

TRANSACTIONS
OF THE
PHILADELPHIA ACADEMY OF SURGERY

Stated Meeting, held November 6, 1916

DR. GEORGE G. ROSS in the Chair

GUNSHOT WOUND OF THE CAROTID ARTERY

DR. E. G. ALEXANDER narrated the history of a man, twenty-six years of age, who was admitted to the Episcopal Hospital, August 6, 1916, with a gunshot wound of the neck. The wound was on the right side of the neck, one and a half inches above the clavicle and one and a half inches to the right of the median line. There was a large swelling on the right side of the neck that extended from the clavicle almost to the angle of the jaw. The trachea was pushed over to the left and on a line with the angle of the jaw. There were periodic discharges of a considerable quantity of blood from the wound, and with each of these discharges the size of the swelling in the neck was appreciably diminished. The patient was slightly shocked, dyspneic, cyanotic and emitting a frothy mucus from the mouth. He could only speak in a whisper. There was no wound of exit but the bullet could be felt subcutaneously to the right of the vertebral border of the left scapula and about on a line with the fourth rib.

The patient was immediately taken to the operating room and operated upon under ether anaesthesia plus the administration hypodermatically of morphine sulphate, grain $\frac{1}{4}$, and atropine sulphate grain $1/150$.

An incision was made along the anterior border of the sternocleidomastoid. The tissue was so infiltrated with blood that the usual landmarks of the neck could not be made out. The incision was deepened and immediately on opening the deep fascia blood gushed forth in a continuous stream. As the flow of blood was so profuse it was impossible to locate any structures or bleeding points. The wound was therefore rapidly enlarged down to the clavicle. Hæmostatic forceps were then thrust at random into the wound and clamped, gauze sponges were also packed into the wound. These two procedures controlled the bleeding to a certain extent. By rapidly removing the gauze packs and quickly inserting another the bleeding point was proved to be at the

PHILADELPHIA ACADEMY OF SURGERY

lower angle of the wound underneath the clavicle. Long curved hæmostats were clamped in the wound underneath the clavicle where the bleeding seemed to be coming from. After several attempts the bleeding was controlled.

As the patient had lost a large quantity of blood his condition was most serious. An intravenous injection of normal salt solution and adrenalin was given.

As many hæmostats were clamped in the wound the next step consisted in removing as many as possible and ligating the bleeding points. Hæmostat after hæmostat was removed until only a few remained and these were over the line of the common carotid and innominate arteries. The tissues were then exposed and it was found that these arteries were clamped. The carotid was ligated and the hæmostats on it removed. There still remained three long curved hæmostats underneath the clavicle, and as it was impossible to pass a ligature around them it was decided to leave them as clamped. The intravenous injection failed to show any beneficial effects, as the patient was blanched and pulseless. It seemed as if he would die on the table. The officer who accidentally did the shooting was fortunately at hand, and after explaining the patient's condition to him he readily consented to give some of his blood. A transfusion of 750 c.c. was done by the Kempton-Brown method. The patient's condition immediately improved. He gained some color and it soon became possible to feel his pulse. The wound was closed with the three-curved hæmostats left *in situ*, supported by a small packing of gauze. The patient was sent to his bed greatly shocked.

After operation (August 6, 1916).—Patient greatly shocked. Recovered from ether quickly, complains of little pain, given stimulation and started on enteroclysis.

7.00 P.M.: Temperature 102, pulse 126, respirations 28. Pulse of much better quality. Given hypodermoclysis, one pint every six hours.

August 7, 1916: Kept mildly under the influence of morphine sulphate. Had a fair night. Can speak only in a whisper. Pulse rapid. Temperature 103.3. Takes enteroclysis poorly. Complains of intense thirst.

August 8, 1916: Temperature down, pulse better, respirations slower. Kept under the influence of morphine sulphate.

August 9, 1916: Given water by mouth, enteroclysis given intermittently. Lies quietly on back. Dressings, which were blood soaked, changed.

August 10, 1916: Temperature 99; pulse 100. Very quiet, lying on back. No pain. Condition satisfactory.

