia with interrupted sutures of fine silk. Take off the clamps with simultaneous compression of the vessel wound. Sew the sheath, then the fascia, then the skin. The continuous suture is believed to be preferable because of its rapidity, and because there is no tendency towards leakage between the points of insertion; and that a suture involving all the coats of the artery is preferable, because it is easier to apply and much more sure to hold. Hubbard (*Boston Medical and Surgical Journal*, vol. xlvi, 1902), in an article in which he collects twenty cases of arterial suture, states that in five cases a suture involving all the coats was successfully employed, and quotes Dörfler, who demonstrated experimentally that a suture passing through the intima would neither cause bleeding nor thrombosis.

Dr. Richard H. Harte advised trial of suture in case of wound of the femoral or of any other large artery; if this fails, ligation can later be performed. He had seen a hospital resident wound the iliac artery with a Hagedorn needle while assisting at an operation for hernia. Hæmorrhage was profuse, the blood spurting a distance of eighteen inches. Dr. Harte exposed the vessel at once and sutured it with silk. The man did well, the case, of course, being much more favorable than was that of Dr. Martin's. Some weeks later the man died from another condition, and inspection of the wound showed that repair of the vessel was perfectly satisfactory. Hence he would not hesitate to suture a vessel, as he believes this to be good surgery. The opportunity seldom presents, but when it does, it should be met by suturing.

Dr. De Forest Willard said that Dr. Brewer's work upon the suture of arteries is a most valuable contribution. Although wrapping the vessel with rubber tissue introduces into the body a foreign element, yet Brewer's reports are very satisfactory. Dr. Dorrance, of the University of Pennsylvania, is now conducting experiments for Dr. Willard, employing, instead of rub-

ber tissue, flaps of fascia to enclose and support the wounded vessel. It is yet too early to draw conclusions, but present indications are that this method will prove of value. By this means it may be possible to succeed in closing vessels whose walls are not strong enough to hold the sutures or the edges of which are too ragged to approximate. The fascia is, of course, left with a base of attachment to preserve its vitality.

Dr. Martin, in closing, emphasized the facts that a growing clinical experience has failed to demonstrate a single case of aneurism following suture of the large arteries. The absence of secondary hæmorrhage and diffuse traumatic aneurism is equally astonishing. It still remains to be proven that in the human either partial or complete wounds can be sewn with an absolute assurance against thrombus, and it is doubtless true that in many of the successful cases reported thrombi formed. However, the possibility of opening even the largest vessels, such as the aorta, and closing them again with safety, suggests a variety of forms of intra-arterial surgical interference, particularly in the direction of preventing gangrene in cases of embolic plugging. Indeed, this has been once attempted because of threatened gangrene of the leg. It is conceivable that an extraordinarily prescient surgeon might thus relieve one suffering from the early stages of mesenteric embolus.

A NEW METHOD FOR IMMEDIATE ENTEROSTOMY.

Dr. Francis T. Stewart said that in cases of enterostomy in which immediate opening of the intestine is mandatory, there is considerable risk of infection of the peritoneal cavity by fæcal contamination. The packing of gauze around the loop about to be opened sometimes averts this danger. Careful suturing of the bowel is an expedient which may succeed, but in cases in which the intestinal wall is stretched and thinned by marked distention it is practically impossible to insert a needle in the bowel wall without entering the lumen and causing leakage. Up to the present time the Paul's tube or one of its modifications has been the best means for safely draining the intestine in these cases. During the past winter he had employed the following method in three cases, two of which died shortly after operation. After opening the abdomen, the desired loop of bowel is drawn into the wound and emptied of its contents by a gentle milking process. A clamp is then placed at either extremity of the loop to prevent the reflux of fæces into it, and the whole is surrounded by gauze packing. One-half of a Murphy button is inserted into the empty loop of the intestine through a small incision, and the other half is squeezed into the end of a long rubber tube whose caliber is slightly smaller than that of the flange of the button, thus making a tight joint. The two halves of the button are then pressed together, or, in other words, a lateral implantation is made between the rubber tube and the bowel. The clamps are now removed and the fæces allowed to drain through the rubber tube into a receptacle on the floor. Whether a bar has previously been placed beneath the bowel or not, the intestine should be securely fastened to the margins of the wound by sutures in order to prevent the prolapse of any additional coils of intestine; with a collapsed bowel, the sutures may be introduced without fear of leakage. By this method an absolutely air-tight joint is made between the bowel and the rubber tube, so that the intestine is drained without the slightest possibility of infection of the peritoneal cavity. By the time the button has sloughed through the bowel (at the end of the third day in his surviving case), adhesions will have effectually closed the peritoneal cavity. The dressing need not be distended until the button comes loose.

VOLVULUS OF THE OMENTUM.

Dr. Francis T. Stewart said that in a paper read before the College of Physicians, November, 1903, he reported a case of torsion of the omentum, and appended an abstract of eight other cases. Since then, Rudolph (*Wiener klin. Rundshau*, 1903, Nos. 44–47) has collected twenty-nine cases, of which twenty-three were intra-abdominal. He states that in one case only was the exact diagnosis made before operation. Sonnenburg (*Arch. Internat. de Chirurgie*, vol. i, fasc. 1), Noble (*American Journal of Obstetrics*, 1904, vol. xlix), and Scudder (Annals of Surgery, December, 1904), have also reported cases. These, together with the present case, make thirty-three thus far reported. A hernia was found in all cases except five. He now was able to report a second case. The patient was a policeman, aged thirty-four years, and weighing 250 pounds, who entered Professor Keen's service in the Jefferson Hospital, April 8, 1905.

Up until three years ago he was in the best of health; every few months since that time he would experience a sharp attack of indigestion, with severe pain in the abdomen. For the past fifteen years he has had a reducible inguinal hernia about the size of a lemon on the right side, which has never bothered him, and for which he has never worn a truss. Just after breakfast, the day preceding admission to the hospital, he felt one of his attacks approaching, the pain, however, being more severe than usual. On admission to the hospital there was severe abdominal pain, especially on the right side. The greatest point of tenderness was just below and to the right of the umbilicus, rigidity of the abdominal muscles was general, but especially marked on the right side. Owing to the thickness of the belly-wall and to the rigidity of the muscles, no mass could be felt, although the right side seemed to be slightly more prominent than the left. The hernial sac was empty. The temperature was 98.5° F.; pulse, 90; respirations, 20; there had been no vomiting; the bowels had moved the previous day. A diagnosis of acute appendicitis was made and the abdomen opened thirty hours after the onset of pain. After some difficulty, the appendix was found between the layers of the mesocolon and excised. It measured six inches in length and, except for several ecchymotic spots in the mucous membrane, was normal. A further search of the abdomen brought to light a mass of omentum, dark red in color, much harder than normal, and evidently in the first stage of gangrene. On pulling the omentum from the abdominal cavity, a twist consisting of three complete turns from the patient's right to left was found just below the transverse colon. After amputation, the spread-out mass measured twelve inches longitudinally and fifteen inches transversely, and weighed one and one-half pounds. At its free edge the omentum presented five large pockets, due to a folding over of the edge with subsequent adhesions. The abdomen was closed without drainage, and the patient made an uninterrupted recovery.

STATED MEETING, JUNE 5, 1905.

The President, Henry R. Wharton, M.D., in the Chair.

SILVER PLATE AND SCREW FIXATION IN FRACTURES OF THE TIBIA.

Dr. John H. Jopson showed a boy in whom he had treated a compound fracture of the tibia by primary fixation of the fragments by means of Halsted's silver splint and screws. The wound had healed with the splint *in situ*, and the result was a perfect one as far as the fracture was concerned. There were certain advantages of the splint and screws over silver wire in the primary fixation of recent fractures which Dr. Jopson thought were sometimes overlooked. In the present case, operation was demanded in the first place because of the difficulty of reduction of an oblique fracture of the tibia complicated by a small wound. The broken ends had rotated in opposite directions. After incision, reduction was satisfactorily accomplished. To have now drilled and wired the fragments would have required much more manipulation and traumatism than the use of the splint and screws, which were easily applied without disturbing the relations of the bone in the wound, and which held the fragments firmly in apposition. Union took place as rapidly as in a simple fracture. Steel screws were used, as silver ones were not at hand. Nearly three months have elapsed since operation, and while the wound is still solid, there is a little tenderness and swelling of recent development at the site of the splint, which probably means that it will require removal.

Dr. John B. Roberts said that this method had been for years a favorite with Dr. L. W. Steinbach, with whom he was associated at the Polyclinic Hospital. The expedient was uniformly successful in holding together the fragments, but he thought that lately Dr. Steinbach is not so enthusiastic regarding its use. He finds that some of the cases are followed by suppu-

ration, due largely to the necessary laceration of the soft parts in applying the splint. This sequel is more apt to occur in deep fractures than in those of superficial bones such as the tibia, the wounding of muscles and other soft tissues being much more extensive in the former. Notwithstanding, Dr. Steinbach secures good results. Dr. Roberts has never employed the splint, but once removed one which had been inserted by another surgeon. The fracture originally was a bad one, and suppuration followed. In treating a recent fracture similar to that reported by Dr. Jopson, Dr. Roberts exposed the fragments and put in two steel staples of his own design, which in some ways are preferable to other devices for holding the fragments in apposition. To insert a wire, the ends of the bone must be freed and drilled, which of necessity cuts and irritates the tissues; in addition, the ends of the bone will wobble when the wires are inserted. Dr. Roberts used a staple which possesses two projecting points, which are driven into holes drilled for them in the fragments. This is simpler than inserting screws and gives greater rigidity than is attainable with wire. Dr. Roberts has also employed fracture-nails with ends fashioned as drills. These are inserted into the bones and make the apposition of the fragments a rigid connection. They are afterwards pulled out. They possess one advantage in that they may be used in subcutaneous fractures.

Dr. Richard H. Harte said that he had used the Halsted splint a number of times, but does not now employ it so often as formerly. Regarding this appliance, an important point to remember is the necessity of using a long splint. Too many surgeons employ a short splint which furnishes support only at the extreme ends of the fragments. It is best to insert four screws, two in each fragment. If a short splint and two screws only are employed, the support given thereby is very slight, and the method possesses no advantage over wiring. Dr. Harte's experience is that removal of the splint is required in essentially every case; removal, however, is a very simple process. As to the use of iron screws by Dr. Jopson, he believes such screws are better than the silver ones as ordinarily sold. The latter are imperfectly made, the threads being much inferior to those on the iron wood-screws, which he would not hesitate to use in a similar case.

Dr. Jopson, in closing, said the staple described by Dr. Roberts appealed to him as being a good appliance, but the Halsted splint has superior advantages. The latter may be cut in desired lengths for any case. In the one reported, the fracture was oblique, and the fragments were held very firmly by two screws above and one below the line of separation. He was quite surprised when the sinus which had formed at the site of a gauze drain underwent spontaneous closure. It will be a simple matter to remove the splint if necessary, and will cause no damage, as the purpose for which the splint was inserted has now been long accomplished.

LAMINECTOMY FOR FRACTURE OF VERTEBRA.

Dr. James K. Young presented a woman who fell eight years ago, fracturing the spine in the dorsolumbar region. In the course of her treatment, a laminectomy was performed by Dr. Ashhurst at the University Hospital. After three months patient was discharged. She was not able to move below the waist. Sensation was absent.

One year after her fall, she went to the Orthopædic Hospital, where she was under the care of Dr. S. Weir Mitchell. She was treated with massage, static electricity, and rest. Improved gradually, until in the course of two months she could walk in a wheeling-crutch. After two months more on crutches she began to walk with a cane.

On October 8, 1904, she came under the observation of Dr. Young, who found that she could then walk on a level, but was unable to walk up and down stairs. Was unable to stand alone. Right leg has lack of co-ordination. Massage, electricity, and special movements were directed to be given to encourage co-ordination. The posterior group of muscles in the thigh and calf are the ones most affected. There is some deviation of the spine. Spinal support applied.

June 1, 1905, Dr. Young finds that she is able to walk up and down stairs with the use of a cane. Is not able to stand unless she can touch something, must move if she cannot hold to something. Legs are much stronger. The right leg is slightly numb. Ever since the injury, she has had a burning sensation in the right leg in the region of the sciatic nerve. This sensation begins in the heel and goes up the back of the leg. It is not continuous, but comes and goes. She experiences it every day.

There is pain in the back, in the lumbar region, sometimes severe, and usually accompanied by headache.

Recently she has not had as good vision in the left eye as in the right, especially when she is fatigued. Tested the vision at thirteen inches, and found the right eye much better than the left. She sleeps well, has a good appetite, and the general health is good. She jumped several inches from the floor to-day. In her own home she frequently walks without support.

