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TRANSACTIONS

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# TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

*Stated Meeting, January 7, 1901.*

The President, De Forest Willard, M.D., in the Chair.

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## WOUNDS OF THE VENOUS SINUSES OF THE BRAIN.

### AN ANALYSIS OF SEVENTY CASES.

By HENRY R. WHARTON, M.D.,

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In the following paper I have embodied the results of a study of seventy cases of wounds of the great venous sinuses of the brain, collected from various sources. Of these cases five have come under my personal observation; and it was this experience which led me to investigate this class of injuries with special reference to their frequency and mortality, and to the determination of the method of treatment which has been employed with the most satisfactory results.

Case I.—H. R. Wharton. Boy, twelve years of age, was admitted to the University Hospital, 1882, having been struck upon the occipital bone by the point of a stick thrown at him with great violence, producing a scalp wound, a little to the right of the occipital protuberance, an inch in length, and also a depressed fracture of the occipital bone three-quarters of an inch in diameter. The patient presented no marked brain symptoms at the time of his admission. On the day following his admission, Professor Ashhurst decided to elevate the depressed bone. The scalp wound was enlarged to give freer access to the wound in the bone. Several fragments were removed with the elevator and bone forceps, and upon the removal of the last fragment there was a furious gush of venous blood. Attempts were made to control the bleeding by grasping the walls of the sinus from which it arose with artery forceps, but were ineffectual, and the patient quickly

succumbed. Post-mortem examination showed that one of the depressed fragments had opened the Torcular Herophili, the junction of the superior longitudinal and lateral sinuses.

Case II.—H. R. Wharton. M. M.,[1] twenty-four years of age, University Hospital, was struck on back of head by dump-car, August 30, 1886, and sustained a compound depressed fracture of the occipital bone. Trephined, and depressed bone removed by Professor Ashhurst, and when largest fragment was removed, which corresponded to the position of the junction of the lateral and superior longitudinal sinuses, there was a gush of venous blood, which was quickly controlled by packing the wound with antiseptic gauze. The patient made a good recovery. Five months afterwards the patient was admitted to the University Hospital with typhoid fever, which proved fatal. Post-mortem examination showed large gap in skull where bone had been removed, and a cicatrix in lateral sinus near its junction with the superior longitudinal sinus, and a well-organized thrombus occupying a portion of the lateral and superior longitudinal sinuses.

Case III.—H. R. Wharton. C. M., aged thirty years, admitted to the University Hospital, 1883, under Professor Ashhurst's care, with an extensive scalp wound, and a compound depressed fracture of the posterior portion of the right parietal bone. A trephine was applied and the depressed bone was removed. Its removal was followed by free venous hæmorrhage which arose from the right lateral sinus. The bleeding was promptly arrested by packing the wound with iodoform gauze. The patient did well after the operation, and the packing was removed in a few days. The patient made a complete recovery.

Case IV.—H. R. Wharton. J. M., aged eight years, fell into an areaway, a distance of six feet, striking upon the right side of the head, October, 1892. He was stunned for a few minutes, but regained consciousness. and walked in the house and went to his room and went to bed. I saw him a few hours after the accident, with his physician, Dr. Williams, and found that he had a large blood tumor over the right side of the skull. He was conscious and did not present any symptoms of cerebral compression. Early in the morning of the next day it was noticed that he became drowsy and did not move the left arm. I saw him again, and found that he could be aroused with difficulty, and that there was decided paralysis of the left arm and left leg. Considering it a case of hæmorrhage from the middle meningeal artery, I turned up a flap from the scalp, so as to expose the anterior inferior angle of the parietal bone, and found a fissure in the bone at this point. I applied a trephine and removed a disk of bone, but found the dura mater in contact with the bone, and no blood-clot present. I then enlarged the wound backward, following the line of the fissure in skull, and exposed an extensive depressed fracture at the posterior portion of the parietal bone. The depressed fragments were removed, and a large blood-clot, weighing four ounces, was exposed and removed. Free venous bleeding, which arose from the lateral sinus, occurred after the removal of the blood-clot, which was promptly arrested by packing the wound with iodoform gauze. The patient did well after the operation, the paralysis disappeared, and the packing was removed on the sixth day. The patient made a good recovery.



Case V.—H. R. Wharton. A boy, aged fifteen years, was admitted to the Bryn Mawr Hospital in June, 1900, under the care of Dr. T. H. Branson, having been struck on the head by a heavy iron bucket falling from a derrick, causing a compound depressed fracture of the right parietal bone, the line of fracture being about three inches in length.

I saw the case shortly after his admission to the hospital. He was conscious and showed no signs of paralysis, and after removing the gauze dressings, which had been freely applied over the wound to control the bleeding, I found a depressed fracture of the parietal bone, almost parallel with the longitudinal sinus, about three inches in length, and about one-half to three-quarters of an inch from the sagittal suture. The posterior portion of the depressed bone extended to the median line of the skull.

Suspecting from the position of the fracture, and from the free bleeding which had occurred, that there might be an injury to the longitudinal sinus, I made provision for the control of the bleeding by having a quantity of strips of sterilized gauze at hand, to use promptly for packing if it were needed. I removed a disk of bone at the outer edge of the line of fracture with a trephine, and, by the careful use of an elevator and forceps, removed a number of depressed fragments; when I removed a large fragment near the median line, there was a furious gush of venous blood, which was quickly controlled by introducing the gauze packing. A very large amount of gauze was introduced before the bleeding could be entirely arrested. After the bleeding had been controlled, the edges of the wound in the scalp were brought together over the packing by silkworm-gut sutures, which were secured by bow-knots, so that they could be untied subsequently for the removal of the packing.

The patient did well after the operation; at the end of a week I again etherized him, untied the sutures, and separated the edges of the wound in the scalp; after soaking the gauze with distilled water, I carefully removed the packing piece by piece. When all the gauze had been removed, it was found that there was no bleeding; after introducing gauze strips for drainage at the most dependent portion of the wound in the scalp, the wound in the scalp was closed by tying the sutures which had already been introduced.

The patient did well, and the wound was healed in a few weeks. When he began to walk, it was found that there was some paralysis of the muscles of the left leg supplied by the external popliteal nerve, constituting a well-marked "foot-drop." This condition has greatly improved, and Dr. Branson, who had charge of the case, reports recently that the improvement has been continuous, and that at the present time the paralysis does not constitute a marked disability.

Case VI.—Guthrie.[2] A heavy dragoon, at the battle of Salamanca, was thrown from his horse, and struck upon the vertex of the skull. He soon became lethargic, and a tumor was observed upon the top of the head. This on being incised showed a separation of the sagittal suture, from which blood escaped. Two crowns of a trephine were applied on the twelfth day, to permit of the discharge of blood, which had been extravasated from a wound of the superior longitudinal sinus. The patient recovered.

CASE VII.—Guthrie[3] reports the case of a child, Sarah R., aged four years, who was struck upon the head by a rake, one of the teeth of which penetrated the skull near the anterior fontanelle, and opened the superior longitudinal sinus. Three or four ounces of blood escaped before the bleeding was arrested by a compress. The child developed a slight hemiplegia following the injury, but finally recovered.

CASE VIII.—Guthrie[4] reports the case of a man who suffered from a fracture of the skull, with laceration of the superior longitudinal sinus, by the breech-pin of a gun. Free hæmorrhage occurred upon the removal of the breech-pin, and the patient succumbed to the free bleeding.

CASE IX.—Mullar.[5] J. A., fifty-eight years of age, was admitted to the London Hospital presenting marked cerebral symptoms, and died twenty-four hours after his admission. He had received a fall, striking the head while intoxicated. Post-mortem examination showed a rupture of the straight sinus near its junction with the lateral sinus.

CASE X.—T. Longmore.[6] Private J. D., injured by a rifle-ball, which divided the scalp and pericranium for three or four inches across the upper and back part of the skull. The ball had passed from right to left and from before backward, just anterior to the angle of the lambdoidal suture. He was rendered unconscious by the injury and never regained consciousness, and died in twenty-four hours. Post-mortem examination revealed a rupture of the superior longitudinal sinus beneath the seat of injury, and a large quantity of coagulated blood upon the surface of the brain.

CASE XI.—H. Ludlow.[7] M. P., aged eight years, on May 10, received an injury of the head, producing a laceration of the right side of the scalp and fracture of the right parietal bone, the fracture extending upward from the squamous suture. The patient died from pyæmia, May 24, fourteen days after the injury. Post-mortem examination showed an accumulation of pus between the dura mater and the bone, and laceration of the superior longitudinal sinus, which contained blood-clot and pus.

CASE XII.—A. H. Buchanan.[8] A woman, struck upon the vertex of the skull by flat-iron, sustaining a compound depressed fracture of the parietal bone. In removing the depressed fragments, as a portion of the internal table was removed, there was a gush of venous blood, which came from a wound of the superior longitudinal sinus, just under the sagittal suture. The bleeding was controlled by pressure with a sponge and a compress and bandage. The sponge and compress were removed in fifty-six hours, and bleeding again occurred; this was controlled by packing the wound with lint, and the patient ultimately recovered.