GUNSHOT WOUND OF THE CAROTID ARTERY

August 13, 1916: Taken to operating room and haemostats unclamped, but as bleeding began they were reclamped.

August 14, 1916: Has developed pain in the left chest, friction rub is heard.

August 16, 1916: Pleurisy better.

August 17, 1916: Taken to operating room and haemostats unlocked, slight bleeding resulted. This was controlled by lightly packing the wound with gauze.

August 21, 1916: Patient taken to operating room and haemostats removed. Slight bleeding again occurred which was controlled by packing. Still has pain in the left chest. Has developed a few râles.

August 22, 1916: Bled a small amount last night which was controlled by pressure. Has developed a pulsating tumor under the line of incision.

August 23, 1916: Bled from the wound again last night, controlled by packing.

August 24, 1916: Pulse suddenly became worse and the patient died in a few minutes.

An autopsy was performed by the coroner's physician and it was found that the bullet had taken the following course: Entering the right side of the neck one and a half inches above the clavicle and one and a half inches to the right of the median line, it passed down and back, partially severing the carotid at its junction with the innominate, it then passed through the edge of the third dorsal vertebra, pierced the fourth rib, and lodged underneath the skin as previously described.

In the wound in the neck was a large traumatic aneurism. In the left thorax was a pint of fresh blood and it was the opinion of the one performing the autopsy that death was due to this hemorrhage and that it was caused by a rupture of the fourth intercostal artery. The rupture of this artery was due to a spicule of bone on the fourth rib.

The reporter added that Thompson (*So. Surg. and Gynec. Trans.*, 1914, vol. xxvii, p. 110), in an excellent article entitled "Ligation of the Innominate Artery for Cure of Subclavian Aneurism," reports a case of his own, reviews the literature on the subject and records in detail all cases operated on for ligation of the innominate since 1880.

Since Thompson's article, Carl A. Hamann (*Cleveland Med. Jour.*, 1916, xv, p. 221) has reported two cases as follows:

CASE I.—*Subclavian aneurism.*—Colored male, aged twenty-five years. Operation, ligation of innominate and common carotid. At time article appeared, which was two months after the operation, the patient was well.

PHILADELPHIA ACADEMY OF SURGERY

CASE II.—Female, aged fifty-nine years. A fusiform aneurism of the innominate at its junction with the common carotid and subclavian. Operation, ligation of the innominate. The patient died the fourth day after operation of cerebral anæmia.

Nearly all the cases reported were operated for spontaneous aneurism and the remaining few for traumatic aneurism or injury to the artery.

Harte (ANN. SURG., 1897, vol. xxvi, p. 488) reports a case of injury to the common carotid due to a pistol wound. The innominate and common carotids were ligated in this case.

Leutas, Hernandez and Saigo report cases of injury to the carotid and subclavian, requiring ligature of the innominate.

Of the 52 cases collected by Thompson, forty-one were operated for spontaneous aneurism, 6 for traumatic aneurism, and 5 for wounds of large arterial trunks. Of this number, 16 recovered.

Secondary hemorrhage and cerebral anæmia were the most frequent causes of death.

A summary of the cases reported in the literature up to date and including the present case is as follows:

	Cases	Rec.	Died
Ligation of innominate alone	37	7	30
Ligation of innominate and carotid simultaneously.....	16	10	6
Ligation of innominate, carotid and vertebral simultaneously....	2	0	2
	—	—	—
	55	17	38

DR. JOHN SPEESE said that he had recently operated upon a patient with an unusual stab wound of the neck. The patient, a colored man, had been stabbed with a large butcher knife, the blade penetrating the tissues of the neck for a distance of about six inches. The man was almost exsanguinated from the constant flow of blood from the wound, the hemorrhage had been partially controlled by packing. The wound, enlarged under novocaine anaesthesia, was found to extend from about the middle of the left sternocleidomastoid muscle, some fibres of which were cut, to the sternoclavicular articulation. The jugular vein was seen but was uninjured. Toward the bottom of the wound there was a discharge of frothy blood, evidently due to an injury to the apex of the lung. The hemorrhage from the lung was easily controlled by packing, and the patient returned to the ward. On the following day he had

STAB WOUND INTO RIGHT AURICLE OF HEART

a slight elevation of temperature, and on examining the chest the left side was found to be clear and resonant, whereas, the opposite pleura contained all the signs of an exudate extending to the angle of the scapula. The effusion was gradually absorbed, the patient making an uninterrupted recovery. The case is reported because of the small amount of damage inflicted by a knife of such size and because of the production of a pleural effusion on the right side when only the left apex of the lung and pleura seemed to be injured.