Dr. Young said that his object in presenting this case was to direct attention to the importance of the after-treatment of fractures of the spine, particularly by the use of spinal supports, massage, electricity, and of every known means which will restore function to the muscles. He had frequently been asked to examine cases of fracture of the spine, one or two years after a laminectomy, where a marked kyphosis was present and where efficient support had not been used.

PARALYSIS OF ARM FROM DISLOCATION OF SHOULDER AT BIRTH.

Dr. James K. Young presented an infant, aged nine months, whose left shoulder was dislocated during birth by traction, resulting in paralysis. Electrical treatment was given. The case had been diagnosed as birth palsy.

Examination, March 19, 1904, showed a backward dislocation of the humerus, with limitation of motion, deformity, and pain upon movement. The arm was held rigidly at the side in a position of marked pronation. Skiagraph showed backward and downward dislocation of the humerus.

He reduced the dislocation April 7, 1904, under anæsthesia. Two months later there was some limitation at the elbow-joint, and some rotation of the radius. This he broke up by forcible manipulation, under anæsthesia. Electricity, massage, and exercises were given, which was followed by marked improvement, continuing up to the present time.

His object in showing this case was to direct the attention to the frequency with which dislocation of the shoulder is mistaken for birth palsy. Injury to the brachial plexus may result from injuries during birth, but dislocations of the shoulder, if allowed to continue, will produce pressure palsies resembling birth palsies, as in the case exhibited.

SPIRAL FRACTURE OF THE HUMERUS CAUSED BY JIU-JITSU.

Dr. George Morris Dorrance presented a boy, aged fourteen years, who came under his care at St. Agnes's Hospital on March 30, 1905, with the history that while practising jiu-jitsu with a playmate he had fractured his humerus. The hold gotten by his opponent consisted in catching him by the left wrist with the forearm flexed on the arm, and rotating the forearm outward.

When seen by Dr. Dorrance the deformity consisted of an outward and upward displacement of the upper end of the lower fragment with one and three-fourths inch shortening; this was overcome by putting the arm on an anterior angular splint with four pounds hanging from arm. At present he has one-half inch of shortening, with full power and use of arm. Massage and passive movements were started on the seventh day, and continued for five weeks.

Dr. Richard H. Harte said the skiagraphs shown by Dr. Dorrance illustrated what he had seen in a fracture caused by a similar accident. Two men engaged in a friendly trial of strength attempted to throw each other's arm to the side, and the humerus of one was fractured. Some time afterwards the man died from other causes, and the specimen showed the same kind of fracture as that just reported. The line of separation was spiral in shape, as though the bone had been twisted off.

OPERATIONS PERFORMED AT THE GERMAN HOSPITAL.

Dr. John B. Deaver presented a report giving an analysis of the operations performed at the public clinics for students held at the German Hospital during the session of 1904–05.

STATED MEETING, OCTOBER 2, 1905.

The President, HENRY R. WHARTON, M.D., in the Chair.

STAB WOUND OF THE LUNG.—TREATED BY SUTURE.

DR. JOHN H. JOPSON presented a young man, who, six weeks before, had been stabbed in the fifth interspace in the anterior axillary line of the left side. When the man was seen there was, in addition to signs of a developing pneumothorax, external hemorrhage, severe enough to make its active control desirable. The wound was enlarged, a part of the sixth rib resected, and inspection made of the pericardium and diaphragm, both of which proved to be uninjured. Examination of the collapsed lung revealed a cut, one and one-half inches long, as the active site of the hemorrhage. The lung was grasped by forceps, drawn out, and the hemorrhage controlled by a continuous catgut suture. The pleura was drained by means of a tube and gauze inserted in the original wound and also posteriorly in an opening made for that purpose. Pyocyaneous infection occurred and later pneumonia developed but the patient recovered. Now, at the end of six weeks, there remains a discharging sinus leading to a contracting cavity of moderate size.

In another case seen recently, there were five wounds in the back, one penetrating the pleura. In that instance Dr. Jopson did not resect a rib but simply plugged the wound with gauze. Symptoms similar to those in the present case developed. After two days the gauze was removed to allow the blood to escape. The wound was then replugged for two days when the drainage tube was inserted. The patient was recovering. Dr. Jopson is aware there is a great difference of opinion as to the control of hemorrhage and also regarding other points in the management of these wounds; in the case shown, the control of hemorrhage seemed to be the imperative indication.

DR. ROBERT G. LE CONTE said that several years ago he had

discussed before the Society the subject of penetrating wounds of the lung, and that he had had no reason since to change the opinions then expressed. His conclusions at that time were that when a wound of the lung is causing only slight hemorrhage, the external wound should be closed with gauze and the physical signs of bleeding watched for. When the hemorrhage is more marked, a small drainage tube should be inserted into the pleura and the admission of air regulated according to the difficulty of respiration in the patient. When the hemorrhage is large and the symptoms alarming, open the chest and insert a large drainage tube, so as to form a rapid and complete pneumothorax; at the same time, when necessary, give salt solution intravenously. When this fails to control the hemorrhage, as shown by the increasing failure of the pulse, it becomes necessary to resect one or more ribs and deal radically with the bleeding vessel, either by ligation, suture, or packing. In severe hemorrhage from the lung the first object is to get pressure on that lung, and this is best accomplished by opening the chest and forming a pneumothorax. The admission of air to the pleura is under perfect control, and it can be increased, diminished or stopped at will, should untoward symptoms appear. Besides permitting a collapse of the injured lung and bringing direct pressure upon it, the presence of air favors the formation of a clot in the severed vessel. This procedure in his experience has been sufficient to control a very alarming hemorrhage from the lung, and he had not yet had a case where resection of a rib was necessary, with suture of the lung.

GASTRO-ENTEROSTOMY FOR GASTRIC ULCER.

DR. FRANCIS T. STEWART reported the following case to call attention again to the difficulty sometimes encountered in differentiating between carcinoma and extensive perigastritis the result of chronic ulcer of the stomach, and to emphasize the advisability of exploratory laparotomy in cases in which intra-abdominal malignant disease is believed to be present. In the upper abdomen a palpable carcinoma so often means the time for cure has passed, that some physicians counsel soothing medical treatment rather than surgical interference unless there are indications for some palliative procedure. One can rarely be absolutely sure, however, that the condition is malignant, and right is on the side of the surgeon who explores such cases with the belief that he is

dealing with an inoperable cancer, but with the hope that he will find gastric ulcer, or gall-stones, or chronic pancreatitis, or some other condition equally amenable to treatment, or, that in the event of malignancy, he will find the disease removable or at least so situated as to permit of some measure which will relieve the patient's suffering. His own patient, a man aged forty-two years, was admitted to the Polyclinic Hospital in September, 1904. He had suffered with indigestion for eight years, during which time, at irregular intervals, he would have attacks of vomiting which would relieve the almost constant pain he experienced in the epigastrium. Two years ago his appendix was removed by another surgeon without giving the hoped-for comfort. Three or four days before admission he had vomited a mouthful of blood, and this was the only time as far as he could remember. During the last year he has lost 77 pounds in weight. At the time of examination he was lemon-colored, markedly emaciated, vomiting all food, and suffering constant pain in the upper part of the abdomen. Beneath the upper part of the right rectus lay an immovable tender mass about the size of an adult fist. The stomach contents showed HCl .073 per cent., total acidity 51, and the presence of lactic acid. The stomach was not distended owing to the discomfort produced. Blood examination revealed hemoglobin 45 per cent., leukocytes 5,000 and red cells 3,000,000. Operation was performed September 30, 1904, disclosing a hard tumor involving the pylorus and adherent to and apparently infiltrating the pancreas, liver, colon and anterior abdominal wall. The adjacent lymphatic glands were swollen and indurated. With some difficulty a posterior gastroenterostomy without the loop and without the button, was performed. For six days following the operation the patient vomited large quantities of dark fluid which during one twenty-four hours amounted to 172 ounces. He refused a second operation and was thought at one time to be dying. The vomiting ceased rather suddenly but recurred at intervals for four weeks and then stopped permanently. The patient is now absolutely well, eats all sorts of food without any distress, has gained 62 pounds in weight, and no tumor can be detected on careful palpation of the abdomen.

Dr. John H. Gibbon recalled an exactly similar case upon which he operated two years ago. The mass involved the pylorus and was as large as a fist. He performed gastroenterostomy with

the idea of later doing a pylorectomy or partial gastrectomy, but as in Dr. Stewart's case the patient went on to perfect recovery and is now perfectly well. Both these cases show the advisability of operating even in the presence of a large mass.

RECOVERY AFTER EXTENSIVE FRACTURE OF SKULL.

Dr. William L. Rodman showed a patient upon whom he had operated two weeks previously for an extensive fracture of the skull. The man was struck with a beer bottle thrown with great force which mashed in the right side of the frontal region. When seen he was conscious, with a pulse of 62 and respirations 20. The fracture involved both the vault and the base of the skull and extended into each frontal sinus. Large fragments of the skull were removed and as the jagged bone had torn the meninges, they were further incised and the brain inspected and irrigated. A large blood clot was found but this had caused only slight paresis of the right arm. The frontal sinuses were packed to prevent infection. The patient unexpectedly made a prompt and uneventful recovery.

A TRANSVERSE INCISION FOR THE REMOVAL OF THE APPENDIX.

BY GWILYM G. DAVIS, M.D.,
OF PHILADELPHIA.

THE most popular incision at present for the removal of the appendix is probably that first described by Battle (*Brit. Med. Journ.,* 1895, ii, p. 1360) and later by Jalaguier (*La Presse Médicale,* 1897) and Kammerer (ANNALS OF SURGERY, 1897, xxvi, 225). It is made along the outer edge of the rectus muscle, and the skin being drawn toward the median line the anterior layer of the sheath of the rectus is incised longitudinally. The rectus is then displaced inwardly, and such portion of the sheath as may be present, and the transversalis fascia and peritoneum incised posteriorly. This operation was modified by Lennander (*Cent. für. Chirurg.,* 1898 xxv, 90) and Endebohls (*Med. Record,* 1899, p. 665) by going directly through the fibres of the rectus instead of drawing it to one side and the method is used at least by many for all kinds of cases, suppurative and otherwise.

The operation of McBurney (ANNALS OF SURGERY, 1894, vol. xx, p. 38) is also frequently used. He made an incision four inches long in the direction of the fibres of the external oblique about one inch from the anterior superior spine crossing a line drawn from it to the umbilicus nearly at right angles. One third of the incision is above this line. The external oblique fibres were divided in the line of the skin incision and the internal oblique and transversalis fibres parted in a direction nearly at right angles to those of the muscle above.

Harrington (*Boston Med. and Surg. Jour.,* Aug. 1899) and Weir (*Med. News,* Feb. 17, 1900, 241) suggested continuing the separation of the internal oblique and transversalis inward by dividing the sheath of the rectus and pulling it toward the median line. This was done in order to obtain

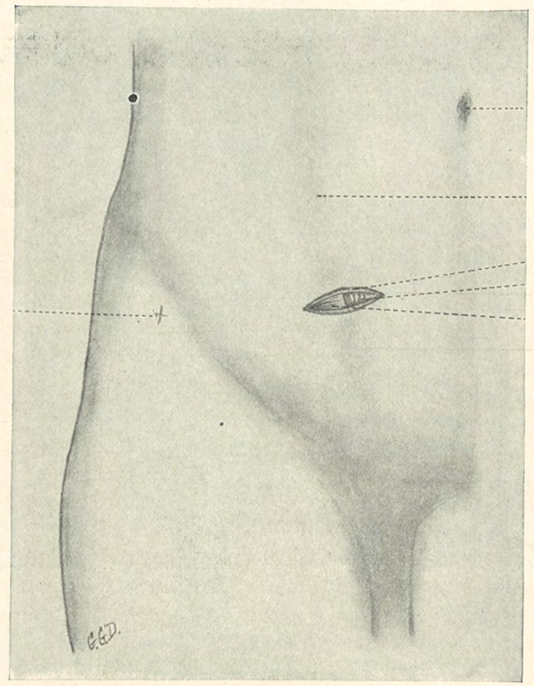

FIG. 1.—Small incision for simple cases.