CASE XIII.—A. G. Reed.[9] G. B., struck upon the head by a brick, producing a compound comminuted fracture of the cranium. In removing the fragments, a small spiculum of bone was found to have penetrated the longitudinal sinus, and free bleeding occurred upon its removal, which was controlled by packing the wound with lint. Death occurred from pyæmia on the ninth day. Post-mortem examination revealed an abscess and a small wound of the superior longitudinal sinus; the latter was occluded by a thrombus at the seat of injury.



CASE XIV.—John Adams.[10] D. L., twenty-seven years of age, a sailor, was admitted to the London Hospital, having received a fracture of the vault of the cranium by falling from the yard-arm. Examination showed a compound depressed fracture three and a half inches in length across the vertex of the skull. Attempts were made to remove the depressed bone, but were abandoned on account of the free bleeding, which arose from a wound of the superior longitudinal sinus by a fragment of the depressed bone. The bleeding was controlled by lint packing and a compress. The patient died of pyæmia on May 1. Post-mortem examination revealed a wound of the superior longitudinal sinus by a fragment of bone. Fibrous coagula were found in the sinus.

CASE XV.—T. A. Gold.[11] H. B., aged six years, was kicked by a horse, sustaining a compound depressed fracture of the frontal bone two inches in diameter. A trephine was applied and the fragments were removed. Upon removing one fragment, free bleeding occurred from a wound of the superior longitudinal sinus, which was controlled by pressure, and finally was arrested spontaneously. The patient made a good recovery.

CASE XVI.—W. Parcels.[12] A man aged nineteen years was struck by a piece of grindstone over the right temporal bone. He was knocked down by the blow, but soon got up and resumed his work, but in twenty minutes became sick at the stomach and vomited. He was seen some hours afterwards by the reporter, and was then in a comatose condition, and he died thirteen hours after the injury. Post-mortem examination showed marked ecchymosis of the scalp at the seat of injury, but no fracture of the skull. Upon opening the latter there was found upon the right side of the brain six or seven ounces of blood-clot, and a rupture of the lateral sinus.

CASE XVII.—Sands.[13] Boy, thirteen years of age, sustained a fracture of the right side of the skull from a fall from a horse, August 25. When admitted to the hospital he was comatose and presented paralysis of the left side of the body. Incision of scalp revealed an extensive depressed fracture of the right temporal and parietal bone, with escape of brain tissue. The depressed fragments of bone were removed, and in accomplishing the latter purpose bleeding occurred from the superior longitudinal sinus, which was controlled by gauze packing. Consciousness did not return, and he died two hours after the operation.

CASE XVIII.—Parkes, C. T.[14] B. B., twenty-seven years of age, sustained a compound depressed fracture of the skull, on June 20, from being struck by a brick. There was profuse bleeding from the wound. Examination showed a compound fracture of the right parietal bone, one and one-half inches in diameter; there was also paralysis of the left upper and lower extremity. Removal of the fragments was followed by profuse hæmorrhage, which was controlled by packing the wound with gauze and the application of a compress. On June 21 the compress and gauze were removed, and hæmorrhage occurred from a small wound in the right lateral sinus about the size of a coffee grain. The wound was closed by introducing three catgut sutures, and the wound was packed with gauze,

and a compress was applied. The patient recovered with the disappearance of the paralysis, except an inability to extend the toes of the left foot.

Case XIX.—A. H. L.,[15] nineteen years of age, while sparring, received a blow upon the left side of the jaw and in a short time became unconscious, and later developed muscular spasms and Cheyne-Stokes respiration. There were clonic movements of right hand, and all four members were in a condition of tonic rigidity. Patient did not regain consciousness and died on the sixth day. Post-mortem examination revealed an effusion of blood, with a small laceration of the left lateral sinus near outer margin of temporal bone.

Case XX.—Wm. J. Taylor.[16] W. P. J., aged thirty-five years, was admitted to St. Agnes's Hospital, June 25, 1890, having sustained a wound of the scalp and a punctured fracture of the vertex of the skull, produced by a pick. The wound was large enough to admit the finger. The depressed bone was removed, and the surrounding bone cut away with rongeur forceps, exposing a wound in the superior longitudinal sinus, from which free bleeding occurred. The wound in the sinus was about one-quarter of an inch in length. The edges of the wound in the sinus were grasped with hæmostatic forceps, which effectually controlled the bleeding. The forceps were allowed to remain in position for seventy-two hours and were then removed, and the wound was packed with iodoform gauze. The patient made a good recovery, and was discharged from the hospital August 29, 1890.

Case XXI.—W. H. A. Jacobson.[17] M. K., aged forty-three years, received a blow on the head February 1, and became unconscious, and presented marked swelling of the scalp behind the right ear. He developed symptoms of compression and died February 3. Post-mortem examination revealed a large blood-clot over right side of brain, and a fracture of the outer table of the skull, which extended to the right lateral sinus. The hæmorrhage arose from injury of the lateral sinus by the fracture, which extended into the mastoid process of the temporal bone.

Case XXII.—W. H. A. Jacobson.[18] W. P. was admitted to the University College Hospital, having received a blow on the left side of the head by a bar of iron. He was unconscious on admission, and presented a wound two inches in length, situated two and one-half inches above the left mastoid. There was a fragment of bone deeply depressed, and when this was removed with an elevator, a stream of venous blood as thick as the finger gushed from the wound. Plugs of lint were introduced, which controlled the bleeding. Hæmorrhage again occurred upon the removal of the plugs of lint on the fifth day, which was controlled by packing the wound with lint. The patient died of pyæmia on the thirty-fifth day. Post-mortem examination showed a wound of the left lateral sinus not completely healed, and the sinus was filled with soft, decolorized, putrid clots. The condition of thrombosis extended into the mastoid vein.

Case XXIII.—W. H. A. Jacobson.[19] J. W. was admitted to Guy's Hospital February 13, 1875, having fallen from a horse, and sustained a contused wound of the back of the head. Upon admission he was irritable, and soon developed convulsions, and became comatose. He died February



17, four days after the injury. Post-mortem examination revealed an extensive blood-clot between the dura mater and the bone, and a fissure of the right cerebellar fossa of the occipital bone, with a wound of the lateral sinus.

Case XXIV.—Phelps.[20] A man, from a fall on sidewalk, sustained an extensive comminuted fracture of the posterior portion of the skull. Two fragments of bone were removed and one was elevated, showing a large epidural clot. The patient had hæmorrhage from the right ear, developed stupor, and general muscular rigidity, and the sixth day after the injury developed unconsciousness and frequent general convulsions, and died on the seventh day. Post-mortem examination revealed an extensive fracture of the occipital and right parietal and temporal bones. A large epidural clot was situated beneath the fracture of the occipital bone; the posterior portion of the superior longitudinal sinus was filled by a thrombus; the walls were infiltrated with blood, and there was a large, partially decomposed thrombus in Torcular Herophili, extending through the right lateral into the petrosal sinus and internal jugular vein.

Case XXV.—C. Phelps.[21] A female, aged thirty years, was struck upon the head by a piece of board which had fallen thirty feet. She sustained a compound fracture of the anterior and superior portion of the right parietal bone. Trephining was resorted to, and the depressed bone removed; it was found that the superior longitudinal sinus had been lacerated by a fragment of bone. The patient recovered.

Case XXVI.—C. Phelps.[22] Male, aged thirty-three years, was struck on the head with a hammer and rendered temporarily unconscious, after which he walked to the hospital. Examination revealed a compound depressed fracture of the vertex of the skull. Depressed fragments of bone were removed, leaving an opening in the skull one and one-half inches by one inch in diameter. Free hæmorrhage occurred from a large wound of the longitudinal sinus, which was controlled by gauze packing. The patient recovered.

Case XXVII.—C. B. Nancrede[23] reports the case of a man who received a wound of the right lateral sinus by a pistol-ball which passed through the mastoid process. The patient died of pyæmia. Post-mortem examination revealed a wound of the right lateral sinus.

Case XXVIII.—A. Genzmer[24] reports the case of a woman, sixty-three years of age, in whom the superior longitudinal sinus was severed in removing a large sarcoma of the dura mater which had perforated the skull in its growth. In this case air entered the sinus, and the patient became collapsed, the respiration intermittent, and she died upon the table. Post-mortem examination. The heart was opened under water, and contained many air-bubbles and frothy blood; the left heart was empty. The arteries of the lungs and the subpleural vessels were partly injected with air.

Case XXIX.—Prescott Hewitt.[25] Man, aged fifty-seven years, received an injury of the head, resulting in a compound fracture of the skull, opening the lateral sinus. The patient died of repeated hæmorrhages.