STAB WOUND INTO THE RIGHT AURICLE OF THE HEART

DR. CHAS. F. NASSAU reported the history of a young man, nineteen years of age, who was admitted to St. Joseph's Hospital on September 26, 1913, while Dr. J. Chalmers DaCosta was on ward duty. The reporter happened to be operating at the moment of his admission, so that the care of the patient in emergency fell to him.

History.—During an altercation the patient had received a thrust in the left upper portion of the chest from a keen narrow-bladed fish knife some three inches in length. He was quickly brought into the hospital by the patrol wagon and transferred speedily to the operating room.

The wound of entrance was in the third interspace on the left side, about one inch from the edge of the sternum. The patient's pulse was extremely weak and the pulse rate so rapid that it could hardly be counted.

Under light ether anaesthesia an incision was first directed along the left border of the sternum for a distance of about three inches, including the third and fourth ribs. From this sternal incision, two others were made laterally from either extremity of the perpendicular incision. These lateral incisions over the intercostal space were about three inches in length. Trap-door of chest wall was then raised up to the outer side. In turning up the flap of the chest wall, the pleural cavity was opened. When the pericardium was exposed, it was seen to be filled with blood, which was oozing from a small wound. The pericardium was incised. Upon opening the pericardium, blood gushed out in great quantity, making it very difficult to determine exactly where the heart had been injured. Quick sponging showed the wound to be in the anterior surface of the right auricle, about five-eighths inch in length. A fine silk suture was inserted at the upper angle and tied, after which four continuous stitches were taken. No attention was paid to the phase of the heart cycle during suturing. After placing this suture, it was necessary to introduce two interrupted sutures of fine

PHILADELPHIA ACADEMY OF SURGERY

black silk, to check some oozing along the suturing line. After cleansing the pericardial sac, an iodoform gauze drain covered with gutta-percha tissue was inserted at the junction of the vertical and lower horizontal incisions. A second drain was placed in the pleural cavity alongside of the drain into the pericardium. Through-and-through silkworm-gut sutures were used to close the wound. The patient stood the operation very well and at the close his pulse rate was of good volume and had dropped to slightly over ninety.

The wound healed by primary union, the pericardial drain being removed first at the end of about forty-eight hours. The pleural drain was removed in four days. Convalescence was smooth but in a few days patient began to run an irregular temperature with physical signs of pleural effusion on the left side. On October 6th, a piece of the sixth rib on the left side was resected, and about two quarts of septic pleural effusion evacuated. With the exception of the irregular temperature, which lasted for some time, he made a complete recovery and was discharged from the hospital on November 29, 1913, in a very satisfactory condition.

The reporter added that his experience in this case was that there cannot well be any chosen time in the heart cycle for the introduction of sutures, for the heart in this instance was merely a quivering mass of flesh without determinable systole or diastole. He now believed it was unnecessary to put a drain in the pleural cavity. He was certain that it was necessary to drain the pericardium, for it is much better to finish the operation quickly than to spend too much time in cleansing the pericardium, and there must be, of necessity, considerable blood behind the heart to be drained out. In this patient, the drainage was profuse for the first twenty-four hours, and upon removing the drain there was a considerable gush of blood-stained fluid.

Through the kindness of Dr. Willis F. Manges, he had an X-ray made last week, more than three years after injury, showing the entire thorax. Dr. Manges reports that there are no adhesions of the lung to the diaphragm, and that, except for a slight defect in the sixth rib, he would be unable to state that any operation had been performed upon this boy. There is nothing to show where the ribs were divided along the sternal margin.