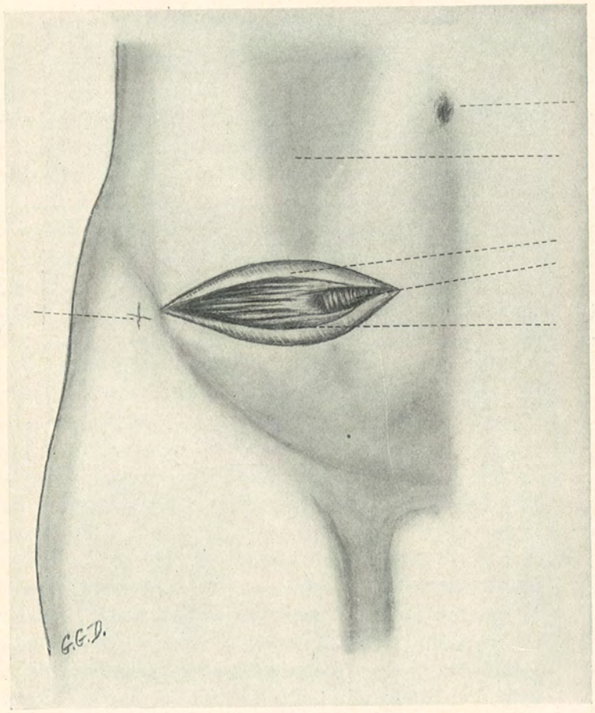

FIG. 2.—Large incision for difficult cases.

additional room in cases in which the McBurney incision had been found to be insufficient. Quite recently I have come across the paper of J. W. Elliot, (*Boston Med. and Surg. Journal,* 1896, vol. ii, p. 433) which seems to have been overlooked by most surgical writers. He made his incision beginning at half an inch inside of the linea semilunaris. The external oblique was divided in the line of the skin incision and the internal oblique and transversalis were divided in the direction of their fibres and in the line of the incisions above. If more room was desired he suggested that the incision could be prolonged along the linea semilunaris or into the rectus muscle if necessary.

It is thus seen that there are three ways of operating—one through the sheath of the rectus longitudinally, another by McBurney's operation with the Harrington and Weir addition and the third the transverse incision of J. W. Elliot through the external and internal oblique and transversalis muscles.

Of the longitudinal incision of Battle and its modification of going directly through the rectus the former seems the better for the following reasons: The incision through the muscle weakens it at this point. In Battle's operation the rectus presents an intact muscle to resist the inside pressure and the incisions through the sheath are overlapped by the muscle slipping back into place. In the modified operation there is left a straight scar from the skin to the peritoneum. Division or parting of the muscle is certain to wound some of the branches of the deep epigastric artery or even sometimes the main trunk. This is more apt to be the case if the fibres are parted from above down than from below up. In longitudinal incisions generally the nerves supplying the rectus are liable to be cut through as well as the vessels. These nerves are motor in character as well as sensory and come from the tenth, eleventh and twelfth intercostals. If cut they, like other motor nerves, do not tend to unite. If large incisions are needed the amount of muscle paralyzed is considerable. If drainage is used it is brought out directly through the lower

angle of the wound and it is needless to point out how favorable this is to the production of hernia.

Paralysis of a part of the rectus is recognized by, first, the operated side of the abdomen protruding more than the sound side and, secondly, by observing that when the rectus contracts the scar is dragged up by the uninjured part of the muscle while the paralyzed lower portion offers no resistance. Another objection to incising the sheath of the rectus pointed out to me by Dr. Porter is that infection may travel along beneath it instead of coming up to the surface. McBurney's operation is good in easy cases but in difficult and suppurative operations it does not give sufficient room and makes a nasty wound if infected and unsuitable for efficient drainage. The operations of Harrington and Weir possess all the objections of the McBurney with the exception of the slight additional space gained by displacing the rectus.

Proposed Incision.—For easy cases the incision is made directly transverse one and a half inches long. Its center is to be on the semilunar line on a level with the anterior superior spine. The aponeurosis of the external oblique is divided in the line of the skin incision but obliquely to the direction of its fibres. The fibres of the internal oblique and transversalis muscles are parted—not cut—in the same line as the structures above. The peritoneum is then opened and the incision carried inward through first the anterior layer of the sheath of the rectus. A blunt retractor three-quarters of an inch wide is then inserted and the muscle drawn toward the median line. This exposes the transversalis fascia and peritoneum posteriorly which are then also divided. Thus is obtained a triangular opening with its base of three quarters of an inch and two sides of about an inch long which is ample for simple cases.

For Difficult Cases.—If the case is a difficult one the outer end of the incision is prolonged to the anterior spine or even above and inwardly through the sheath of the rectus to within an inch of the median line. This will give an opening four to five inches long according to the size of the patient, sufficiently

large to insert the hand if necessary and through which the appendix can be extracted under almost all circumstances.

The operation was developed as follows: Previous to about eight years ago the incision parallel to Poupart's ligament dividing all structures in the line of the skin incision was used. About that time, desiring to avoid the transverse division of the muscular fibres of the internal oblique and transversalis, the incision was made higher up on the abdomen, practically Elliot's operation. It began where a line from the femoral artery to the umbilicus crossed the linea semilunaris (about opposite the ant. sup. spine) and went outward and slightly upward toward the crest of the ilium. In cases requiring a large incision room was obtained outwardly and the ascending branch of the circumflex iliac artery was divided. It was to avoid doing this that for the past two years the incision as above described has been used. The center of the incision on the linea semilunaris opposite the anterior spine is almost over the base of the appendix. Sometimes it is higher, more rarely it is lower, in either case it is easily within reach. The ileo cæcal junction lies three-quarters of an inch above the base of the appendix so that one serves as a guide to the other. The incision is designed to avoid wounding arteries. The deep epigastric always enters beneath the edge of the rectus muscle below the level of the anterior superior spine and its main trunk is out of the way. To divide and ligate the epigastric vessels as suggested by Weir appears to be an objectionable and unnecessary procedure. As the deep epigastric proceeds upward it lies on the under surface of the muscle at about its middle or often a little toward the outer side, sending branches to each side, the larger ones going outward. They are usually drawn aside when the muscle is retracted even in extensive operations.

At the outer angle of the wound no vessels will be divided unless the incision is carried upward and backward beyond the anterior spine as the ascending branch of the deep circumflex iliac is given off and proceeds upward just above the anterior spine. As the deep muscles are divided in the direction of the

nerves these are not injured as occurs in longitudinal incisions through the rectus. The appendix in this incision is particularly accessible because its center lies almost over the base of the appendix. In the longitudinal incisions through the rectus they lie to the inner side of the base of the appendix and if it points to the right and is retro-cæcal the operator encounters the objection pointed out by McBurney of having to work outward under a shelf of tissue made by the outer margin of the wound.

In cases in which drainage is necessary the drain is brought out at the outer angle of the wound and lies close to the bony anterior superior spine and passes through the thick muscular mass of the internal oblique and transversalis, all of which ensures against the formation of a hernia at that point.

The inner portion of the wound is protected absolutely against hernia by the rectus muscle, and to its outside there are the thick internal oblique and transversalis muscles beneath, and above them the aponeurosis of the external oblique. The aponeurosis of the external oblique does not blend with the sheath of the rectus at the linea semilunaris but joins it at about one-third of the distance between the linea semilunaris and the linea alba. The division of the external oblique aponeurosis obliquely instead of parallel to the direction of its fibres may be urged as an objection but this is more than compensated for by the better access which is afforded. No hernias have come under my observation even in suppurative cases.

Dr. William L. Rodman agreed that McBurney's operation is anatomically correct and usually satisfactory in clean cases; in pus cases it is inadequate and should not be employed. It would seem that any transverse incision is more liable than oblique ones to be followed by ventral hernia though Dr. Davis has not found this to be the case in the operation he advocated.

THE RADICAL CURE OF DIRECT INGUINAL HERNIA.

BY GWILYM G. DAVIS, M.D.,

OF PHILADELPHIA.

The radical cure operations for both oblique inguinal and femoral hernias are fairly well understood and satisfactory. Direct hernia is much less frequent, not so well understood and not infrequently its operative treatment is quite difficult and not always satisfactory. The direct hernias which have come under my notice have presented themselves in two forms. One form pushes its way through the conjoined tendon and comes out of the external ring. It possesses as its coverings the peritoneum, sub-peritoneal fat, transversalis fascia and thinned conjoined tendon, and intercolumnar fascia, all usually more or less matted together. The other form bulges around the outer edge of the conjoined tendon and gradually decreases in size as it extends out toward the deep epigastric artery. It is pear shaped rather than spherical in form.

In this form we might expect to see the remains of the obliterated hypogastric artery going over the sac, but I have seen no evidence of it: possibly it has been pushed to the inner side behind the edge of the rectus muscle. It is recognized that when muscular and tendinous tissues are thick and abundant the operations for the radical cure of hernia are quite satisfactory and easy of performance. It is just the opposite condition that is confronted in direct hernia. The relation and construction of the conjoined tendon should be borne in mind. This tendon which is formed by the fusing together of the aponeurotic tendons of the transversalis and internal oblique muscles at the linea semilunaris passes over the rectus muscle and is almost immediately joined by the aponeurosis of the external oblique to form the sheath of the rectus. Thus

it is seen that the insertion of the conjoined tendon and sheath of the rectus are practically the same. The sheath below the fold of Douglas is entirely in front of the muscles. Posterior to the muscle is transversalis fascia only. As the sheath descends it inserts into the crest of the pubis its spine and a short distance—about an inch—along the ileo pectineal line. The outer or lower edge of the conjoined tendon (sheath of rectus) fuses into and blends with the transversalis fascia as it goes out to the deep epigastric artery. This being the case the conjoined tendon has no free edge unless it is made by the knife dissecting it away from the transversalis fascia beneath.

Below, lying on Poupart's ligament is the spermatic cord covered by the fibres of the cremaster. The cremaster is nothing more than the lower edge of the muscular fibres and connective tissue of the internal oblique continued down over the cord.

In performing a radical cure of oblique hernia these cremaster fibres are sometimes quite abundant and may, as I have done, be utilized in closing the canal, but in direct hernia they are apt to be too scanty to be of any service. In oblique hernia the gap from the deep epigastric artery to the spine of the pubes is closed by bringing down the internal oblique muscle and conjoined tendon and sewing them beneath the cord (Bassini) to Poupart's ligament; but in direct hernia these tissues are so scanty that they are insufficient for the purpose. The suggestion of Halsted to take a flap from the sheath of the rectus and turn it outward I have never tried. The usual method resorted to to reinforce this weak spot is that of Wölfler and Bloodgood of opening the sheath of the rectus and dragging its fibres outward and sewing them to Poupart's ligament. The incision for exposing the rectus is shown in Fig. 1. The external oblique has been turned back exposing the internal oblique. The conjoined tendon is drawn up and in by a retractor introduced beneath it out toward the muscular fibres. The incision is then made from the muscular fibres toward the spine of the pubis. This incision is practically made through the lower edge of the conjoined tendon

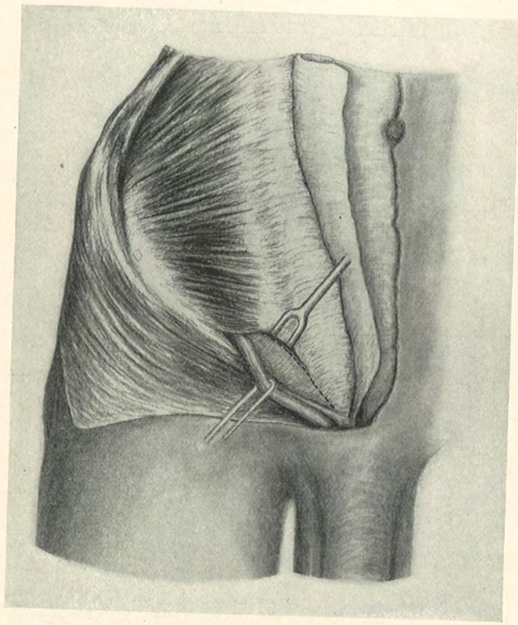

FIG. 1.—Showing incision from muscular fibres of the internal oblique to the spine of the pubis to expose the edge of the rectus muscle.

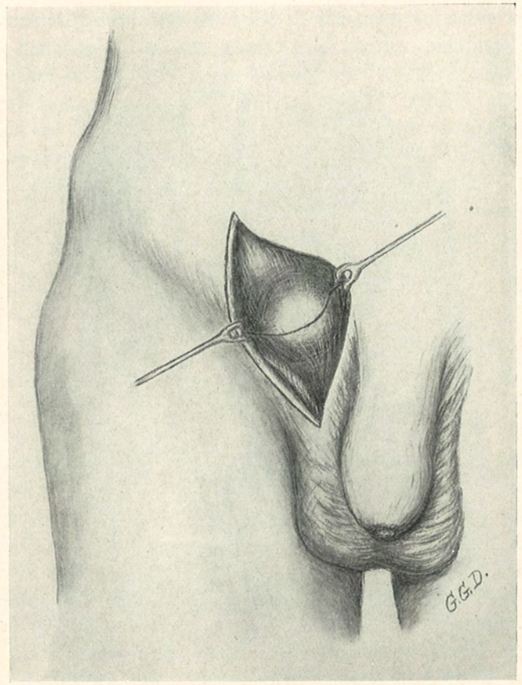

Fig 2.