Case XXX.—Navratil.[26] Girl, twenty-four years of age, sustained a

fracture of the skull, with perforation of the superior longitudinal sinus, with a spiculum of bone. He sutured the dorsal wound with a deep continuous suture, so that the sinus was included. During the application of the suture the bleeding was arrested by the application of a tampon. The bleeding was controlled and the patient recovered.

Case XXXI.—Dr. J. E. Sheppard.[27] W., aged sixty-four years, received an accidental wound of the lateral sinus in an operation for mastoid disease. The bleeding was controlled by packing with gauze, and the patient made a good recovery.

Case XXXII.—M. E., twenty-two years of age, received a wound of the lateral sinus in an operation for mastoid abscess. The hæmorrhage was controlled by packing the wound with gauze, and the patient recovered.

Case XXXIII.—M. McL., aged fifty-five years. In opening a mastoid abscess in this case, the lateral sinus was injured and free bleeding occurred. The hæmorrhage was controlled by packing the wound with gauze, and the patient made a good recovery.

Case XXXIV.—G. Luys.[28] Male, thirty-eight years of age, received an injury of the head in falling from an omnibus, and was admitted to the hospital in an unconscious condition. At the time of his admission there was bleeding from the right ear, the pulse was normal, and the respiration was slow and deep. Trephined over squamous portion of right temporal bone. Lateral sinus found perforated. Hæmorrhage checked by tamponing with iodoform gauze; hæmorrhage from ear also arrested by this procedure. A fracture was also found running to the base. The patient showed some improvement, but died on the fourth day. Post-mortem examination revealed a very extensive blood-clot over right side of brain, also fracture of squamous and petrous portion of temporal bone. The dura mater was torn in the neighborhood of the right cerebral fossa, extending obliquely to superior part of right lateral sinus, which was opened and gaping, a little less than a centimetre. A portion of the dura was caught in the fracture.

Case XXXV.—Corporal W. S.,[29] aged twenty-one years, was wounded near Petersburg, Va., June 20, 1864, by a conoidal ball, which entered the mastoid process of the temporal bone and passed upward and backward through the occipital protuberance just above the Torcular Herophili. In its course the ball opened the superior longitudinal sinus. The patient became comatose, and died eight hours after his admission to the hospital.

Case XXXVI.—S. W.,[30] aged twenty-four years, suffered from a gunshot fracture of the left parietal bone. In its course the ball severed the superior longitudinal sinus. The patient recovered with partial paralysis.

Case XXXVII.—Cushing.[31] A boy sustained a compound comminuted fracture of the vertex of the skull. There was extensive subconjunctival hæmorrhage with partial oculomotor paralysis, but no involvement of the seventh or eighth pair of nerves. The patient remained unconscious for three weeks, but his throat reflexes were good, and he would swallow food placed in his mouth. An incision was made and fragments of bone removed, and there was found a laceration of the longitudinal sinus. The boy made a good recovery.



Case XXXVIII.—Hutin.[32] A soldier, aged thirty-five years, received at the battle of Jena two gunshot wounds of the head, one dividing the two external tables of the skull for a distance of five or six centimetres, the other causing a comminuted, depressed fracture of both parietal bones obliquely, from before backward and from right to left, crossing the superior longitudinal sinus. He did not lose consciousness. The patient recovered.

Forty years afterwards he received a fall, sustaining a fracture of the thigh and a wound of the chin. He developed erysipelas and pleuropneumonia, and sixteen days later a parotid abscess. He also developed a painful, œdematous, fluctuating swelling at the top of the head, at the seat of the wound of the parietal bones, which was opened under the impression that it was an abscess, and was found to contain only black blood. It was found to communicate with the superior longitudinal sinus at the site of the old wound. The cavity was tamponed with charpie, and the bleeding was permanently arrested after three days. The patient died in a few days, but presented no head symptoms. Post-mortem examination showed a spine of bone four millimetres in length and seven millimetres in width growing from the bone at the seat of fracture, which had perforated the superior longitudinal sinus; the hæmorrhage, having leaked along the dura mater, had formed the tumor of the scalp.

Case XXXIX.—N. R. Moseley.[33] Private E. S., aged eighteen years, was wounded June 3, 1864, at the battle of Cold Harbor, Va., by a conoidal ball, which fractured the occipital bone just above the left extremity of the superior curved line. The patient presented symptoms of compression of the brain, and later became comatose. The ball was removed from the left lateral sinus and the hæmorrhage was controlled by pressure with sponges. The patient died June 18.

Case XL.—John A. Liddell.[34] Private P. K., twenty-one years of age, was wounded at Middleburg, Va., on June 21, 1863, by a carbine-ball, which produced a fracture of the right parietal bone near the junction of the coronal and sagittal sutures. Five days after the injury he became comatose. He was trephined, and two fragments of depressed bone were removed,—one about one and a half inches in length by three-fourths of an inch in breadth, embracing both tables of the skull, the other being a small fragment of the inner table. Upon the removal of the fragments bleeding occurred from the superior longitudinal sinus, which was controlled by packing with lint. The patient died June 27. Post-mortem examination revealed a laceration of the dura mater, and a considerable effusion of dark blood, which came from the superior longitudinal sinus.

Case XLI.—B. W. Allen.[35] Private I. S., aged nineteen years, received a gunshot fracture of the frontal bone near the anterior fontanelle. He was admitted to the hospital and trephined, and fragments of bone removed. One week after the operation he developed pyæmia, and died of hæmorrhage from the superior longitudinal sinus sixteen days after the operation of trephining. Post-mortem examination revealed ulceration of the coats of the sinus, with small spiculæ of bone resting upon it.

Case XLII.—R. G. Le Conte. A child, two years of age, was admitted

to the Methodist Hospital, having fallen from a second-story window and struck upon its head. There was no external wound of the scalp, but a large hæmatoma. The patient was unconscious and in collapse. The scalp was incised, and the parietal bones were comminuted near the vertex; fissures extended to the bones at the base of the skull. In removing fragments of bone free hæmorrhage occurred from the superior longitudinal sinus, which was controlled by packing the wound with gauze. The patient did not react, and died in a short time.

Case XLIII.—W. H. A. Jacobson.[36] Man, thirty-five years of age, was admitted to the hospital with scalp wound, November 29, 1862, in a state of insensibility. He was dressed and sent out, but was returned later by the police, who found him insensible on the street. The patient was unconscious, breathing was slow, and the pupils were moderately dilated and fixed. Died without marked change in symptoms eight hours after admission. Post-mortem examination revealed no fracture of the skull, but large blood-clot over left hemisphere of brain, under the dura; blood also entered to the right side of brain under the crux cerebri. A lacerated wound was found in the left lateral sinus near the middle of its highest point.

Case XLIV.—Gangolphe and Piery.[37] A young man, aged twenty-five years, in consequence of a fall down-stairs, suffered a fracture of the base and lateral aspect of the occipital bone, and a portion of the temporal bone. The lateral sinus was torn by divulsion, and a large hæmorrhage with resulting clot accumulated between the dura mater and the skull, compressing the brain over the anterior two-thirds of the temporal lobe and a portion of the parietal lobe behind the Rolandic zone. Subdural ecchymosis on the left side, covering the external surface and base of the left hemisphere. The symptoms were mistaken for those of apoplexy, which they resembled. There was coma, stertor, left-sided hemiplegia of the face, apparent left-sided anæsthesia, and contraction of the right arm and leg. A slight wound of the scalp, examined twice, did not extend to the bone. No fracture discovered until autopsy. Death on the fifth day.

Case XLV.—Petit.[38] A child of ten years fell from a second story to pavement, and became unconscious. No bleeding from nose, mouth, or ears. Hæmatoma developed behind right ear. The patient exhibited unconsciousness and restlessness, alternating later with delirium. Retention of urine, constipation, vomiting for first day or two. Rapid pulse, contracted pupils, extremities insensible. Later, deep coma, general insensibility, contracted and insensible pupils, limbs flaccid, slow, deep, but not stertorous respiration. Death on third day. Post-mortem examination revealed a radiating fracture of the right lateral aspect of the skull, with laceration of the lateral sinus and large epidural clot, with extravasation of blood beneath the scalp; subdural ecchymosis on the same side, and intra-arachnoid effusion on the opposite side. Contusion of the brain.

Case XLVI.—Aran.[39] Male, aged forty-one years. A fall down-stairs on the head. Bleeding immediately from left ear, continuing for two days. Upon the third day after the injury, after two days in bed, he



walked several miles, and later complained of headache and fatigue. He became delirious, and on admission to the hospital was observed to have a swelling over parietal region in superior posterior portion, several fingers' breadths in size. The right arm and leg were paralyzed and sensibility diminished. He died in coma on fifth day. Autopsy showed separation of left posterior portion of lambdoidal suture, and fracture of temporal, extending to base of mastoid. Another fracture extended through auditory canal. Comminuted fracture of petrous portion. Fracture of glenoid cavity. Lateral sinus torn where it reaches posterior lacerated foramen. There was a large epidural clot under left parietal bone. There was also intra-arachnoid ecchymosis and contusion of the brain.