STAB WOUND INTO THE LEFT VENTRICLE OF THE HEART

DR. J. F. JONES reported the history of a young man, aged eighteen years, who was admitted to St. Joseph's Hospital, April 18, 1916, at 3:00 P.M. He had plunged a large and not especially clean penknife into

STAB WOUND INTO LEFT VENTRICLE OF HEART

his chest about fifteen minutes before reaching the hospital. The patient walked into the dispensary from the patrol wagon, a distance of about twenty-five feet, and placed himself upon the examining table with little or no assistance.

From the amount of blood on the patient's clothing, it was judged that the hemorrhage must have been quite profuse, but upon cutting away his shirt, no blood whatsoever was issuing from the stab wound. There was a small wound in the fourth interspace about one inch internal to the midclavicular line. Pulse was 148, of fairly good volume and regular at first, but later showing a tendency to intermit. The temperature was not taken. Patient was ordered to the operating room, and while being prepared became unconscious. Fifteen minutes had elapsed from the time of his admission to the time that he became unconscious, or one-half hour from the time of stabbing. Five minutes more elapsed before the commencement of the operation. When the incision was begun, thirty-five minutes after the infliction of the wound, the patient's pulse could not be felt and he was apparently not breathing.

A vertical incision was made to the left of the sternum, beginning at the second rib and extending downward for about five inches; the cartilages were cut through, and at each extremity of this vertical incision, a horizontal incision was made in an intercostal space extending about three inches in the direction of the midaxillary line. The flap thus formed was turned upward and outward by fracturing three ribs.

The pericardial sac was found distended and the heart was not beating. There was a very small puncture wound in the sac low down. When the pericardium was opened, a large amount of blood, both clotted and liquid, gushed forth and immediately thereafter the heart began to contract violently and with great rapidity. There was a small puncture in the heart near its left margin, close to its apex and extending into the ventricular cavity. The wound in the heart was slightly larger than the one in the pericardium. Three interrupted silk stitches were introduced into the ventricular wall and the pericardium was sutured with a continuous silk stitch, a small opening being left at the lower angle of the pericardial incision and the sac drained by a small piece of plain gauze. The pleural cavity, which had been opened, was also drained by gauze. Nearly a quart of salt solution was introduced intravenously during the operation.

The patient was on the operating table about three-quarters of an hour. At 8.30 A.M. of the morning following the operation, temperature was 98, pulse 110, and respiration 50. Respiration remained at 50 for three days, and gradually descended to normal. Gauze drain was

PHILADELPHIA ACADEMY OF SURGERY

removed from pericardium on the fourth day and from pleura on the thirteenth day. There was a stitch infection at the upper and outer angle of the skin flap. The patient was discharged from the hospital on the seventy-seventh day after operation.

His present condition is best expressed by the reports of Dr. Willis F. Manges and Dr. Ross V. Patterson, both of whom have examined the patient quite recently, October 5, 1916.

Dr. Patterson reports that the patient "complains of occasional moderate degree of precordial pain, some dyspnoea on exertion, and at times a rapid heart. A careful examination failed to reveal any gross abnormal signs of cardiac damage, or disturbance in the mechanism of cardiac contraction. A walk of two miles at an ordinary gait was accomplished without undue fatigue. There was a moderate degree of cardiac impairment for unusual effort. The pulse at rest was 78, systolic pressure 115, diastolic pressure 85. There was no evidence of displacement, enlargement, or dilatation. The area of visible cardiac impulse was visible from the second to the fifth interspace within the midclavicular line. Systolic retraction at the apex in the fifth interspace in the anterior axillary line was probably due to pericardial adhesions."

The report of Dr. Manges is as follows: "Fluoroscopic observation reveals a normally pulsating heart except that the rhythm is somewhat disturbed. There is practically no deviation in the position of the heart. The diaphragm moves freely on both sides, and is free from adhesions. Stereoscopic plates show that the third, fourth and fifth ribs have been fractured, about one inch or more external to the costochondral junction. They are united by bony union with considerable angulation. There is no evidence of disease of the lung tissue or of fibrous tissue formation. The heart seems to be a little above the average in size."