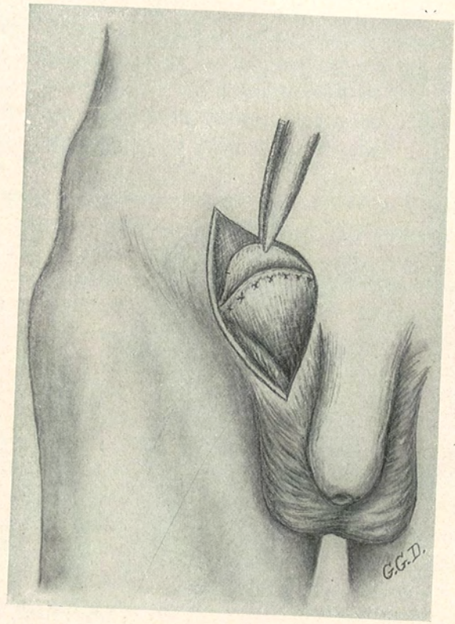

Fig. 3.

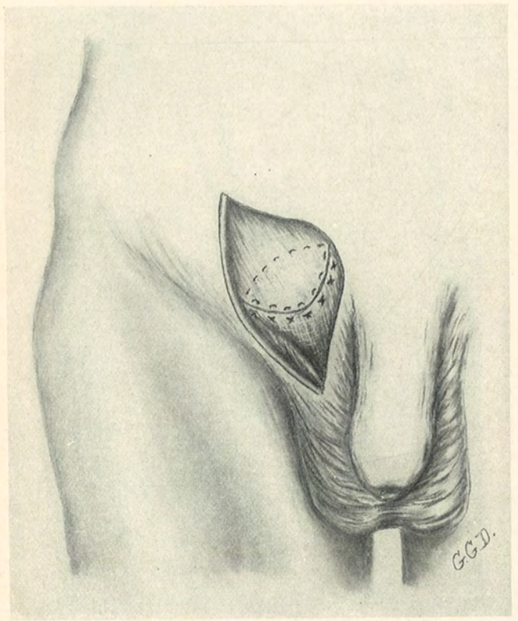

FIG. 4.

because this latter fades away into the transversalis fascia in the direction of the deep epigastric artery. The transversalis fascia is then pushed back from the posterior surface of the rectus and the conjoined tendon (sheath of the rectus) raised up from its anterior surface. Personally I have not been able to draw the rectus as far out as Bloodgood advises.

After having transplanted the rectus as far out as possible then the arching fibres of the internal oblique and conjoined tendon are to be brought down and sutured to Poupart's ligament beneath the cord as in Bassini's operation. The external oblique is then sutured as desired (overlapped or not) over the cord.

In operating on the other form of direct hernia an entirely different state of affairs is presented. The rounded hemispherical tumor presents itself just above the position of the external ring with the cord below. One of two conditions will be found. Especially when the hernia is an old one the hernial coverings from the intestine within to the superficial fascia without will be a single thick strong membrane incapable of being separated into layers. When such a condition is found in several cases I have divided the sac transversely and overlapped its two parts, suturing the apex of the lower flap to the base of the upper and then bringing down the upper flap and suturing it in place as is done in the Mayos' operation for umbilical hernia. They dissect off the peritoneum but I believe it is better not to do so because it is firmly blended with the other tissues and adds considerable to the strength of the flaps, whereas alone it is too weak to be of much service. (See Figs. 2 and 3.)

In some other cases the peritoneum is not adherent to the conjoined tendon and intercolumnar fascia in front but has a layer of fat between. When such is found, the fat may be scraped away and the two laid together and treated as a single layer and overlapped as already described or some other method may be resorted to. The treatment of these direct hernias is not entirely settled and different methods must be used for different conditions. As the overlapping plan has

been found to work satisfactorily in cases of oblique inguinal hernia (Andrews) and umbilical hernia (Mayo) so I believe will it also be found of value in certain cases of direct inguinal hernia.

Dr. Wm. L. Rodman was much interested in Dr. Davis's statements regarding direct inguinal hernia. He believes the frequency of this type is greatly over-rated by anatomists; instead of being in the ratio of 1 to 5 as usually stated, he considers 1 to 25 more nearly correct. In more than 300 operations for hernia he has rarely seen the direct form, though recently he operated upon two cases in one day, one of them being a hernia of the bladder, the only one he has ever seen. He has never encountered the conjoined tendon as a covering of a hernia and does not see why it should be so, it being very easy for the gut to slip around the muscle and, going in the direction of least resistance, carry with it the transversalis fascia instead; the former condition may occur in persons with great muscular relaxation but does not take place usually. Dr. Rodman made this point in a lecture several years ago when Dr. Coley was present and this experienced operator agreed that the conjoined tendon was rarely, if ever, present as a hernial covering. Dr. Rodman finds the transplantation of the sheath of the rectus, after Halsted's method, very satisfactory and is resorting to it with increasing frequency and confidence in cases of relaxed musculature. He does not operate on direct hernia with the same confidence that he feels regarding the indirect form but considers Halsted's method of transplanting the anterior sheath of the rectus and also using the cremaster muscle as distinctly strengthening the wall. Operated upon in this way, direct inguinal hernias will seldom recur. He has had but one recurrence of a direct hernia in the comparatively small number he has operated and this was reoperated by Halsted's method *four* years ago and remains perfectly cured. The patient is a motorman, leads a very active life, and has given the cicatrix sufficient test. Recurrence, in any hernia, is rare after one year.

Dr. Davis, in closing, said the experience of various surgeons differed greatly as to the proportion of direct to indirect hernias. The number of the former is not large but, though he does not see many of them he operated upon five hernias in four patients within a short time during the past winter. As to the occurrence of hernia in the transverse incision for appendicitis, in the case of the short incision, the inner half, three-fourths inch, is blocked by the rectus muscle and the outer half by the transversalis and external oblique. When the larger incision is employed, the inner two inches is blocked by the rectus and the outer three inches by the internal oblique and the transversalis which are cut in the direction of their fibers. The only aponeurosis divided diagonally to its fibers is that of the external oblique and it seems to heal strongly and satisfactorily.

APPENDICEAL ABSCESS POINTING IN THE RIGHT SIDE OF THE SCROTUM IN A PATIENT FREE FROM HERNIA.

Dr. Robert G. Le Conte reported the case of a man, aged twenty-one, colored, who was admitted to the Pennsylvania Hospital on the morning of July 17, 1905, with the following history: Seven days previous to admission he was seized with pain in the abdomen and vomiting. Fever developed soon afterwards, and the abdominal pain continued, with rigidity and tenderness over the appendix. The night before admission the pain suddenly extended to the right scrotum, with the appearance of a tumor in this region.

On admission the temperature was 102°; pulse 104; respirations rapid; facial expression pinched; mucous membranes blanched. The abdomen was slightly distended and tympanitic, with marked rigidity on the right side and exquisite tenderness over the whole lower right quadrant, where a diffuse mass could be made out, the feeling of tumor extending down to the right inguinal ring. The external inguinal ring and upper portion of the scrotum were filled with a tumor the size of an orange, the overlying skin being reddened and edematous. This swelling was tense, dull, without fluctuation or impulse on coughing, and did not diminish with taxis. No history could be elicited of a previous hernia, and as the man had been in bed for a week the probability that this mass might be inflamed omentum was remote. There was no obstruction of the bowels, they having been freely moved the night previous. It was therefore thought that a patent funicular process had existed since birth, into which an appendiceal abscess had ruptured.

Ethyl chlorid and ether were used for narcosis, and a three-inch incision was made over the scrotal mass, extending from the external ring downwards. As the dissection proceeded a thick, inflammatory capsule was opened and a large quantity of pus evacuated with a typical appendiceal odor. The finger readily passed through the inguinal canal into the abdomen, but only a rounded channel could be felt and no portion of the appendix was within reach. Owing to the precarious condition of the patient further operative procedure was not considered. A drainage tube was inserted through the internal abdominal ring into the abdomen, and a portion of the wound closed with silkworm gut sutures.

The following day the patient's condition was still very serious; pulse rapid and weak; temperature 102.4°; discharge on the dressings was very free. He responded fairly well to free stimulation. The day following his condition had somewhat improved. From then on convalescence was fairly rapid, although the temperature remained elevated for a week. The wound gradually closed, until only a small sinus resulted, with persistent discharge.

On August 23 the patient consented to a second operation for the removal of the appendix. This was done by Dr. Hutchinson.

Ethyl chlorid and ether narcosis. Incision was made along outer border of right rectus below umbilicus, and was gradually prolonged until the internal abdominal ring was exposed. On opening the abdomen the intestines were found matted together, and after some difficulty the cecum was recognized and in part isolated. What appeared to be the stump of a sloughed-off appendix was caught and ligated, but later, after breaking up still more of the adhesions in an attempt to trace the sinus to the scrotum, the real stump of the appendix was found in a retro-cecal position. It was patulous and oozing a small amount of fecal material. The stump was tied, inverted with a pursestring suture of chromicised gut, followed by a few Lembert interrupted sutures. The tip of the appendix, which had sloughed off, was found still further posterior to the head of the cecum in an opening through the pelvic peritoneum, the cavity resembling somewhat the sac of a hernia. On removing it a fecal concretion about as large as a bean was also found in this pouch. A probe entered in the scrotal sinus passed directly into this pouch, the sinus being entirely posterior to the pelvic peritoneum, and in that sense extra-peritoneal. The sinus was curetted and the sub-cecal region drained with iodoform gauze. The wound was partly closed.

An uninterrupted recovery followed this operation, and by the 10th of September the wound and sinus had entirely closed, and on the 13th the patient was discharged cured.

An interesting and unexpected feature in this case was the perforation of the pelvic peritoneum with the burrowing of the abscess outside of the peritoneal cavity, the pus finding its way into a previously normal inguinal canal and scrotum. In this case there was no history of a hernia, nor did the operation show that one had previously existed. It seems strange that the pus after having broken through the pelvic peritoneum and reached the psoas muscle—did not follow this muscle and point in the usual position for psoas abscess, instead of entering a normal inguinal canal.

Dr. James P. Hutchinson said the most interesting point to him regarding the case was his mistake of opening too low down for the appendix, though this part was relatively free from adhesions as compared with the upper part. The appendix was difficult to bring up and he believes he tore the organ from its cecal attachment during the attempt at removal. When the other portion was removed it was patulous; hence the belief that the concretion came from the appendix and not from the cecum.

STONE IN THE CYSTIC DUCT.

Dr. Charles F. Mitchell presented a specimen obtained from a patient whose gall-bladder contained seventy-five gall-stones and a quantity of pus. The cystic duct was dilated as was also the hepatic duct, the latter readily admitting a finger. A number of stones were removed from the hepatic duct. Following operation the patient developed many complications and finally died. At autopsy the cystic duct was found to be almost occluded by a faceted stone which was probably left in the hepatic duct at the time of operation.

Dr. John H. Gibbon found the patient referred to by Dr. Mitchell in his ward when he went on duty; the gall-bladder wound was still draining but in a few weeks it entirely closed and there were no symptoms referable to the liver. A recto-

vaginal fistula which had developed shortly after the gall-bladder operation was the important feature at this time. Dr. Harte regarded it as the result of numerous turpentine enemas; at one time a spoon had also been used in removing hardened feces. Pure pus was discharged from the fistula about one week after Dr. Gibbon took charge and in a few weeks this was repeated. At these times there was a chill and rise of temperature and the patient developed a low sepsis. Dr. Gibbon concluded there was an abscess cavity in the abdomen, originating in the appendix or a tube, and emptying into the bowel. As Dr. Mitchell found the appendix normal when he operated, that organ seemed to be excluded. Because of the infiltration about the fistula a satisfactory examination of the tubes could not be made. Exploratory operation was possibly too long deferred but the abdomen was finally opened. The peritoneal cavity was full of light, straw-colored fluid. The tubes and ovaries were slightly adherent to the surrounding structures but no abscess was found. The rectum was adherent to the uterus and attempt to separate them resulted in the finger passing into the rectum. In closing the fistula, two other small openings into the vagina were found; the rectum was an unrecognizable cavity containing a quantity of pus. The patient was practically pulseless when operated upon and died in a few days of peritonitis. At autopsy it was found that three or four inches of the rectum in the hollow of the sacrum had sloughed. A small tract extended upward along the sheath of the psoas muscle but there was no distinct cavity at the upper end. No other pathological condition was found although a careful search was made. Dr. Gibbon believes that the lower three or four inches sloughed because of the injury done by the turpentine.

AN UNUSUALLY LARGE PREPATELLAR BURSA.