Case XLVII.—Larry.[40] A soldier was shot behind the right ear, the ball entering at the level of the mastoid process, grooving its base, fracturing the squamous plate of the temporal, and presenting two wounds of exit, one through the antihelix, the other at the level of the zygomatic arch. There were symptoms of concussion and compression. Larry enlarged the wound and trephined for the purpose of elevating any depressed fragments. A collection of blood was evacuated through the opening from between the skull and dura, and the patient immediately improved. The symptoms of compression were considerably diminished, but the intellection was confused, and the patient was deaf on the same side and limbs relaxed. Improvement continued for a few days, when the patient on going to stool fell, and died shortly after. Post-mortem examination revealed a rupture of the right lateral sinus, effusion of bloody serum in the lateral ventricles, and on the surface of the cerebellum, and at the entrance of the spinal canal and sanguineous pus in the superior longitudinal sinus.

Case XLVIII.—Morgagni.[41] A woman fell down-stairs, striking her head. She lost the power of speech immediately, also power of feeling and movement in limbs, especially lower extremities. There was bleeding from the nose and one ear, and she died in an hour. Post-mortem examination revealed a transverse fracture of the base, involving the petrous portion of the temporal bone, crossing the sphenoidal sinus to the other side of the skull, and opening the auditory canal. The lateral sinus and dura mater were torn, and there was a large extravasation of blood at the base of the skull. The cerebellum was slightly lacerated.

Case XLIX.—Gaignere.[42] Injury of the lateral sinus by an iron dung-hook. Profuse hæmorrhage. Pressure bandage controlled it. Recovered.

Case L.—Marchetti.[43] Injury of the superior longitudinal sinus by a foreign body which penetrated to corpus callosum. Five pounds of blood lost. Controlled by astringents. Bandages removed at end of fourteen days. No more bleeding. Healing by granulation.

Case LI.—Lamotte.[44] Transverse wound of both parietal bones by a sabre-cut, with simultaneous injury of superior longitudinal sinus, meninges, and brain. Hæmorrhage followed by serous fluid and white flakes. Recovery in two months.

Case LII.—Mackenzie.[45] Injury of cavernous sinus through penetration of the sphenopalatine fissure by the stem of a tobacco-pipe. No fracture or injury of brain or extravasation of blood. Patient died. Post-

mortem examination revealed disorganization of the cavernous sinus and neighboring portion of brain and dura.

Case LIII.—Chassaignac.[46] A man suffered from a deep penetrating wound of skull and brain, followed by loss of memory and of power on left side. Delirium, and death on seventh day. Post-mortem examination showed penetration of superior longitudinal sinus and left ventricle, which contained large quantity of serum and coagulated blood.

Case LIV.—Broca [47] mentions a case in Nélaton's clinic of simultaneous wound of cavernous sinus and internal carotid artery by an umbrella-stick penetrating the orbit. Result: arteriovenous aneurism.

Case LV.—C. Bell.[48] A workman, aged sixty-three years, while pushing a heavy wheelbarrow after eating a hearty meal, suddenly became unconscious and fell, and after a deep inspiration died. Post-mortem examination revealed a rupture of the right lateral sinus, with an effusion of ten ounces of black and fluid blood into the arachnoid, covering the right hemisphere and the base of the brain. The walls of the sinus were thin and atrophic, and in the middle of the sinus there was an irregular tear. There was no fracture of the skull.

Case LVI.—Schmucker.[49] Soldier, wounded by hand grenade, twice trephined, died on eighteenth day. Splintering of inner table, with one splinter penetrating the superior longitudinal sinus. In the sinus were found blood-clots and a mixture of blood and pus, and the walls covered and the posterior portion filled with granulations.

Case LVII.—Chassaignac.[50] Case was struck on back part of head, skull fractured, and Torcular Herophili torn. Delirium. Death after a few days without symptoms of compression. Extravasation outside dura.

Case LVIII.—Volmer.[51] A fifteen-year-old boy fell fifteen feet, striking back part of his head on the firm floor. He was stunned, and died in convulsions on the same day. Post-mortem examination revealed no fracture, but a tear several lines in length in the middle of the right lateral sinus. Blood extravasated around cerebellum and into inferior occipital fossa in large quantity, partly coagulated.

Case LIX.—Boinet.[52] A forty-one-year-old male fell down-stairs while intoxicated and bled freely from left ear. No other symptoms. He felt so well that he walked three miles. After return felt fatigued and ill, complained of headache, fever, later delirium. On the second day there developed stertorous respiration, followed by coma, and death the fourth day after the accident. Post-mortem examination revealed a fracture of the left petrous portion of the temporal bone, extending into glenoid cavity; left lateral sinus widely opened at its point of termination in posterior lacerated foramen.

Case LX.—Hedlund.[53] A farm-hand, twenty-seven years old, stumbled over a door-sill, fell over backward, and died in a short time. Post-mortem examination revealed no fracture of the skull. A long bony spiculum, four inches long, one-half inch wide, one-half inch thick, and weighing 190 grains, projected into the superior longitudinal sinus, which was torn throughout the corresponding distance. Whole brain covered with blood. Hedlund considered that the wall of the sinus had been gradually thinned by the pressure of the spine of bone, and the slight shock sustained in falling had torn it.



Case LXI.—Gama.[54] A patient had superior longitudinal sinus torn by a depressed splinter of bone, large opening. Recovered under simple compression dressing.

Case LXII.—Pott.[55] This surgeon opened the superior longitudinal sinus with a lancet in a girl aged sixteen years, who had a comminuted fracture of the skull. After removing the splinters, and thus laying bare the sinus, he bled the patient therefrom until she recovered consciousness. A charpie compress held with the finger for some time checked the bleeding. There was marked improvement of the condition, but death later from abscess formation on the upper surface of the brain.

Case LXIII.—Pott.[56] An eight-year-old boy who, after a blow with a stick upon the vertex, developed a painless, fluctuating, and pulsating swelling the size of a walnut, which when opened gave exit to a flow of blood from its depths. Investigation showed a fracture over the sagittal suture and a fragment penetrating the superior longitudinal sinus. He was trephined, the fragment removed, hæmorrhage checked by a few minutes' compression with a charpie compress, and the patient recovered.

Case LXIV.—Warner.[57] A thirteen-year-old boy received a severe blow upon the head, causing a depressed fracture of both parietal bones. Temporary unconsciousness. On the sixth day convulsions, vomiting, paralysis of the left side, double vision in right eye, left unaffected. On the eleventh day trephined and depressed fragments removed, and a wound of the superior longitudinal sinus by a splinter discovered, the splinter still in the wound. Its removal was followed by severe hæmorrhage, controlled by dressing. Improved for four weeks, then developed symptoms of compression and died of abscess of the brain.

Case LXV.—Wharrie [58] reports the case of a man who, in consequence of being knocked down by blows by the fist, immediately expired. He suffered from a rupture of the right lateral sinus, with extravasation of blood into the lateral ventricles and upon the base, and with great congestion of the vessels of the upper surface of the brain. Externally there was only an insignificant contused wound.

Case LXVI.—Phelps.[59] Patient admitted to hospital unconscious, pupils contracted, skin cold and moist, bleeding from both nostrils, large hæmatoma in right frontoparietal region. Linear fracture discovered by incision. Death occurred in two and one-half days. Post-mortem examination disclosed a large hæmatoma over vertex of skull; separation of coronal suture and fissure in right parietal bone extending from it; large epidural clot over left parietal region, and another over right frontal region; superior longitudinal sinus filled with a firm blood-clot; epidural clot in left middle fossa; rupture of superior longitudinal sinus, with large pial hæmorrhage over left frontal, temporal, and parietal lobes.

Case LXVII.—R. G. Le Conte. J. E., aged thirty-eight years, Italian, struck by falling lumber on crown of head. Both parietals fractured, and depressed area over two inches in extent. Great damage to inner table, with many small spicules of bone. Superior longitudinal sinus perforated

in seven places by these small spicules. Sutures used (fine silk) to close openings, then packed over with gauze. Shock very great. Three quarts of salt solution intravenously injected. Did not react, and died in two and a half hours.

CASE LXVIII.—R. G. Le Conte. R. G., aged seventeen years, roofer, Germany. Cause of injury unknown, as he was found unconscious in a building undergoing construction. Fracture of skull, with depressed fragments over left parietal bone; area about two and a half by one and a half inches. Superior longitudinal sinus perforated by a fragment; controlled by packing. Part of packing removed in forty-eight hours, and remainder twenty-four hours later. No further hæmorrhage. Case doing well, but still has marked aphasia, two weeks after the injury.