CASES OF INFECTIOUS ARTHRITIS

DR. WILLIAM JACKSON MERRILL related the history of a patient who had every symptom of tuberculous arthritis of the hip—muscular spasm, rigidity, tenderness on motion and the systemic symptoms. There was a history of tonsillar infection, followed by arthritis of the left hip with the usual symptoms, and it was under desultory treatment for nearly a year, the hip-joint improving not a bit. The patient came to the University Hospital and was sent to the nose and throat department where the tonsils were removed, shortly after which the hip began to improve. A plaster bandage was worn for protection and in about

CASES OF INFECTIOUS ARTHRITIS

eight months the hip-joint had almost normal motion. In a year motion had entirely returned and the tenderness had entirely disappeared.

Also the history of a child who had a recurrent arthritis in the opposite hip after removal of tonsils. There was periarticular thickening about the right hip with marked muscular spasm and tenderness on motion. Immediately following tonsillectomy the joint began to improve. About a year ago she began to have trouble in the other hip-joint. She was sent to the nose and throat department where no tonsillar trouble was reported. The adenoids, however, were removed and the hip-joint disease entirely disappeared—a coincidence since it was proven that there was no throat infection and that the adenoids had nothing to do with the recurrence.

The third case had a very acutely affected right knee. There was muscular spasm; practically no motion; much tenderness and swelling, but without very marked general systemic disturbance. Under rest and treatment the patient improved slightly. The tonsils were removed. After a stay in the hospital of two or three weeks the disease subsided and the patient went home with a plaster bandage from the crests of the ilia to the toes, which he wore for a short time. There is now absolutely normal motion in the knee-joint and no tenderness.

In two other cases, boys of the same family, he saw the first seven years ago when he had a very acutely affected hip with the usual local and systemic symptoms, and the family was told that the child had a tuberculous hip-joint disease. The hip-joint was absolutely rigid; the X-ray showed no organic changes, but there was a great deal of periarticular thickening, the tonsils were so enlarged that they almost touched each other. They were removed and in six months the hip-joint disease was much improved. Pain on motion had nearly subsided but there was still some restriction of motion. In about fourteen months he could walk normally.

The second boy had a polyarthritis, the left hip being practically stiff; he could move the right hip slightly. His knees were also quite rigid. One shoulder-joint and his wrists were affected. His throat was in the same condition as his brother's and the tonsils were likewise removed. Now, while there is some slight enlargement in the wrists, the joints are flexible. The boy was treated for a year and a half in the nose and throat department.

In yet another case the patient was admitted to the hospital July 28, 1916, with the knee in the condition shown with apparently a good deal of organic change. Under rest and treatment all symptoms disappeared and there is no evidence now of any joint irritability except a

PHILADELPHIA ACADEMY OF SURGERY

slight roughness on one side of the epiphysis of the femur which he did not believe represents organic change.

Dr. Merrill added in reply to questions, that laboratory examination of the tonsils removed was not routinely carried out in these cases. All the work attending the removal of the tonsils was done in the nose and throat department, and so far as the bacteriological examination is concerned they had no report. The tonsils were, however, reported cryptic and containing pus. Some of the cases reported, and others of the 40 or 50 on record at the dispensary, seem to prove that the tonsils were an etiological factor. Some of the cases which presented recurrent arthritic attacks in the same or other points at intervals of from six to eighteen months recovered entirely after removal of the tonsils. The first and fourth cases had such a history. Some of the cases were not admitted to the hospital for treatment but had their tonsils removed and measures for the improvement of the general health were carried on at home, treatment of the throat being administered in the nose and throat dispensary; it would seem, therefore, that these cases, having recovered after the local infection, were not tuberculous but due to the septic infection of the tonsils.