Dr. John H. Gibbon presented this specimen which before removal was as large as the patient's knee. It was of several years' duration and had never been tapped. The work of the patient had not required the kneeling position. Portions of the bursa are so hard as to suggest the presence of calcareous material but the exact nature has not been determined as the sac has not been opened. A great deal of redundant skin was removed with the bursa. The bursa was dissected away from the patella without rupture and was shown after it had been hardened in formalin solution.

STATED MEETING, NOVEMBER 6, 1905.

The President, Henry R. Wharton, M.D., in the Chair.

SARCOMA OF THE BREAST IN A GIRL OF ELEVEN YEARS.

Dr. William L. Rodman presented a girl of eleven years upon whom he had operated for sarcoma of the breast. Through an unaccountable oversight the specimen was thrown away by the clinic attendants and hence a microscopic examination could not be made, but from the clinical history and the microscopic appearance of the specimen there seemed no doubt that it was a sarcoma. Certainly it was a neoplasm and was not encapsuled. Nearly a year ago the patient struck the breast, the injury being followed by pain. She was treated in the dispensary of the Jewish Hospital from Easter until September, the pain persisting and the growth increasing in size. When Dr. Rodman saw the patient, the growth was evident and was reasonably hard. Immediate removal was advised because the pain was increasing and also because of the large veins which ran across the tumor; he has never seen such veins in anything but a sarcoma. Three weeks ago the entire breast, including a large area of skin, was removed; the incision was carried well into the axilla but no enlarged glands were found. Sarcoma of the breast at any age is rare, there being ten or more carcinomas to one sarcoma. Dr. Rodman has not seen another case in so young a girl but recalls the reporting by Dr. Dugan, of Louisville, of a sarcoma in a girl of eight, and still younger have been observed; he had never before seen a neoplasm of any kind in so young a child.

LAMINECTOMY FOR PARAPLEGIA THE RESULT OF TUBERCULOUS DISEASE OF THE SPINE.

Dr. Richard H. Harte presented a man aged twenty-six, who was admitted to the Orthopædic Hospital on September 5, 1904. There was no tuberculous family history obtainable. He

had suffered from pneumonia two years previous, had scarlet fever when five years old and diphtheria when seven. In 1896, when nineteen years old, he had typhoid fever which was complicated by phlebitis in both lower extremities, the right leg being the first affected. After three months of convalescence the leg ceased to swell. In 1898 he entered the army and in the course of his duties he fell and struck his left kneecap. The injury was not severe but there was much swelling and considerable pain. On June 29, 1898, he was admitted to the Pennsylvania Hospital under the care of the late Professor Ashhurt, with a diagnosis of tubercular disease of the left knee joint. Some iodoform emulsion was injected into the joint and a month later an abscess, apparently tuberculous in character, formed on the inner side of the right arm; this was opened and drained. Three months after his admission to the Pennsylvania Hospital the patient's knee condition improved and he left the institution walking on crutches. In the following May he returned to the hospital for examination and was under Dr. Harte's care. His limb was in good condition and he had a fairly useful knee and was allowed the use of his leg. After this date he states the abscess in his arm opened again and the shoulder became stiff. Two years later he was readmitted to the Pennsylvania Hospital and the knee joint was found to be so badly diseased that palliative treatment was no longer considered, and the limb was amputated by Dr. Hopkins in the lower third of the thigh, on October 23, 1901. The patient made a good recovery from the operation and returned to his home. Shortly after this he noticed a lump the size of a hickory nut on the lower dorsal region of the spine. He complained of pain in the lumbar region and was treated for lumbago. He was not seriously incommoded until June, 1904, when he began to suffer from what he described as "remittent fever." He was confined to bed for two weeks, and when able to be up noticed a numbness which he had felt for some months about his hips and which increased so that his foot was numb; in a short time he entirely lost the use of his body and limbs below the waist line.

He was admitted to the Orthopædic Hospital in September, 1904, paralyzed from the waist down. Sensation was markedly impaired throughout the affected area. He had incontinence of urine and feces and a very severe grade of cystitis. The stump of the amputated limb was in good condition. There was very

marked kyphosis in the lower dorsal region. Every effort was made to relieve the annoyance due to the incontinence; extension was applied to head and right leg and the bladder thoroughly irrigated twice daily. After about two months of treatment the sensation improved and the incontinence and cystitis disappeared. At this time he was able, with effort, to slightly move the great toe. He remained in this state for about five months and no further improvement seemed probable; the question of laminectomy was then considered. He was examined by some of the neurological staff of the hospital, who advised against operation. Nevertheless, on April 27, 1905, nearly eight months after his admission to the Orthopœdic Hospital, with his desire, laminectomy was undertaken, although a cure was not looked for. The spines and laminæ of the ninth, tenth and eleventh dorsal vertebræ were removed, thus thoroughly exposing the cord so that it could be approached from all sides. Considerable extradural tuberculous material was removed and the anterior portion of the neural canal curetted and made as smooth as possible. Practically no shock attended the operation and on recovery from the anesthetic the patient expressed himself as being able to feel the bed beneath him in a much more natural way than before operation. He was put to bed with extension and counter-extension to the head and extremity. The wound convalescence was uninterrupted. Gradually increased power in the great toe was developed and at the end of four weeks sensation was perfect all over the lower extremities. The toes could be flexed, the ankle-joint, right knee and amputated left thigh could be moved at will, although markedly ataxic. On July 1, three months after operation, a plaster cast was applied. This was worn until about September 21, when it was replaced by a brace. Since that time his ability to walk has steadily increased, until now, seven months after operation, he is able to walk as well as the average one-limbed person, although he is necessarily handicapped in the use of his crutches by the brace. The first of October he developed a small abscess in the right shoulder, which was evacuated and soon healed.

In this case it would seem that ample time had been allotted to treatment by rest, extension, etc., and that if this mode of treatment was to be pursued further valuable time would be lost and degenerative changes would soon be manifested in the cord,

which would materially interfere with the results from any operative measure which might be determined on at a later period. Operative treatment in this class of cases is much more applicable in adults than in children. In the latter most brilliant results can be obtained by extension, pressure, etc., as the age, anatomical conditions, etc., lend themselves more readily to this mode of treatment. In adult cases it is Dr. Harte's judgment that after a reasonable period of rest and extension in bed, if no positive results manifest themselves after, say, from four to six months, more positive and radical measures should be considered. He was inclined to think that the paralysis and symptoms occurring in this class of cases are due in a great measure to tuberculous and inflammatory deposits, thickening of the membrane in and about the canal, and that their removal by a laminectomy will give a thorough exposure of the cord and its membranes, both anteriorly and posteriorly, and will thus offer the best means of relief. This procedure should be carried, if necessary, even to the severance of some of the spinal nerves so that the operator can be positive that no point of pressure has been overlooked. In a very small percentage of cases will any bony or angular compression of the cord be found. The region of the spine most prone to these affections would naturally be the dorsal, where the lumen of the canal is more restricted and where a small degree of thickening will be followed by pressure symptoms. It is a well-known clinical fact that many severe grades of paraplegia may recover though great angularity still exists, provided the tuberculous and inflammatory deposits are absorbed.

A number of years ago the brilliant results reported by Macewen, Horsley, and others led the profession to believe that almost every case of spinal carious paraplegia would be cured by operation. As a result many cases were operated upon with disastrous results. The operators failing to recognize that in addition to the local condition, their patients were afflicted with a weakening constitutional disease when the reactive condition was very low and where operative conditions were contraindicated.

With regard to the operative technique Dr. Harte had found that the best incision is one directly down on the top of the spinous process quickly separating the muscles and thoroughly exposing that portion of the column. For a few minutes violent hemorrhage will result, but this is easily controlled by pressure.

After a thorough exposure of the laminæ by removal of the spines with a large bone forceps a trephine can be applied and the neural canal thus carefully opened. After the exposure of the cord the other parts of the canal can be easily removed with a pair of Rongeur forceps. The trephine seems to be the simplest means of entering the neural canal, and after the removal of the disc the later steps of the operation are comparatively easy, little difficulty being experienced in exploring and examining the cord. In closing the wound deep buried stitches of chromicized catgut should be employed, insuring accurate approximation of all the overlying tissues, thus doing away with any possible dead spaces for clots to collect in and favor suppuration. The wound is preferably drained with gauze, as its contact with the cord is not liable to cause any undue pressure, which might possibly arise from the use of a drainage tube.

Dr. DeForest Willard said the exceedingly favorable result obtained in this case by Dr. Harte was undoubtedly due to the thoroughness of the operation, which extended both above and below the principal lesion, and also to the fact that he was able to remove so much tuberculous deposit. If in these cases extensive pachymeningitis be present in addition to the deposit, operative benefits will not be so speedy or so satisfactory. Striking cases like the one shown by Dr. Harte were reported fifteen years ago by Macewen, Horsley and others and as a result the profession was deluded into thinking that all would give the same improvement. Laminectomy is an excellent operation in favorable cases; in others it is a total failure and relapses are numerous. In the case shown by Dr. Harte relapse is not likely to occur unless the man again becomes tuberculous. Dr. Harte spoke of the care needed in selecting cases and of the feebleness of certain patients contraindicating operation. A very good illustration of these statements is the case of a boy upon whom Dr. Willard operated recently who for twenty months had lain totally paralyzed from spinal caries. At last motion slowly returned in his legs but as the muscles had contracted so much that he could not bend his ankles, it was decided to divide the tendo-Achillis in order to allow more motion. This was done, the boy, roused from his ether, talked and seemed comfortable, then suddenly died in five minutes in spite of every effort made in his behalf. The result showed the poor general condition of the patient, death

following so trivial an operation as division of tendons, with the loss of about three drops of blood and with an etherization of only a few minutes in a patient with no discoverable renal or cardial disease. These are cases that die after laminectomy.

Dr. James K. Young said that Dr. Harte had very carefully selected his case in this instance, and hence had met with success.

The difficulty in selecting cases lies in the recognition of the pathological process which is present in an individual case. Only 2 per cent. of paraplegias are due to bone pressure and 25 per cent. to tuberculous masses, the majority being caused by pachymeningitis. These patients should be operated on early, and they are in England, but not early enough here, especially by orthopedic surgeons. The operation is often delayed until complete loss of sensation has existed for a long period, and until every other known means of treatment has been exhausted. Often they are allowed to continue without operation more than four or six months. Early spasticity and early contractures are indications for early laminectomy, no other symptoms being so urgent. In all cases where it is possible the anterior portion of the spinal canal should be carefully examined. The removal of tuberculous masses from the anterior portion of the cord is difficult and it is only in adults that it can be accomplished. The incision employed by Dr. Harte is the best of the various ones in use.

TWENTY-ONE GUNSHOT PERFORATIONS OF THE SMALL INTESTINES WITH RECOVERY.

Dr. William L. Rodman reported this case, showing a specimen of six inches of jejunum containing three large perforations which was resected.

THE TREATMENT OF DIFFUSE SEPTIC PERITONITIS.

BY ROBERT G. LECONTE, M.D.,
OF PHILADELPHIA.

While in Chicago a month ago I was astonished to hear Murphy say that in his last 29 cases of diffuse peritonitis he had had but one death; and the purpose of my remarks this evening is to recount his technique in these cases and bring the subject before you for discussion. The majority of us, I think, have been in the habit of douching the peritoneum with large quantities of sterile salt solution, with or without partial evisceration, where the infection was diffuse. This has been our practice at the Pennsylvania Hospital, and our mortality is probably between 70 and 80 per cent., for we receive many cases in the last stages of septic peritonitis, where operation is undertaken as the only chance in an otherwise hopeless condition. If more than 20 or 30 per cent. of such cases recovered, we fancied our technique was rather superior.

While the procedures of Murphy do not present anything particularly new, he has assembled in his technique all of the good things to do and has eliminated the unnecessary or harmful ones. His principles, from a theoretical standpoint, will appeal to everyone, and in practice the theory is sustained by the excellent results obtained. The essentials of his technique may perhaps best be stated under six headings:

1. The rapid elimination of the cause of the peritonitis, whether it be a perforation of the bowel, a gangrenous appendix, a ruptured pus tube, etc. This must be done with the least possible handling of the peritoneal contents.

2. Drainage by tube of the lowest portion of the pelvis through a suprapubic opening, and free drainage through the operative incision.

4. The semi-sitting position of the patient after operation, the so-called Fowler posture.

5. The absorption of large quantities of water through the rectum, which reverses the current in the lymphatics of the peritoneum, making the surface of that membrane a secreting instead of an absorbing one, and also markedly increasing the secretion of urine.

6. The prevention of peristaltic movements of the intestines by withholding all food or liquids by mouth, and perhaps by the administration of opium.