CASE LXIX.—Brodie.[60] A boy who received an injury of the head and died shortly after the accident. Post-mortem examination showed fracture of the base of the cranium, with laceration of the cavernous sinus, from which the hæmorrhage had occurred.

CASE LXX.—Bergmann [61] reports the case of a man, whose occiput was badly injured by a blow on the back of the head, who on admission to the hospital was bleeding from the nose and mouth, and died in four hours. Post-mortem examination revealed œdema of both lungs and air embolism, the air probably entering through the injured longitudinal sinus at the Torcular Herophili at the seat of injury.

Wounds of the venous sinuses of the brain are of comparatively infrequent occurrence, which may in a measure be accounted for by the anatomical peculiarities of these venous channels; they are enclosed in a firm bony case, and their external walls are continuous with the dura mater. Their lining membrane is that of the veins; they are also closely attached to the cranial bones. It is only in exceptional cases that the sinuses are wounded unless the cranium has been fractured. The only sinus which is accessible to direct violence without fracture of the skull is the cavernous sinus, which can be reached by small objects without fracture of the cranial bones by way of the orbit and the sphenoidal fissure, and is the sinus which is most infrequently injured.

In looking over the literature of injuries of the venous sinuses of the brain, I have been surprised to find that comparatively few cases have been recorded. This is remarkable when we consider the great interest which has always been attached to injuries of the head and its contents, and the amount of work which has been expended in recording and



studying this class of injuries. It is to be accounted for possibly by the fact that in many cases of serious injury of the brain the symptoms presented were considered due to lesions of that organ itself, and the lesions of the venous sinuses, being thought to be of minor importance, were overlooked or not recorded.

*Causes of Wounds of the Venous Sinuses.*—Wounds of the venous sinuses of the brain most frequently result from direct injury to their walls by fragments of bone in depressed fractures of the skull, the sharp edges of the fragments frequently tearing the walls of the sinuses, but may also occur from the impact of foreign bodies, as the result of gunshot injuries and from divulsion of the bones of the skull, and they may also be torn or incised in operations upon the brain. These injuries may also occur in infants during birth. Litzmann [62] has twice observed rupture of the superior longitudinal sinus in cases of a narrow, flat pelvis, with the promontory of the sacrum so arranged as to make deep pressure upon the side of the head, in consequence of which the sagittal border of the parietal bone pierced its coverings and opened the superior longitudinal sinus.

Laceration of the venous sinuses of the brain may also result from force transmitted through the bones of the skull without fracture.

Duchame-Moncharmant [63] investigated the resistance of the venous sinuses to traction, and found it less in children under twelve years of age.

*Comparative Frequency of Injury of Special Sinuses.*—It is also interesting to study the injuries of the special sinuses as regards their frequency. In this collection of seventy cases the superior longitudinal sinus was injured in forty cases, the lateral sinus in twenty-five cases, the cavernous sinus in three cases, the straight sinus in one case. Bergmann mentions two cases of rupture of the transverse sinus which are not included in this collection, and says that this sinus is liable to rupture when the force is applied from above and behind, as the result of which the skull is compressed in a downward direction.

It will be observed that in this collection of cases of injuries of the venous sinuses of the brain the longitudinal sinus was most frequently injured, and next in frequency the lateral sinus, and that the cavernous, straight, and transverse sinuses were rarely injured. It should be noted, however, that considerable difference of opinion exists among different observers as to the comparative frequency of injury of the various sinuses. Prescott Hewitt [64] thinks that the lateral sinus is more frequently injured than any of the other sinuses of the brain. Agnew [65] states that the superior longitudinal sinus is the one most frequently injured. Phelps [66] considers wounds of the superior longitudinal sinus most frequent. The superior longitudinal sinus from its position is more liable to injuries by direct violence, and is frequently injured by fragments of bone in fractures of the parietal bones and by foreign bodies penetrating these bones. The lateral sinuses appear to be more liable to injury by transmitted force than the superior longitudinal sinus; they are also infrequently penetrated by fragments of bone, but are sometimes torn by divulsion of the bone in fractures.

Gangolphe and Piery [67] present some interesting observations upon wounds of the various sinuses. They find that the rigidity, inelasticity, and close adherence of the walls of the lateral sinus to the bony walls of the skull render it liable to tears and to injury by fragments of bone in fractures, prevents its collapse when wounded, and precludes the chance of the spontaneous arrest of hæmorrhage. It is by its position readily accessible to injuries, being included with the superior longitudinal sinus and the Torcular Herophili in Gerard Marchants' Classification of *accessible sinuses,* as opposed to the others,—the *inaccessible,* which, though not entirely free from the risk of injury, are only exceptionally injured by traumatisms. The sinuses can be injured in two ways,—by foreign bodies and fragments of bone tearing it, and by rupture by disjunction of fragments in fractures of the cranial bones.

Duchame-Moncharmant and Carle conducted experiments upon skulls as to the liability of the lateral sinus to rupture by





disjunction, and found that lesions were comparatively rare. Chipault, in thirty cases of rupture of the venous sinuses of the brain, states that only four were of the lateral sinus. G. Marchant explains the relative immunity of the lateral sinus to the fact that in the occipital bone the two tables are separated by a thick layer of spongy bone, not easily splintered when fractured.

Wounds of the cavernous, transverse, straight, circular, and petrosal sinuses appear to be very infrequent. Wounds of the cavernous sinus which do not prove immediately fatal from hæmorrhage are apt to result in the development of arterio-venous aneurism. It is probable that these sinuses are frequently injured in cases in which there has been extensive disorganization of the cerebral tissues, and that the sinus lesions have been overlooked in the presence of graver lesions of the brain.

*Prognosis.*—In the preceding collection of cases of wounds of the venous sinuses, recovery followed in twenty-five, —35.7 per cent. of the cases,—and death in forty-five,—64.3 per cent. of the cases. In forty cases of wounds of the superior longitudinal sinus recovery occurred in sixteen cases, 40 per cent., and death in twenty-four cases, 60 per cent.

In twenty-six cases of wounds of the lateral sinus recovery followed in eight cases, 30.7 per cent., and death in eighteen cases, 69.3 per cent.

In three cases of wounds of the cavernous sinus recovery occurred in one case, 33.3 per cent., and death in two cases, 66.7 per cent.

In one case of injury of the straight sinus death resulted.

In view of the high mortality which has been shown to follow wounds of the venous sinuses of the brain, it is difficult to understand why many of the older writers considered these injuries not of a serious character. Brodie [68] says that wounds of the venous sinuses bleed profusely when there is a free opening in the bone made by accident or operation through which the blood can readily escape, but very slight pressure is adequate to the suppression of this as well as other venous

hæmorrhage. He also says: "I have never known of a case when such a collection of blood, in consequence of a wounded sinus, between the dura mater and the bone, or between the dura mater and the brain, was capable of interfering with the function of the brain." Hennen [69] mentions a case of wound of the superior longitudinal sinus from a sabre-cut, which bled profusely without producing fatal consequences, and remarks that he had seen the superior longitudinal sinus opened by splinters of bone, but had never seen anything approaching dangerous hæmorrhage from it; in truth, he considered bleeding from wounds of the head one principal source of the patient's safety.

Guthrie [70] says that a wound of the longitudinal or lateral sinus which permits of a free discharge of the blood poured out is of little comparative consequence; but it is, on the contrary, a very fatal injury when the blood is permitted to accumulate.

Pott, in a case of compound fracture of the skull, after removing the fragments of bone, which exposed the superior longitudinal sinus, intentionally opened the sinus and allowed a quantity of blood to escape, afterwards controlling the bleeding by pressure. This patient subsequently died of abscess of the brain.

M. Serres [71] opened the superior longitudinal sinus in animals, and found that a large quantity of blood might be allowed to spread itself slowly over the surface of the brain without causing a loss of motion or sensation. This is accounted for by this observer by the fact that the blood from the veins and sinuses of the head flows more slowly and is more fluid and less coagulable than that from the arteries, and to the capability of the brain to bear pressure which is slowly and equably spread over it, while it is not able to resist a pressure that is more direct and more rapidly effected.

As has been stated, many of the older writers were inclined to consider wounds of the venous sinuses of the brain as not of a serious character There are, however, certain risks in these injuries which cannot be overlocked. The first is hæmorrhage. Blood may escape from an external



wound and quickly exsanguinate the patient. Death resulted from this cause in seven cases in this collection. Blood may also escape from a wounded sinus and collect between the dura mater and the skull, thereby diminishing the capacity of the cranial cavity and causing mechanical compression of the brain, with the consequent changes in the circulation and nutrition of the organ which accompany this condition, and producing slowly or rapidly developing symptoms of compression of the brain. Blood may also accumulate beneath the dura mater. Intracranial hæmorrhage, more or less extensive, was present in twenty-six of the fatal cases.