So far as the test for tuberculosis is concerned he did not know how a positive conclusion could be reached. Von Pirquet himself said that his test is worthless after the age of four and all surgeons know the value of the subcutaneous and intracutaneous tests. Tuberculous joint disease has a pretty definite course and history, and persists even after the removal of tonsils, adenoids, teeth and, in fact, the correction of any other trouble. It presents a picture which is recognized by experience and which is unmistakable. The general and local symptoms during the onset are entirely different in tuberculosis when compared with the septic. The manifestations in and about the joint, even in the very beginning, in the case of tuberculosis show trophic changes which do not appear in the septic. A mild case of tuberculosis might be mistaken for septic arthritis. In many of his cases the hygienic conditions had been good. He did not feel, therefore, that the hygienic surroundings in these cases were important. It is said, that certain cases recover without having the tonsils removed. Similarly many cases of tonsillitis get well, the disease coming on quietly and after a time subsiding, with no concomitant joint disturbances. At other times joint affections occur with attacks of tonsillitis and get well after the subsidence of the tonsillar disease. Again joint diseases follow tonsillar infection, become subacute or chronic and persist for an indefinite time.

Regarding the relationship of the involvement of the joint and the

CASES OF INFECTIOUS ARTHRITIS

epiphysis in the cases studied, he had rarely seen epiphysial involvement.

DR. GWILYM G. DAVIS said that in comparatively slight cases it is impossible to prove absolutely the existence of an infectious cause. In recent years the dependence of arthritic troubles upon infection has in a few cases been demonstrated as a certainty, and in a larger number of cases with a certain degree of probability. Many cases, however, are not sufficiently marked to enable us to localize the origin of infection. The doctrine of infection as a cause of chronic joint disease has, however, gained ground. Particularly in the older case reported the question of a metabolic cause may arise as in the hypertrophic arthritis of adults. In young cases such as those shown by Dr. Merrill, the metabolic cause would not be so probable. In those, of course, one would consider the possibility of traumatism without infection, and specific infections such as syphilitic and tubercular. Joint troubles are gradually being systematized and when not simply traumatic are usually found to be tuberculous, or infectious, and disturbed metabolism as a cause seems to be losing ground.

DR. A. BRUCE GILL said that the diagnosis of the cause of arthritic conditions in children often presents a difficult problem. The Von Pirquet test done routinely usually will be found positive except in very young children. Often by putting these children at rest in bed with extension their symptoms quiet down and they are discharged from the hospital wearing a case and walking on crutches. As time passes they acquire good motion, and upon examination the joint is apparently normal. All have seen many arthritic cases clear up without treatment except putting the patient at rest and without excision of the tonsils. Orthopaedic clinics are flooded with arthritic cases of all kinds and in these days the theory of focal infection is greatly emphasized. Every effort is made to discover and to remove the source of such infection. Notwithstanding the fact, however, that patients are referred to the nose and throat and gynaecological departments and to the dentist and elsewhere for removal of such focal infection, in many cases the arthritis remains unchanged.

DR. P. G. SKILLERN, JR., thought Dr. Merrill's series of joint infections to be instructive because of the clear relationship he has established between effect and cause, as was demonstrated by the prompt improvement and ultimate cure after the tonsils were ablated *in toto*. He said ablated *in toto* in order to "knock" those operators who are satisfied with performing partial tonsillectomy by means of the tonsillotome. This is a procedure that is about as logical as removal of a portion of the appendix for appendicitis. There is no reason to suppose

PHILADELPHIA ACADEMY OF SURGERY

that the outer, or buried, portion of the tonsil is any less diseased than the inner, or exposed, portion—a conclusion that the operation of partial tonsillectomy presupposes. As a matter of fact both bacteriologic and pathologic-histologic examination of totally ablated tonsils show that the outer, or buried, portion of the tonsils is also involved in the disease of the inner portion, which is more evident to the naked eye at the time of physical examination, and that this outer portion exhibits no such immunity to disease as the partial tonsillotomists would have us believe. Nay, more: recent investigations have shown the *capsule* of the tonsil—the outermost portion—is frequently diseased, particularly in tuberculosis, so that any operation must be discarded which does not remove the capsule together with the tonsil.

Dr. Merrill described a case of metastatic arthritis of the hip-joint in which recrudescence followed "removal of the tonsils." This recrudescence suggests the probability of the tonsils not having been wholly removed—an inference that seems more logical than the essayist's adenoid hypothesis, for he did not see how adenoids with their smooth and edematous mucosa could act as portals of entry for bacteria, unless the adenoids were the seat of ulcerous processes the result of trauma.