You will notice that none of these essentials is absolutely new, for all of us have practiced one or more of them at different times on different patients. But while doing some of them we have omitted others and at the same time perhaps have done things that were unnecessary and harmful to the patient. Let me elaborate these points a little more fully.

First. In removing the cause of the peritonitis the less the peritoneal surfaces are handled the better, for nature has thrown out protecting lymph which inhibits the absorption of toxic substances and in handling such surfaces there is danger of bruising and rubbing off the lymph, opening up a new avenue for absorption and infection. Therefore Murphy believes that no attempt should be made to sponge the peritoneal surfaces or to wipe off any lymph that may be found, as such manipulation would increase the danger of septic absorption.

Second. When the patient is placed in the Fowler position the fluids in the peritoneal cavity will tend to gravitate towards the pelvis, and in addition the action of the diaphragm during respiration will help to pump the fluids in that direction, making drainage of the lowest part of the pelvis with a tube very important. If there is sufficient fluid in the pelvis to fill the tube, each excursion of the diaphragm will pump a certain amount of it out, which will be absorbed in the dressing. It must be remembered that it is not the quantity of fluid present which is harmful, but rather the extent of the peritoneal surface which comes in contact with it, so that a quart

of pus contained in a round cavity would be less dangerous than an ounce thinly coating over the peritoneal surface.

Third. It is well known that patients with diffuse septic peritonitis stand a short operation well but a prolonged one badly; therefore, when all one's energy is directed to at once removing the cause of the peritonitis, and all other procedures except drainage eliminated, an operation can be speedily completed, on an average, perhaps in six or eight minutes. This naturally permits of a minimum amount of anæsthetic, thereby directly decreasing the chances of shock and vomiting after operation.

Fourth. The advantages of the Fowler position are so well recognized now that it only needs to be mentioned.

Fifth. Murphy's method of introducing large quantities of water into the rectum is novel. He inserts a nozzle containing three or four openings into the anus to which is attached a rubber tube leading to a bag. This bag is filled with water and elevated but a few inches above the plane of the rectum, the idea being that the water shall just trickle into the rectum not much faster than absorption takes place. In this way from a pint to a quart of water should be allowed to trickle in during an hour, the process being a continuous one and the flow so regulated that no accumulation of fluid takes place in the bowel. In other words, an attempt is made to run the water in as fast as it is absorbed. The object of having more than one outlet in the nozzle is that in case flatus accumulates in the rectum it will pass out through one of the openings in the tube while the others continue to discharge the water into the rectum. When it is desirable to stop the flow of water the tube is disconnected from the nozzle, the latter remaining in the anus, thereby avoiding irritation to the anus by the constant removal and insertion of the nozzle and at the same time facilitating the passage of flatus.

By this method large quantities of water will be absorbed within the first few hours after operation. This absorption does two things: First, It reverses the current of lymph in the peritoneal lymphatics so that instead of absorption taking place

from the peritoneal surface the mouths of the lymphatics pour out fluid, bathing the peritoneum with this free discharge. The posture, together with the action of the diaphragm, constantly sends this fluid downward to the pelvis, washing away the infectious material from the peritoneum in its descent, and escaping from the pelvis through the drainage tube. Second, The free absorption of the fluid from the rectum stimulates the heart and kidneys, and largely increases the amount of urine passed, eliminating through this channel the septic material which has gained entrance to the circulation. After the ordinary abdominal section in a non-septic case the average amount of urine secreted in the first twenty-four hours is perhaps 15 ounces, and in the presence of sepsis it is apt to be even less. In the first case that I shall report this evening more than 60 ounces of urine was secreted in the first twenty-six hours.

Sixth. Stopping all food and liquid by mouth will check peristalsis and prevent the dissemination of septic material by peristaltic movements. The absorption of large quantities of fluid by rectum is quite sufficient to sustain the patient for forty-eight hours or more, but if the condition of the patient is so precarious that food seems a necessity, small quantities of it can be run into the rectum with the water.

As an example of the results obtained by this method let me relate briefly the histories of two cases; one representing the fulminating type of perforating appendicitis in which perforation takes place within a few hours after the onset of the first symptom, without protecting abdominal adhesions; the other a case of walled-off appendiceal abscess in which the abscess had ruptured into the general peritoneal cavity, where no adhesions were present.

Case I.—A small, pale, thin married woman, aged 26, was admitted to the Bryn Mawr Hospital at 11 A.M., October 11, while in her third attack of appendicitis. The attack began the previous day at 8 P.M., with a sharp abdominal pain, which gradually became agonizing, but which was suddenly much relieved at 4 A.M., the estimated hour of perforation of the appendix.

On admission the temperature was 100 2-5; pulse 112. An hour and a half after admission an incision was made through the right rectus, and immediately on opening the peritoneum there was an escape of a considerable amount of purulent fluid with shreds of lymph floating in it. The appendix was ruptured, partially gangrenous and bound down at its base by rather old adhesions, but the remainder was without adhesion to the surrounding viscera. There was a general diffuse peritonitis, (no attempt at walling off), with occasional patches of lymph coating the intestines, while the head of the cœcum was much inflamed, intensely red and the peritoneum had lost its glistening character. The appendix was removed, a puncture made through the abdominal wall in the median line two inches above the pubis for the admission of a drainage tube which led to the bottom of the pelvis. Another drainage tube was inserted through the operative wound leading to the right iliac fossa, while the remainder of the incision was filled with loose gauze. No sutures were used. The duration of the operation was six or seven minutes.

The patient was placed in bed in the Fowler position and the rectal enema at once begun. During the first twenty-four hours the patient received 12½ pints of salt solution through the rectum, not more than 6 or 8 ounces of which was expelled. The temperature ranged from 98 to 99⅗, and the pulse came down to the 80's. She had a fairly comfortable night after ⅙ gr. of morphia had been given hypodermically. During the first twenty-four hours the abdominal dressings had to be changed twice owing to their complete saturation with a colorless fluid of a slightly sour odor, and in the first twenty-six hours 65 ounces of urine were passed. On the third day a little water was given by the mouth for the first time, and from then on the fluids were rapidly increased. The rectal enemas were stopped at this time. No purgatives were given and on the fifth day the bowels moved twice naturally. The remainder of the convalescence was uneventful, the temperature and pulse remaining normal.

Case II.—An Italian aged 37 was admitted to the Bryn Mawr Hospital October 14, having been sick five days. The attack started with severe general abdominal pain and nausea. The pain shortly localized itself in the appendix region, and previous to admission he had two chills, with fever and sweats. On admission temperature was 102⅗; pulse 120; respirations rapid; tongue dry; general appearance of typhoid condition.

The abdomen was opened through the right rectus and an appendiceal abscess was found, which had ruptured into the general peritoneal cavity, the pus swelling up through the incision with each respiration. A gangrenous, perforated appendix was removed, and the drains arranged as in the previous case without sponging the peritoneum or even removing the excess of pus which was flowing from the wound. The operation lasted about seven minutes. While on the operating table his pulse was recorded at 200.

During the first ten hours 9 pints of salt solution were given by rectum, about a pint of which was not retained. Temperature dropped to 98⅘ and the pulse varied from 100 to 80. He passed 900 c.c. of urine during the first thirty hours. As in the previous case nothing was given by mouth until the third day, when water was begun and the fluids rapidly increased. On the third day, without purgatives, the bowels moved twice. The rest of the convalescence was uneventful.

These two patients recovered without a single untoward or alarming symptom. The rapid falling of the temperature and pulse to normal; the absence of further septic absorption; the free elimination through the kidneys of toxic material; the absence of distention, nausea and vomiting, etc., lead me to believe that the favorable termination was directly due to the method practised.

Dr. John H. Gibbon said that the method described in Dr. Le Conte's paper was a direct opposite of that advocated by many surgeons, in which the entire peritoneal cavity is thoroughly flushed and all of the lymph removed from the intestines. It is thought that many cases are lost because surgeons do not adhere strictly to either of these methods, that, is either a half-hearted irrigation is done, or else in trying to follow the Murphy plan too much is done. Murphy not only places these patients in the Fowler position after operation but has them brought to the hospital and placed upon the operating table in this same position. Dr. Gibbon stated that he had failed to introduce the large quantities of salt solution which Murphy recommended. He has employed the method in other respects in five or six cases with most satisfactory results. He lost one case treated in this way a few

days ago but believes that the patient died from a pulmonary embolus. Since reading Murphy's first paper two years ago Dr. Gibbon has used much larger quantities of salt solution but states that after every abdominal section which he has ever done he has used either plain water or salt solution in the bowel. He learned this from Baer, who advocated it strongly fifteen years ago. Dr. Gibbon strongly urged the employment of the Ochsner treatment *after* the removal of the appendix; he believes that frequently cases die from a spreading peritonitis the result of an active peristalsis. He always gives his abdominal cases morphia before they come out of ether; this he also learned from Baer, and has employed it in every case. The patients are much quieter during their recovery from the anesthetic and are much more comfortable. Many of the cases require but the one dose of morphia. If, however, the patients are restless, and if peristalsis is to be avoided the morphia is repeated.

Dr. Gibbon is now watching four cases of diffuse peritonitis treated after the plan of Murphy, with the exception that the enemata of salt solution were not so large, and in which not a single suture was introduced in the wound. Incision was made through the right rectus. Three of these patients are entirely well and show no evidence of a hernia. Where no sutures are introduced it is believed that the rectus incision is a much safer one than those which are more nearly over the appendix region. Another exception to the Murphy technique which Dr. Gibbon made in all of his cases is that of gauze drainage instead of tube drainage. He is careful to carry a large gauze drain back of the bladder, another to the right iliac fossa, and a third into the right kidney pouch.

Dr. Richard H. Harte said that there were two classes of cases with which the surgeon is constantly coming in contact: First, where the infection is diffuse and very acute and which when opened and drained invariably do well; second, those in which a similar condition has remained from twenty-four to forty-eight hours, during which time the toxic influences have been increasing enormously until the patient is profoundly poisoned, and his powers of resistance materially impaired. In the latter class when operated upon the prognosis is always exceedingly grave, it being impossible to say just what amount of toxine these patients can stand. It is here that most of the failures are to be

found. There is no doubting the fact that the method of Murphy, as emphasized by Dr. Le Conte, of keeping the bowel full of water, is an exceedingly good one, and its employment often decides between failure and success in the treatment of these cases. For many years Dr. Harte has pursued practically this method of treatment and has long appreciated the good results which come from it. He also is thoroughly convinced of the importance of keeping food away from patients after operation, as the too early ingestion of food is bound to be followed by fermentation, distention, etc., thus adding materially to the discomfort of the patient.

Dr. Le Conte, in closing, said in reply to Dr. W. Joseph Hearn, who asked him to report the results of the Murphy treatment in cases of peritonitis of several days' duration, that persons are usually dead that length of time after perforation and he does not see them. If they do live for days, adhesions are generally found enclosing pus in pockets and these adhesions need to be broken up. Where pus is free in the peritoneum the method of Murphy gives only the best possible chance of recovery. The operation lasts but a few minutes, the amount of fluid in the blood-vessels is increased, which stimulates the heart, and above all, by its introduction into the rectum, the fluid changes the current of the lymph stream and prevents absorption of septic products. If the patient be in the typhoid state, as was one of those reported by Dr. Le Conte, he believes much obnoxious material is passed out by the increased flow of urine from the kidneys. Usually only 12 to 15 ounces of urine are passed the first day after an abdominal operation, while in the case mentioned, 65 ounces were voided. This cannot be other than a great aid in eliminating toxic products. In answer to a question by Dr. Taylor regarding the length of nozzle for introducing salt solution into the rectum, Dr. LeConte said that two inches entrance was sufficient.

CANCER OF THE BREAST: CANCER OF THE CECUM.

Dr. William L. Rodman exhibited these specimens. The first is interesting from a pathological and anatomical standpoint, as proving that the pectoral muscles should always be removed when operating for cancer of the breast. He has followed the teaching of Grossman and Ratler as regards the presence of glands between the two muscles, but had never before seen a clear

demonstration of the truth of such statements. In the specimen are three enlarged glands between the two muscles, and none of them was seen or felt until the greater pectoral was removed. The glands all lay well below the upper edge of the pectoralis minor.

The specimen of cancer of the cecum was removed post mortem from a man who had several months ago suffered from chronic intestinal obstruction. He was in a very bad condition when put upon the table, vomiting fecal matter and with a pulse beyond 130. The diagnosis of malignancy had been made some time before and it was quite clear that the only thing which could be done was an entero-anastomosis. When the abdomen was opened the diagnosis of carcinoma was evident, the growth appearing to have originated around the base of the appendix. Nodules of various sizes from a millet-seed to an olive were scattered over the intestines and mesentery. The small intestine was so greatly dilated as to look like the stomach; the cecum was collapsed. A lateral anastomosis between the ileum and the cecum was performed by the clamp method as employed by Moynihan in gastro-enterostomy. The relief from obstruction was complete, patient living three or four months entirely comfortable so far as the intestinal current was concerned. An opening three inches long was made between the small and large intestines. There were no further symptoms of obstruction at any time during the life of the patient.