In extensive wounds of the sinus the hæmorrhage is profuse; and if it does not escape from the wound, the blood accumulates slowly within the skull and soon produces marked symptoms of compression of the brain. On the other hand, if the wound in the sinus is small the amount of blood extravasated may be small, and it may be largely absorbed, leaving only a mass of fibrous tissue at the seat of injury. If the wound of the sinus be due to a fragment of bone or foreign body which has penetrated the sinus and remains impacted, the hæmorrhage may be insignificant, but upon removal of the fragment or foreign body profuse hæmorrhage may occur, which may prove fatal unless promptly controlled. It is possible in such cases to have recovery take place without removal of the fragment if the injuring body does not produce infection of the sinus, a limited thrombosis of the sinus resulting, for it has been shown that a partial occlusion of the sinus may exist without marked disturbance of the functions of the brain.

The greatest danger in wounds of the sinuses of the brain is from septic infection. In the present collection of cases a large number died of pyæmia and abscess of the brain. This cause of death is more frequently noticed among the cases reported before the introduction of the antiseptic method of wound treatment. Many cases of sinus wounds were complicated with injuries of the brain, and death in these cases resulted from cerebral hæmorrhage combined with that from the

wounded sinus, giving rise to general symptoms of compression of the brain.

Air embolus is an occasional cause of death, causing the fatal termination in at least two of the cases, reported by Genzmer and Bergmann, and may have been overlooked in some others.

The case reported by Genzmer, as well as his experiments, is of especial interest in this connection.

Genzmer records a case in which the superior longitudinal sinus was severed during an operation for removal of a large sarcoma of the dura mater, which had perforated the skull in its growth. The patient was a woman, aged sixty-three years, and the tumor was situated at the posterior end of the sagittal suture. The operation was performed by Volkmann. After turning down the skin-flaps, the opening in the skull was enlarged around the base of the tumor, the attachments to the surrounding dura from which it sprung were severed, and the tumor was then lifted up, and its remaining connection with the falx cerebri attacked with scissors. As the blood was sponged away in great haste, and the field of operation was momentarily visible, they suddenly heard the characteristic lapping noise, and the same instant the anæsthetizer who was administering the chloroform called out, "She is dying." The patient went into collapse, with snoring and intermittent respiration. The operation was completed; when the tumor was lifted and the last connections severed about the attachment of the longitudinal and transverse sinuses, and the field of operation sponged dry, the same sound was heard. The patient was pulseless, pupils dilated, barely reacting, extremities blue and cold. After bandaging arms and legs the pulse was perceptible for a short time; breathing continued, becoming more intermittent; consciousness did not return, and the patient soon died.

Autopsy confirmed the view that death was due to air embolism, as, when the right heart was opened under water, it contained many bubbles and frothy blood. The left heart was empty. The arteries of the lungs and subpleural vessels were partly injected with air. The inner organs were anæmic, but not excessively so. The longitudinal sinus was found to communicate with the wound in the dura and another very large vein of the skull.



Genzmer does not know of any other case in the literature in man, but Bernard has observed it in animals, when after opening the longitudinal sinus air was observed to find its way through the vertebral veins and vena azygos into the right heart.

Genzmer experimented on nine dogs, and in six of them observed the entrance of air into the circulation after opening of the longitudinal sinus. In two of the cases in which it was not observed, the animals had been tracheotomized, which lowered the negative pressure in the thorax, as the air easily found its way in. In all three the blood-stream soon ceased to pulsate with the breathing, and a clot was found after death in the central part of the sinus. Death occurred much sooner in the animals in whom air was found in the heart. Strong and dyspnœic breathing increased the risk of entrance, as did free bleeding, by lowering the positive blood-pressure. By sponging away the blood, air entrance was favored. Therefore, in operating on such cases, we must see (1) that the blood-pressure is not too much reduced; if much hæmorrhage is expected, before opening the sinus the patient's limbs may be bandaged, to raise the blood-pressure. (2) That the patient makes no forcible inspiratory movements; use deep narcosis. (3) That the wound in the sinus is kept covered with a layer of fluid; therefore do not sponge away the blood, and also irrigate with salt solution.

*Repair of Wounded Venous Sinuses.*—Wounds of the sinuses may heal without obliteration of the canal, or there may be partial obliteration, diminishing the capacity of the sinus at the point of injury. A thrombus may form at the seat of injury in the wall of the sinus and extend so as to completely occlude the sinus, often extending from the superior longitudinal to the lateral sinus. If this thrombus be non-infective, it appears to have little effect upon the functions of the brain, which is to be explained by the free intercommunication of the various sinuses. Obliteration of the largest sinus has been observed, with little variation in the functions of the brain.

*Symptoms.*—The symptoms which indicate a large extravasation of blood within the cranial cavity from a wound of one of the venous sinuses of the brain are not definite as regards the source of the bleeding, and are simply those of intracranial hæmorrhage. The symptoms are often indistinguishable from those arising from injuries of the meningeal vessels and from apoplexy, with the possible distinction that in bleeding from sinus wounds compression symptoms are apt to develop more slowly. It should also be noted that wounds of the sinuses are often associated with laceration and contusion of the brain itself, and complicated symptoms arising from both of these injuries may exist at the same time. If the pial veins are torn in conjunction with the sinus, the blood accumulates under the dura mater, and compression symptoms from intracranial hæmorrhage may develop earlier than in uncomplicated wounds of the sinuses. Unconsciousness is a very constant symptom in fatal cases, and comes on later in wounds of the venous sinuses than in wounds of the meningeal arteries.

Marchant,[72] from his investigations upon wounds of the lateral sinus, concludes that the symptomatology is very variable, and that rarely can the source of the hæmorrhage be diagnosed before operation; the presence of some form of intracranial hæmorrhage causing compression of the brain is all that can usually be determined upon, and even this not always clearly. The symptoms may be those of cerebral apoplexy, as in one case he reported.

*Diagnosis.*—The diagnosis of wounds of the sinuses of the brain is often a matter of difficulty, from the fact that the symptoms presented are often similar to those resulting from lesions of the arteries of the meninges and of the brain. In wounds of the sinus in which there is an external wound, the location of this wound and the character of the blood which escapes will often assist in making a correct diagnosis. The most difficult cases are those in which a sinus wound exists without an external wound. In doubtful cases, when the diagnosis lies between apoplexy and lesions due to traumatism, the



decision as regards treatment should be in favor of the latter. In cases without distinct localizing symptoms, the comparative greater frequency of wounds of the meningeal arteries following traumatisms should be borne in mind, and may be of value in forming a diagnosis.

Chipault,[73] in 117 cases of intracranial hæmorrhage, records seventy-two cases from injury of the middle meningeal artery, and thirty cases of wounds of the venous sinuses. Treves[74] says that intracranial hæmorrhage in from 80 to 85 per cent. of the cases arises from wounds of the meningeal arteries, and that in about 15 per cent. to 20 per cent. of the cases it arises from wounds of the venous sinuses of the brain. Phelps[75] records 300 injuries of the brain and membranes, and in this collection there are mentioned only four cases of wounds of the venous sinuses.

The diagnosis of wounds of the sinuses of the brain must therefore be made largely upon the site of the injury, the character of the blood which escapes, and in cases in which no external wound exists, by the slower development of the symptoms of cerebral compression.

*Treatment.*—In the majority of cases of wounds of the venous sinuses of the brain, when the wounded sinus is open to inspection through a wound in the scalp, and a fracture of the skull, the treatment is not a matter of difficulty; but in cases where these conditions do not exist, their treatment is attended with great difficulty. In cases of sinus injury without fracture of the skull, a trephine should be applied, and the bone removed by rongeur forceps to a sufficient extent to expose freely the injured portion of the sinus. The recommendation of Gangolphe and Piery in such cases, that the trephine be applied at the point of traumatism rather than at the point indicated by the symptoms, which may be misleading, I think is sound and should be followed. After exposing the wound in the sinus, the bleeding should be controlled by some of the various methods of treatment. The observance of the greatest care as regards asepsis cannot be too strongly urged in connection with the treatment of wounds of the venous sinuses,

for infection of these channels is always followed by fatal results.

In view of the high mortality which follows wounds of the venous sinuses of the brain, it is a matter of interest to study the different methods of treatment which have been at various times recommended to control the bleeding, and if possible to determine that method which has been followed by the best results. The methods of treatment which have been most employed are pressure by compress or gauze packing, ligation of the sinus, the lateral ligature, suture, and forceps pressure.

*Gauze Packing.*—The most widely employed method, and the one which seems to be the most generally applicable, is gauze packing. The results from this method of treatment have been most satisfactory, and the unfavorable results only have occurred in the cases reported before the introduction of modern methods of wound treatment, when material which was not aseptic was used as the packing material, and the wounds later became infected. It is in cases of depressed fractures of the skull, with wounds of the sinuses by the fragments of bone, that the most alarming hæmorrhage is apt to occur upon the removal of the fragments. Where depressed fragments of the skull occupy a position near any of the large venous sinuses, it is well to bear in mind the possibility of a sinus wound, and be prepared to control hæmorrhage if it occurs. This complication should be considered in cases which present symptoms of intracranial hæmorrhage, as well as in those which do not present such symptoms, for often the intracranial bleeding is insignificant, as the fragment of bone which has produced the wound in the sinus plugs it; and it is only when the latter is removed that dangerous bleeding occurs.