The pathology of Dr. Merrill's cases was probably not sufficiently extensive, judging by the short clinical course, to warrant the use of so comprehensive a term as "arthritis." The term "serious synovitis" would doubtless apply, the bacterial emboli lodging in the subsynovial vascular layer and by their toxins irritating the sensitive synovial layer itself until a serious effusion—at first bacteria-free—is poured into the joint cavity from the congested membrane.

Given a case of joint disease, it often requires a painstaking and exhaustive study to detect and establish the primary focus of infection. The work of Rosenau in the bacterial, and of Pemberton, of Philadelphia, in the non-bacterial or metabolic joint-disease, has already shed much light upon the pathogenesis and successful treatment of these respective lesions.

ACIDOSIS IN SURGICAL CONDITIONS

DR. J. HAROLD AUSTIN said that normally CO₂ is present in the tissues at a tension of about 80 mm.; in the alveoli of the lungs and in the arterial blood leaving the lungs, at a tension of about 45 mm. Every unit of arterial blood as it passes through the tissues takes up a certain load of CO₂ as a result of this difference in tension, and reaching the lungs loses this CO₂ there. When there is a diminution in the "buffer substances" of the blood there is a diminution in the amount of CO₂.

ACIDOSIS IN SURGICAL CONDITIONS

which each unit of blood can take up in response to a given increase of CO₂ tension. In consequence there follows a diminished removal of CO₂ from the tissues and among others from the respiratory center. The accumulation of CO₂ results in a higher CO₂ tension in the center and this in a stimulation of the center with increased alveolar ventilation so that the center may have a CO₂ tension of what we will suppose 85 mm. and the alveoli of the lungs of 30 mm. The difference of CO₂ tension between the pulmonary alveoli and the tissues will thus have been increased from 35 mm. to 55 mm. Now it is possible that in spite of the diminished "buffer substances" in the blood the amount of CO₂ taken up by each unit of blood under the influence of this increased difference of CO₂ tension will be sufficient to maintain an adequate transfer of CO₂ from the tissues to the lungs and establish an equilibrium upon this new basis.

To recapitulate: The CO₂ carrying capacity of the blood is diminished for a given difference in CO₂ tension. This interferes with the removal of CO₂ from the tissues, including the respiratory center. This stimulates the respiratory center, leads to hyperpnoea and an increased pulmonary ventilation. This increases the difference of CO₂ tension between tissues and pulmonary alveoli, and this in turn increases the amount of CO₂ carried by each unit of blood and re-establishes an equilibrium.

The only clinical feature characteristic of these cases is the peculiar deep respiration without cyanosis with the usual association of headache and frequency of vomiting. It is the very inability to recognize acidosis on the symptom-complex alone which makes the tests for acidosis of value, and it is our knowledge of these tests which will enable us to detect unsuspected cases of acidosis.

DR. ASTLEY P. C. ASHHURST said that the laboratory men and the physicians in the last few years have brought the surgeons to the realization of the fact that starvation, among other things, is a potent cause of acidosis. When we see children in the wards who are homesick and do not eat, we do not operate on such children until they become accustomed to their surroundings, when they begin to eat and get better. Surgeons did not formerly recognize that anaesthetization and operation on such patients before this improvement occurred, might result in the death of the child from acidosis. He recalled one such case in which death occurred a number of years ago, following a double osteotomy for knock-knees. We then thought it a case of status lymphaticus: the child's temperature rose rapidly after operation, respiration was exceedingly rapid, and she died within a few hours. Autopsy showed nothing

PHILADELPHIA ACADEMY OF SURGERY

very conclusive. No doubt death was due to acidosis. This patient starved herself before operation because of her unhappiness and homesickness. There can be no doubt that in many cases in the past, where we have thought death was the result of the operation, it was really due to acidosis; and that the fatal termination might have been averted if operation had been postponed. Acidosis, as pointed out by Crile, is greatly to be feared in cases of advanced peritonitis; and in such cases it is often acidosis and not bacterial intoxication that is responsible for the patient's death.

EXPERIMENTAL CHEMOTHERAPY OF BACTERIAL INFECTIONS

DR. JOHN A. KOLMER, by invitation, read a paper with the above title.

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