Dr. Addinell Hewson referred to a case operated upon last June in which he found between the pectoralis major and minor a single tumor the size of a duck egg. It extended from the pectoralis minor backward to the vessels. Both pectorals were removed. Subsequent microscopic examination showed the tumor to be a cancer. Concerning the anatomical relations of the part there are two chains of lymphatics, one to the breast proper, the other to the pectoral muscles themselves. These two chains join before emptying into the general axillary chain of glands and the growth described was situated at the junction of the two chains. Dr. Hewson has never seen glands situated so high as are those shown by Dr. Rodman. In his own specimen the growth was directly in the middle of the pectoralis minor. Pressure may have prevented it going higher, the mass from the outside appearing as large as a fist.

As emphasizing the great distention which occurs in the gut in cases of cancer, Dr. Hewson mentioned a case which came to the Oncologic Hospital after having been operated on elsewhere. Through the operation wound in the left groin a soft rubber catheter could be passed to a point between the median line and the opposite groin.

CHEWING GUM REMOVED FROM THE BLADDER.

Dr. E. H. Siter showed this specimen, which had been in the bladder four days. It was remarkable chiefly for the large amount of salts adherent to it. The gum had been inserted in the penis to prevent nocturnal emissions.

Dr. William J. Taylor recalled the fact that he reported to the Academy last year an instance of gum in the bladder, it having been inserted in the penis to stop a gonorrheal discharge. This had become encrusted with salts and formed a large stone. Perineal section failed to allow removal of the mass, which was finally secured through a suprapubic opening.

STATED MEETING, DECEMBER 4, 1905.

The President, Henry R. Wharton, M.D., in the Chair.

THE OPERATIVE RESULTS IN AN OLD FRACTURE OF THE PATELLA.

Dr. Edward Martin presented a man who in May, 1905, had by a direct fall upon the patella fractured that bone, the fracture probably being comminuted. Two months later he came to the hospital with his knee-joint absolutely stiff and very painful, the patella being firmly fixed by adhesion to the anterior surface of the lower articulating end of the femur, and also to the skin. Operation was performed in the usual way by turning a broad flap from above downward. The upper fragment was firmly adherent to the femur by tissue that was almost bony in character. After the removal of several small splinters, the bone and capsule were sutured in the ordinary manner, the patella with silver wire passed through drill-holes. The patient did well and at the end of three weeks went home with a freely movable patella and a painless smooth flexion of 45°. A few weeks ago he returned because motion in the knee was not sufficient to allow him to go upstairs readily or to stoop, positions required in his work. Examination showed that the joint appeared to lock and on forced flexion pain was felt on the outer side of the articulation. The patella was firmly united by bony union. Reopening the joint was considered, but under moderate anæsthesia flexion was carried to beyond a right angle. Two days later the joint was again bent, under ether, and the patella refractured. Dr. Martin now intends to allow the man to go home with a slight separation of the fragments (maximum in flexion ¼ in.) as this may give him a more useful knee; he has been allowed to walk about since the fracture. The case illustrates that it is not necessary to transplant a soft flap between a patella which has grown to the femur and the surface of the latter bone after loosening their adhesion as the

same result can be secured by passive movement of the bone. It also suggests that some of the good results reported from the use of such flaps may have been due to passive motion after operation. He also believed that a longer period of delay after operation before forcibly breaking up adhesions would have been desirable.

EXTENSIVE ANGIOMA OF THE FACE.

Dr. Martin presented a boy of 12, who had been under treatment for eleven months. The angioma, which was noticed the second day after birth, involves the entire upper lip and extends well toward the left eye. It is adherent to the skin, the vessels of which are also affected, and extends into the mouth as far as the soft palate. Plastic operation seems out of the question, as any radical surgical proceeding could not help leaving an enormous scar and excessive disfigurement. Galvano-puncture was employed every second or third day for several weeks, the needle being inserted about the periphery of the mass but from this no distinct benefit was derived. The injection of absolute alcohol, 20 minims once a week, was then begun and has been carried out for some months. This procedure is followed by inflammation and contracture and is undoubtedly causing improvement. Dr. Martin is now contemplating the use of subcutaneous ligature or of causing a greater degree of inflammation by inserting sterilized catgut. The latter may be accomplished by passing a large hollow needle through the plexus of veins, having a piece of catgut through the lumen of the needle; withdrawing the needle, leaving the catgut in its place, and cutting both ends of the gut close to the skin. This should encourage the formation and subsequent organization of an extensive exudate.

Dr. John B. Roberts mentioned a case of angioma of the lip, in a child of three, recently under the care of Dr. J. P. Hutchinson at the Methodist Hospital. A good deal was gained in that case by subcutaneous ligature; and now Dr. Roberts is injecting with success boiling water after the manner of Wyeth. A year ago he operated on an infant with a large angioma of the brow which had been subjected to almost all the disfiguring operations resorted to in these cases, without permanent benefit. It was cured by the use of Wyeth's method. There seemed to be but

little irritation caused by the injection, though five or six punctures were made at each sitting. The method is a very valuable one.

Dr. Richard H. Harte spoke of a case which some years ago was under the care of Dr. Hodge in the Presbyterian Hospital. It was similar to the case shown by Dr. Martin, except the growth did not extend so far toward the nares. Dr. Hodge succeeded in applying a ligature and this was followed by satisfactory results. Regarding the Wyeth method of using hot water, Dr. Harte had one case of angioma involving the hand and forearm in which he employed the injections extensively. His experience is that a great deal of care and caution must be exercised in its use. In many cases if water be used indiscriminately, disastrous results will follow. In angiomas injection does cause an inflammatory thickening and the mass shrivels and disappears. Dr. Harte finds that a great deal of reaction follows the injections; at one time he was quite alarmed by the after symptoms in his case.

URINARY INFILTRATION; ACUTE SEPSIS; RECOVERY AFTER PERINEAL SECTION.

Dr. De Forest Willard reported the history of a mulatto, 24 years of age, who was admitted to the Presbyterian Hospital December 1, 1905, with a temperature of 104.2. He gave a history of gonorrhea six years previously with intervals of urethral discharge since that time. He had had no previous retention of urine, no ardor urinæ, except occasionally when the stream would be interfered with. An advertising doctor whom he visited in New York (according to his account) divided his meatus and apparently did an internal urethrotomy with an intensely infected instrument. He returned to Philadelphia the same evening and drove about the city as coachman the following day, bleeding somewhat from the urethra. In the evening he had a considerable hemorrhage. On admission he was bleeding slowly from the urethra and the following day there was so much oozing that no instrument was passed. His perineum was bulging but was not hard, but was moderately tender. The following night he had two chills, after which his temperature rose to 108.4; pulse 176. The temperature was taken by the mouth by a careful nurse, and was verified a half hour later by the head

nurse, when it was still 107.8; leucocytes 17,000 to 24,000; urine, blood tinged; bowels moved involuntarily in bed. Abundant staphylococci only in blood.

Dr. Hodge then made a median perineal section. An English catheter was inserted into the bladder and on a grooved director the urethra was split back to the prostate only. The catheter was left in the bladder and connected by a tube to a urinal. The hemorrhage was considerable but was controlled by packing. No pus was found, but the oozing of the septic products and toxins was free and the effect upon the temperature and pulse was speedily evident and improvement was rapid. He was discharged from the hospital in twenty days with an opening still in the perineum. Steel sounds to be passed at regular intervals to insure the formation of the proper sized urethra.

A peculiar part of the history is the insistence by the patient that the operation from which he so narrowly escaped death was performed, not for stricture, but for the cure of seminal emissions.

The reporter said that he had never before, save in sunstroke, had a recovery when the temperature reached 108.4.

Dr. William J. Taylor said the man operated upon by Dr. Willard was in his employ. The urethrotomy was done on Tuesday afternoon and the man came to his work on Wednesday morning apparently perfectly well. He drove until 2 o'clock but was taken with a chill and fever in the afternoon. In the evening he became ill and was seen by Dr. Steele, who lived near his home, and sent to the hospital. Now a 28 French sound can be passed. The perineal wound is not yet skinned over but the man seems perfectly well and attends to his driving as usual.

BRADYCARDIA FOLLOWING HEAD INJURY.

Dr. De Forest Willard reported the history of a man, 64 years of age, who was in good health until ten days previous to observation, when he had an attack of vertigo lasting but a few minutes, with no spasmodic symptoms. He was admitted to the Presbyterian Hospital November 21, 1905, with a slight scalp wound in the back of the head, reported to have been occasioned either by a brick having fallen upon him, or as believed by a fellow workman to have been occasioned by vertigo which had caused him to fall about four feet. Patient walked to the hospital, but while being dressed had a slight convulsion in which the face

became cyanotic and was followed by snoring sleep of several hours but from which he could be easily aroused. Was dazed and slightly delirious for several days. There were no evidences of fracture; no paralysis; pupils slightly unequal for two days, afterward of same size. He lay most of the time with his eyes closed, quietly sleeping, but could be easily aroused and answered questions intelligently.

On entrance his pulse was 56, but fell steadily without diminution in volume until on the second day it reached 28; the fourth day 25; the seventh day 23; has continued in the twenties up to the present time—*i.e.*, ten days. Respirations varying from 12 to 20; temperature 97. His arteries are very atheromatous, but he presents no evidence of valvular disease of the heart, although the muscle is weak. Heart sounds agree with pulse at wrist. Urine from 30 to 90 ounces daily. At first slight trace of albumen with a few casts; later, negative. Leucocytes 8000; hemoglobin 98 per cent.; red blood corpuscles 4,900,000.

The cause of this inhibition of heart action is difficult to explain and the point of interference with the pneumogastric or sympathetic is uncertain. He eats and sleeps well and appears to suffer no special inconvenience. Has no loss of motor or sensory power. As he had not been attended by any physician it is not known whether he had ever shown this slow pulse on previous occasions. Dr. Willard had never, save in opium poisoning, seen so low a continuous pulse.

ASEPTIC FOREIGN BODY LEFT WITHIN THE CRANIAL CAVITY.

Dr. John B. Roberts reported the following case because of the unusual position in which a piece of sterile gauze was left after operation for trephining the skull.

A man was admitted to the Methodist Hospital on November 7, 1905, with a sinus above the right ear which was discharging a small amount of pus. He complained of severe headache, in the same region, and general convulsions accompanied by unconsciousness.

The history which he gave was to the effect that on July 1, 1905, he fell from the third story of a building, sustaining an injury to the head, for which he was subjected, in a hospital, to operation upon the skull. He was discharged cured in a month

and returned to work. At this time he felt fairly well, although he complained of mild headache, progressive loss of hearing in the left ear and diminution of sight in the right eye. Two and a half months after the time of the original injury, he was struck upon the head in the region of the scar and promptly thereafter suffered an increase in the severity of the headache. In the course of a few days there was a discharge of a considerable amount of pus from a swelling at the region affected. The discharge of pus continued through the sinus left and was present when he came to the hospital for treatment. A week before his admission he had sharp pain at the site of the old scar, clinching of the hands and jaws and unconsciousness.

Examination upon admission showed a semilunar scar over the right ear and a sinus near the ear at the end of the former incision. There appeared also to be a slight discharge from the ear itself. The heart, lungs, liver and spleen showed on examination nothing abnormal. The reflexes were normal and the sensation unimpaired. Careful examination of the eyes and ears was not made at the time, because the patient's convulsions became so marked that Dr. Roberts proceeded to operation a day or two after his admission. The pain in the head and the convulsions were so severe, and the latter so frequent, that it seemed important to open up the sinus and search for a brain abscess rather than wait for extended study of the case. The region affected was incised and developed evidence of a former trephining, and a sinus running into the cranial cavity. The opening, which was in the squamous portion of the temporal bone, was closed with thick fibrous tissue. A few drops of pus exuded from the fistulous tract, but no abscess cavity was found. There came to view, however, underneath the dura at the upper part of the trephine opening a piece of gauze, such as is used for packing wounds, firmly attached to, and interlaced with, the fibrous tissue. In order to withdraw this foreign body, it was necessary to cut out the mass of fibrous tissue which closed the opening in the skull and then cut away a portion of the bone at the upper edge of the opening. The original opening had been about 1½ inches in diameter anteroposteriorly and three-quarters of an inch vertically. Careful exploration was made to see that no portions of gauze were left.