If the wound in the skull be a small one, it is well to enlarge the opening either with a trephine or rongeur forceps before the depressed fragments are removed, so that sufficient space may be afforded to expose the injured portion of the sinus and permit of the satisfactory application of the packing to control the bleeding.

The material which has been found most satisfactory for



packing is iodoform or sterilized gauze, which should be used in strips two or three inches in width. This is introduced with a director or elevator until a sufficient quantity has been applied to arrest the bleeding, and a gauze dressing is applied over the packing and held in place by a bandage. In other cases it may be advisable to close the wound in the scalp over the packing with interrupted sutures, to hold it more securely; the latter being secured by bow-knots so that they can be untied when the packing is finally removed, and again secured, thus obviating the necessity of a second introduction of the sutures. The packing should be allowed to remain in position for three to six days; after this time its removal is usually not followed by bleeding, and the wound can then be closed. The only disadvantage of this method of packing in these cases is that the wound is practically an open one for some days, and may prove an avenue of infection unless the greatest care is observed to prevent its occurrence. The prompt and complete control of dangerous bleeding by this method of treatment cannot fail to recommend it.

*Ligation.*—Ligation of injured venous sinuses has been recommended and practised with satisfactory results in some cases, and the complete occlusion of the sinus appears to have had little effect upon the functions of the brain. Ligatures do not appear to have been often used in controlling hæmorrhage from ordinary wounds of the venous sinuses, but seem principally to have been resorted to as a preliminary step in removing growths of the brain, or in accidental wounds produced in the removal of such growths. They have also been frequently employed in cases of operations upon the sinus for infective thrombosis. Kammerer ligated the longitudinal sinus an inch above the Torcular Herophili in an operation for removal of a sarcoma involving the dura mater above the sinus. Bergmann, Küster, and Navratil have also recorded cases in which they ligated the venous sinuses in operations upon the brain.

It is a difficult matter to pass a ligature around the longitudinal or lateral sinus unless the dura mater is freely incised

on each side of the sinus. In passing the ligature, the sinus itself may be punctured, or the vessels of the pia mater or the tissue of the brain lacerated, unless the operator has a very free exposure of the seat of operation, which is not often present in the ordinary accidental wounds. In applying a ligature to a venous sinus, great care should be taken not to injure the veins of the pia mater, as the blood-current is maintained through them after occlusion of the sinus. Stratton [76] directs attention to the difficulties and dangers of ligation of the venous sinuses, and confirmed his observations by experiments upon the cadaver. He says, " The sinus may be lacerated as the ligature is drawn taut, or pressure upon the cerebral tissues may be produced by great tension upon the dura, depressing it below its normal position. If relaxation of the membrane does not exist, as the ligature is drawn tight the dura, falx or tentorium—if the lateral sinus is being operated upon—must tear sufficiently and in such a direction as to permit easy and safe approximation of its walls. If, coincidently with the tightening of the ligature, the dura could be incised, thereby cerebral pressure and laceration of the sinus might be avoided; even after tying the ligature incisions of the dura would relieve pressure upon the cortex by that membrane. Puncture of the pial vessels, which at their junction with the sinuses are of considerable size, may give rise to a fatal subdural extravasation of blood." He found in an experimental ligation of the superior longitudinal sinus upon the cadaver that no laceration of the sinus had occurred, and only a slight tear of the dura mater was present, but the dura was locally in a state of great tension, and was depressed beneath the inner surface of the skull for a considerable distance beyond either border of the opening in the bone.

Macewen recommends, it seems to me, a much safer procedure than ligation, which consists in a separation of the outer wall of the sinus from the skull, pressing it inward into the sinus, and tamponing the intervening space with gauze.

*Lateral Ligature.*—This procedure, which is very satisfactory in controlling hæmorrhage from small wounds of the



larger veins, would seem to be an ideal one in similar wounds of the venous sinuses of the brain. The successful application of such a ligature would require free exposure of the sinus, so that the size and site of the wound could be accurately determined before it could be grasped by forceps and the ligature applied. This form of ligature seems to me to be only applicable to small wounds, and is not to be recommended in large wounds on account of the inelasticity of the walls of the sinus. I have not been able to discover that this method of ligature has been employed in wounds of the venous sinuses of the brain.

*Suture.*—Suture of wounds of the venous sinuses by silk or catgut has been employed in a few cases with good results. This procedure was employed successfully by Navratil and Parkes in two cases in this collection, and by Le Conte in one case which proved fatal from other causes. It seems only applicable to small wounds of the sinus in which there is not profuse hæmorrhage, or, if in larger ones, in those in which there is a sufficient exposure of the sinus wall to permit of the control of the bleeding during its application by pressure upon either side of the wound.

The great advantage of the ligature, the lateral ligature and sutures in wounds of the sinuses, in addition to the control of the bleeding, rests in the fact that after their use the wound in the scalp can be immediately closed, thus diminishing the risk of infection.

*Forceps Pressure.*—This method of controlling bleeding from the larger veins has also been employed in wounds of the sinus in a few cases, and consists in grasping the wound of the sinus with hæmostatic forceps, and in allowing them to remain in position for two or three days. Dennis, W. J. Taylor, and Stratton have recorded successful cases following this procedure. Stratton, in excising a sarcoma of the dura mater, removed the growth with a portion of the longitudinal sinus, controlled the bleeding by clamps which were allowed to remain for three days, and there was no hæmorrhage after their removal, the patient dying on the twelfth day from other

causes. The method has the disadvantage of keeping the wound open, and thus incurring the risk of infection. Personally, I have always considered the procedure a dangerous one, in view of the fact that a patient with an injury of a sinus may develop brain symptoms, rendering it difficult to restrain him, and his uncontrollable movements may cause the forceps to inflict serious injury upon the cerebral tissues.

## Conclusions.

(1) Wounds of the venous sinuses of the brain should be classed as dangerous injuries, being followed by a high mortality, from external or intracranial hæmorrhage or septic infection.

(2) They are especially liable to infection, resulting in septic thrombus and pyæmia, therefore the greatest care should be taken to render them aseptic and preserve them in that condition.

(3) The most satisfactory and generally available method of treatment consists in controlling the bleeding by aseptic gauze packing.

(4) Ligation of the venous sinuses presents definite dangers in itself, is only available in certain wounds, where a free exposure of the injured sinus is possible, and cannot be employed with advantage in ordinary accidental wounds of the sinuses.

(5) The application of a lateral ligature to a wound of a sinus is less difficult and dangerous than ligature of the sinus, but is only applicable to small wounds.

(6) Suture of sinus wounds is a valuable procedure in a certain class of cases, namely, small wounds which can be freely exposed.

(7) Forceps pressure is also a ready method of controlling hæmorrhage from wounds of the sinuses, but possesses no distinct advantages over some of the other methods, and its employment is accompanied by certain dangers.



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## DISCUSSION.

DR. OSCAR H. ALLIS said that there was sometimes a difficulty in making diagnosis in head injuries. Some of the injuries would, of course, be sudden, and the symptoms would be masked.

On one occasion he assisted the elder Gross in an autopsy upon a man that had been thrown from a carriage, striking upon the head and profoundly concussed, but without wound of scalp or depression of the skin. Gross said that a surgeon of



considerable notoriety had urged very strongly that there should be a trephining of the case. He had watched the case, and refused to trephine it. At the autopsy there was found no topical hæmorrhage or depression of bone, but innumerable little points of hæmorrhages,—the size of a pin-head,—showing that his judgment, that trephining would do no good, was well founded.

Another point: To render the field of operation absolutely sterile, all the hair should be shaven from the head. This he knew to be the practice of Dr. Wharton. A partial shaving of the head leaves an area for contamination that often defeats the best surgical skill. Surgeons are now very generally, in all serious head injuries, demanding that the hair be entirely removed.

He recalled the case of a little child who fell from a piazza, backward, striking her head on an iron rake. The teeth went into the base of the skull. The case proved fatal.

DR. WILLIAM G. PORTER said that there were two things which had impressed him in cases of wound of the longitudinal sinus. One was the enormous amount of gauze which was required in some of them to arrest the hæmorrhage, and, in the second place, the absence of symptoms of cerebral pressure which one would naturally expect to occur from the presence for days of a large amount of gauze tightly packed between the skull and the dura mater. In a recent case of suicidal gunshot wound of the head, during the operation of trephining, the superior longitudinal sinus was opened. The hæmorrhage was frightful, but was speedily checked by gauze packing, and the patient made a good recovery.