The wound was thoroughly cleansed and closed partially,

but in a manner not to interfere with drainage. The dura, of course, could not be closed and it was necessary to provide drainage, because of the existence of pus before the operation was begun.

The plug of gauze removed was about the size of a hazelnut. It seems probable that at the time of the original operation, done by a surgeon in some other hospital, bleeding occurred and a piece of gauze was used to make pressure upon the divided vessel. It is evident that the operation was done with such aseptic care that prompt union without septic inflammation occurred. Whether the abscess, which subsequently occurred, was caused by the blow upon the side of the head received two months and a-half after the original injury, it is impossible to determine. From the short time after this injury that the abscess opened spontaneously, one would be led to believe that a chronic abscess had already formed before the blow upon the side of the head called the patient's attention to the matter.

Since the time that the gauze was removed, which is now about five weeks, the patient has had no special difficulty with the wound, except that he complains at times of pain in the head, and there is a protrusion of brain substance at the opening in the skull. This protrusion was to be expected, because there was neither dural covering nor bone over the brain at the site of operation. It was impossible, and it would have been unwise, to cover in the opening in the calvarium.

The man has been irritable during convalescence and occasionally has violent convulsive seizures, clonic in type, accompanied with opisthotonos and pain in his head. The wound is in good condition; and pulse, respiration and temperature are practically normal. He is liable to get convulsive attacks and become excited, if he is kept in a ward with other patients or in a place where there is noise and confusion from people passing to and fro. When he has mild convulsions, which occasionally take place, the seizures are focal in type; the muscles of the neck pull his head to the right with the chin upward very much as if the spasm were in the left sternomastoid muscle; the head and eyes are deviated to the left without twitching of the face and eyes. At such times there is no involvement of arms, feet or legs in the convulsion. Recently he has been more apt to have the severe convulsions than the milder ones. In these there are clonic

spasms of the extremities, with opisthotonos and violent shouting. The man is conscious and rational, except at the time of his convulsion. The convulsions, when severe, are described by the resident physician, Dr. Hall, as follows:—"The arms are sometimes extended, sometimes flexed, and shake with a fine tremor, being held quite rigid. The lower jaw is moved slightly up and down; the chin is rotated to the right and slightly elevated as if by action of the left sternomastoid. The eyes roll upward, sometimes looking directly upward, more often being deviated to the left. They are held immobile. In addition, the patient sometimes raises his hips up from the bed and rolls and threshes about, but the movements are in no definite order. They are such as any patient would show when suffering intense pain. After the convulsion is over the patient frequently complains of intense pain in his head and points to the right anteroparietal region." For a time these convulsions were very frequent and severe. Some of them are accompanied by vomiting, which occurred after the convulsion was over.

Large amounts of bromide potassium, some chloral, and hyoscine and codein have been used to quiet him. Occasionally it was necessary to confine him with straps or bandages. Chloroform has sometimes been given by inhalation to stop the convulsion.

The eyegrounds are apparently normal. There is no discharge from the ear. There are some casts in the urine. On account of the result of the recent urinary examinations, he has been given Basham's mixture as a diuretic.

The convulsions have seemed to be of a type which might, perhaps, be described as hystero-epileptiform.

THE EFFECT UPON GLANDULAR TISSUE OF EXPOSURE TO THE X-RAYS.

BY WILLIAM J. TAYLOR, M.D.,
OF PHILADELPHIA,
Attending Surgeon to St. Agnes Hospital and to the Orthopædic Hospital; Consulting Surgeon to the West Philadelphia Hospital for Women.

THE beneficial effects of the X-rays are so enthusiastically proclaimed by the advocates of its therapeutic use in granular swellings and certain of the new growths, that I think a few of its disadvantages should be spoken of by those who see the after effects and who are forced to operate upon tissues that have been long under its influence. My own personal experience is such as to lead me to advise against the employment of the X-rays wherever there is a probability of the case coming to a formal surgical operation. On account of the alteration in appearance and character of the tissues where its use has been prolonged, operations which would ordinarily be simple and easy dissections become formidable and dangerous, as the tissues are thickened and matted together by fibrous material.

This change in the character, both of the surface skin and underlying tissue, is particularly well marked in cases of enlarged cervical glands,—the so-called tubercular adenitis. Ordinarily operations for this condition are easy to perform, the glands readily peel out by blunt dissection, and the blood-vessels and nerves retain their distinct characteristics, thus being plainly recognized and preserved from injury. The physical characteristics of the tissues of the necks which have been subjected to treatment by the X-rays are, however, markedly changed in appearance; the glands become hardened, and may be shrunken if this method of treatment is employed before they have broken down, and while it is true that in cases of recent origin many of the swollen glands may

entirely disappear, this is not usual. The majority of the glands which the surgeon sees have already broken down and softened in their interior, and the cheesy pus may be simply incapsulated. It is of this variety particularly that I wish to speak.

Most of these cases are of long standing and have been subjected to various plans of treatment by ointment, massage, counter-irritants, etc., before the X-rays are employed. It is only after all the various methods have been tried that the surgeon is requested to operate.

The overlying skin is now found to be thickened, indurated, and much toughened. The glands cannot be peeled out, or pulled away from the blood-vessels and nerves by blunt dissection, but each step must be taken with the greatest deliberation and every particle of tissue that is removed must be separated by cutting with the knife or scissors. The blood-vessels, from the fibrous thickening of their sheath and the surrounding tissues, cannot be easily distinguished; and are only saved from being cut by the utmost vigilance. The dangers, the difficulties, and the time consumed in the operation are thus very materially increased, and my own belief is that the only action of the X-rays in these cases is distinctly harmful.

I have had one case of cystic disease of the left breast in an unmarried woman of 37 where the X-rays were employed, and which subsequently came to operation. The history was that a year before she had discovered a lump in her left breast, but it gave her no discomfort. She consulted a physician, who advised operation, but as her father was very ill and she was nursing him, she refused operative treatment at that time, as she would not leave him. Her family history was bad, as her mother had had cancer of the uterus and her father's illness was supposed to be cancer of the stomach. She elected to try the value of the X-rays and submitted to twenty-eight treatments of ten minutes each. As a result there was an extensive burn of the skin of the whole breast; the outer layer of the skin peeled off and this was true also of the areola nipple. I saw her first when this burn was at its worst. I could feel that the breast was enlarged

and that in the gland there was a swelling, which I took to be, and still believe to have been, a cyst. Shortly after this her father died and she then came to me and submitted herself to operation.

The skin over the whole of the breast was very dense and hard and in a condition such as I had never seen before. It was almost impossible to cut through the skin with a very sharp knife without using extreme force. The breast and both pectoral muscles were removed and the axilla cleaned out. At this time I could not distinguish definitely a tumor, but the whole breast was thickened and indurated. The breast, after its removal, was cut open and macroscopically seemed to be simply a mass of fibrous tissue with few of the characteristics of the normal gland. There were one or two small retention cysts. She made an absolutely uneventful recovery, but the wound did not heal quite as rapidly as is usual. The breast was sent to Dr. Longcope, of the Ayer Laboratory, who made this report:

The specimen consists of a breast, pectoral muscle and axillary fat. Section has been made through the breast. It is covered by a piece of skin 1 cm. in diameter. The center appears yellowish and slightly ulcerated. On section the cut surface discloses opaque white breast tissue, which is slightly larger than normal. It is fairly well circumscribed and has a more or less pyramidal form. The margins are well defined, particularly the lower margin, which is separated from the pectoral muscle by a zone of fat about 1 cm. in thickness. The breast tissue is quite firm but flabby. Scattered through it can be seen bits of fat. Here pectoral muscle appears normal. The axillary lymph glands are small, soft and pink in color.

Sections are made from all parts of the breast. They show a coarse net-work of rather dense fibrilated connective tissue enclosing lobules of fat-cells of various sizes. The connective tissue contains extremely few cells. In many sections the acini are lined by two regular rows of cuboidal epithelium which do not differ essentially from the normal, except that many of the cells contain large fat droplets. Sections through four of the axillary lymph nodes show chronic inflammatory changes. There is some hyperplasia of the lymphadenoid tissue with thickening of the reticulum, especially in the lymph sinuses and proliferation of the recticular cells.

The lymph sinuses are converted into solid cords. The capsule is regular but a little thickened.

Skin.—The epidermis is thickened. At one point there is a small area of ulceration. Here the corium is covered with a thin layer of fibrin. Polymorphonuclear leucocytes and red blood-cells. The corium is greatly thickened and the papillary process atrophied. It consists of rather dense connective tissue infiltrated in circumscribed foci by cells usually of one type. These cells are scattered through the corium, but are most numerous beneath and about the ulcerated surface. They are somewhat smaller, irregular, often have a shriveled appearance and the protoplasm stains intensely blue in hœmotoxylin and eosin stains. The nuclei are very black and piknotic. Sometimes they show a central unstained band which gives the nucleus the appearance of a diplococcus. About the ulcerated area there are also many small round cells, a few polymorphonuclear leucocytes and occasional large multinucleated giant-cells.

Diagnosis.—Chronic mastitis with atrophy of mammary gland. Chronic inflammation of skin with thickening of corium. Chronic inflammation of axillary lymphnodes.

Dr. Longcope states in a letter which accompanies this report that there was no evidence of malignant growth, but, on the contrary, there was marked atrophy of the glandular tissue with extensive fibrous overgrowth in a diffused manner. He considers the thickening of the skin must have been caused by the X-rays, but whether the changes in the breast itself are due to this cause he cannot state positively.

In a very carefully written article by Dr. A. G. Ellis, "The Pathology of the Tissue Changes Induced by the X-Ray" (*American Journal of Medical Sciences,* January, 1903), he quotes Huntington as stating that the X-ray burn consists of an acute, subacute, or chronic necrobiosis. He quotes Rudis-Jicinsky as saying that, "The irritation of the peripheral extremities of the sensory nerves causes paralysis of the vasomotor and vascular cells affected. Spasmodic contraction of the arterioles and capillaries follows and the proper nutrition of the cells is impaired. With these changes, which are directly depending upon disturbances of the circulation,

there are changes in the parenchyma cells of the affected region. The death of tissue follows, being caused by permanent stasis in the blood-vessels. This is carried out by Codman's statement (Ellis) that the reports of microscopic examinations of the excised tissue agree in stating that similar arterial branches are occluded and the appearances are not unlike those of necrosis and inflammation due to other causes.

Scholtz (Ellis) says that the cell elements under the influence of the X-rays undergo a slow degeneration, chiefly in the epithelial cells; that the nucleus as well as the protoplasm of the cell is affected. This article by Dr. Ellis is so exhaustive and carefully prepared that it should be read by all who are interested in this subject.

In the X-rays we have a very powerful therapeutic agent, whose power for good is undoubtedly very great in inoperable malignant disease of a superficial character and as a prevention of the recurrence of malignant disease after radical operation; but I believe that its use should be confined to this class of cases. I do not believe, in view of the extreme difficulties and complications which are produced by its effects, that it should ever be employed upon the tissues before surgical operation is undertaken.

Dr. A. G. Ellis said he had made no studies of X-ray tissue —those reported in the paper mentioned by Dr. Taylor. In the enormous literature which was accumulated, however, are many references to the untoward effect of this agent, and in the present state of our knowledge it should be used with caution. The numerous cases of sterility in X-ray workers reported by Dr. F. Tilden Brown are examples of its unexpected influence. The cases cited by Dr. Taylor further emphasize the necessity of careful and discriminate use of this illy understood force.

Dr. John H. Gibbon spoke of a case of enlarged cervical glands in which he had operated during the past summer. The patient in the spring had a prolonged treatment with the X-rays. The glands were most difficult to remove because of adhesions. It required two hours and ten minutes, with the help of an experienced assistant, to remove about thirty glands, whereas the next

day twice this number were removed with the help of an inexperienced assistant in one hour. Every gland was so adherent that it required minute dissection to separate it from the surrounding tissues. It was impossible to remove the glands in a continuous chain.

It is regrettable that so many of the less radical measures which are employed in the treatment of surgical diseases cannot be used without interfering with subsequent operation, but yet this is a claim which is frequently made for them. No better illustration of this statement can be given than the difficulty encountered in operating for hernia where the injection treatment has been tried.

Dr. Richard H. Harte recalled a case of a child in which the cervical glands had been treated for some weeks with the X-ray, hoping by this means to avoid an operation. When, however, removal of the glands was attempted, the dissection was very difficult, as all the anatomical conditions were changed. The glands were adherent to the surrounding tissues, requiring forced dissection. In the course of a couple of weeks a small gland, which had been overlooked at the time of operation, broke down and suppurated. Dr. Harte is inclined to regard the use of the X-rays in cervical glands of the neck as most unsatisfactory.

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