DR. WILLIAM L. RODMAN said that he had always been much surprised at the comparative infrequency of these injuries, a fact emphasized by Dr. Wharton in his paper. In an experience of over twenty years, Dr. Rodman had seen but two injuries to the great sinuses of the brain, and he thought that rather remarkable, in view of the frequency with which the cranium is injured, especially in depressed fractures resulting from ordinary trauma, punctured wounds, gunshot wounds, and otherwise.

He fully agreed with the position taken by the essayist, that it will be exceedingly difficult to arrive at an accurate diagnosis

in cases not accompanied by fracture of the cranium; for it must be borne in mind that the middle meningeal will suffer much more frequently than the sinuses, and surgeons are therefore apt to trephine on its site rather than on the sinus.

He called attention to the exceeding necessity for acting promptly in cases of this kind, on account of the fact that blood which is lost from the brain always produces a greater amount of constitutional shock and depression than the same amount lost from any other part of the body. Therefore, it becomes not only necessary to control hæmorrhage from the brain with ordinary promptness, but with extraordinary promptness, if it can be done.

He thought that there was very little question that the packing with gauze was the most reliable method of controlling hæmorrhage in these injuries. Of the two injuries of this kind in his personal experience, one was controlled by gauze packing and the other by lateral ligature. He was far better satisfied with the one treated by packing than the one with lateral ligature. While lateral ligature seems ideally, as does suturing, better than forcipressure, in his judgment they are less so. Forcipressure is more quickly and easily applied, and is more certain in its effect on account of a small opening to work in. Although the essayist had brought out a very good point against the application of forceps, yet, when it is remembered that symptoms of meningitis or encephalitis are unlikely to occur until the third or fourth day, by which time the forceps can be removed with perfect safety, the objection is not so very great. Ligation of cerebral vessels is not perfectly satisfactory: these vessels have no sheaths, and the ligature is apt, on this account, to slip; and he thought one would feel a greater sense of security in using forcipressure next to gauze pressure, which in all instances should be preferred.

Dr. G. G. Davis said that as regards frequency, he thought in a certain class of cases they are more frequent than the remarks here would appear to indicate. These wounds may occur by puncture. In that case injury to the skull is slight, but they most often occur in extensive fractures of the skull. Therefore, if a person's practice includes many cases of this severe class of injuries, he believed they would be found to be not so very rare. He could not conceive of a laceration of one of these sinuses occurring in cases of concussion, or in other words, without a displacement of the bone. This occurs in those great crashing injuries which break in considerable portions of the skull. This accounts likewise for their fatality. The fatality is not due simply to the hæmorrhage, but rather to direct traumatism to the brain itself.



When it comes to the question of diagnosis, the blood in intracranial hæmorrhage may come from three sources,—from the meningeal arteries, from the large sinuses, and from the vessels of the pia mater. If the question of diagnosis is raised, he should think it would be not as regards that of injury of the sinuses themselves, but as regards some other source of bleeding. Injury to the sinuses would declare itself very quickly, because the blood would come directly to the external opening, the injury being compound. An epidural clot due to hæmorrhage from the sinuses is not likely to occur. He could not conceive of the blood from the sinus dissecting the dura mater away from the skull. The blood in the venous sinuses would hardly have force enough to do it. If there was an epidural hæmorrhage, the chances would be more in favor of its proceeding from the middle meningeal arteries. The other source of hæmorrhage would be subdural, and a subdural hæmorrhage would occur from concussion, and that, to his mind, with the middle meningeal bleeding, is almost the only hæmorrhage that would give rise to pressure symptoms.

The statistics which Dr. Wharton had quoted from Treves he did not quite understand. If he heard aright, it was 15 per cent. from the large venous sinuses, and 85 per cent. from the middle meningeal artery. Where do the subdural hæmorrhages come in? What part do they play in the question? He thought the statistics from Charles Phelps—it was about 1 per cent.—to be approximately correct.

Of the injuries he had seen to the sinuses, he could definitely recall two,—one of the superior longitudinal in a large crush of the vault of the skull, in which bleeding was controlled by pushing gauze beneath the edge of the skull; another, which he was inclined to think was of the cavernous sinus, but possibly the superior petrosal, or the ophthalmic vein, or some of the vessels closely around the cavernous sinus. The case was one of injury in which a man fell from a height and struck on an

iron wheel, rotating as he fell, striking on his forehead. He crushed in the right side of the frontal bone; the orbit was fractured, and there was a very large external wound. In cleaning up, there was a great gush of blood directly from the depths of the wound, which went directly downward and backward towards the posterior portion of the orbit. A large amount of gauze was pushed in, and it controlled the bleeding. It was afterwards removed, and the man recovered. These two cases he could recall definitely, but he believed that he had seen in other cases wounds of the lateral sinus. In these cases there were very severe injuries of the bones.

Dr. Ross related the history of an injury of the superior longitudinal sinus. A woman was brought into the German Hospital on the evening of the Fourth of July, in 1890, unconscious. The history was that she had been sitting on her door-step, when suddenly she fell over unconscious. A careful examination disclosed no cause for the condition. Dr. Deaver saw the case, and in passing his hand over her head found a lump on the top of her head, in the median line, and on looking he found a bullet. He removed it, packed the wound, and the patient got well. It is probable that the bullet, which had been shot by some person at a distance, went up in the air, and, on coming down, struck her on the head, penetrating her skull.

Dr. Allis added, with regard to what had been said as to the frequency of cases, that he did not remember a single case coming to the Jefferson Hospital while he was assistant to Dr. Gross, and in his service at the Presbyterian Hospital. He noted that Dr. Wharton and Dr. Porter had referred to cases, but he had never seen one there. The only one he had—sent there from his private practice—was the little child already mentioned who fell on the rake, and struck probably the lateral sinus and at the base of the skull. He thought that this class of cases was comparatively infrequent.

Dr. De Forest Willard said that he had certainly seen in the Presbyterian Hospital one wound of the lateral sinus and two of the superior longitudinal; one, only ten days since, was caused by an enormous fracture; a circumferential fracture, entirely encircling the head, passing through the base of the skull and up the opposite side; the skull being divided into anterior and posterior halves. The longitudinal sinus necessarily was torn



through, but there was no marked displacement of the fragments. He trephined in the parietal region, and as he approached the longitudinal sinus the hæmorrhage was simply enormous, but it was speedily and entirely stopped by packing with gauze.

In regard to the effect of hæmorrhage which has been alluded to, his experience had not been that the bleeding was more serious than from other parts of the body. He had been rather inclined to look upon it somewhat as of less importance than from other regions, *i.e.*, that brain cases have borne hæmorrhage well. There are very large venous hæmorrhages, but in the venous sinuses injuries the patient is often in a serious condition apart from the hæmorrhage.

Dr. Wharton remarked that he agreed with Dr. Allis as to the comparative infrequency of wounds of the venous sinuses. He also had been struck with the large amount of gauze packing which it was necessary to use in controlling hæmorrhage from the venous sinuses in certain cases.

He agreed as to the advisability of using suture in suitable cases; but believed that there were very few cases in accidental wounds of the sinuses where a suture could be very satisfactorily employed, and he thought, therefore, that packing was the most generally available method of treatment.

Dr. Rodman had spoken of the comparative infrequency of wounds of the venous sinuses and the importance of prompt action when a large venous sinus was opened. This he appreciated. He did not know of any more alarming form of hæmorrhage than that arising from the superior longitudinal sinus, if the wound is of any extent.

In regard to forceps pressure, it may, in certain cases, be a very satisfactory method of treatment; but the principal objection was the uncontrollable movements of the patient which might cause them to inflict injury upon the brain; so he preferred packing instead of forceps pressure, but the latter may, in certain cases, serve a useful purpose.

In wounds of the lateral sinus made in operations for mastoid abscess, the hæmorrhage is usually not so profuse or serious as in accidental wounds in fractures. The sinuses in these cases are probably more or less thrombosed, and the capacity of the sinus is very much diminished at the point of injury.

As to the suggestion of Dr. Davis that sinus wounds are

much more common than are generally supposed, this point he had brought out in the paper; namely, that in cases of extensive injury to the brain where the sinuses were injured, the symptoms of sinus injury were often masked by the grave lesions of the brain. He questioned Treves' statistics as to the frequency of injury to the middle meningeal and great venous sinuses. Treves, of course, makes this statement as regards extradural hæmorrhage. Phelps refers to a great many deaths from pial hæmorrhage. The hæmorrhage in cases of rupture of the pial veins is usually subdural hæmorrhage. Phelps records in 300 cases of traumatism of the brain a great many fatal cases resulting from injury to pial vessels; so that this variety of hæmorrhage is a cause of death, combined with hæmorrhage from the venous sinuses.

# TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

*Stated Meeting, February 4, 1901.*

The President, De Forest Willard, M.D., in the Chair.

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## THE BEST INCISION IN OPERATIONS FOR MAMMARY CARCINOMA.

By WILLIAM L. RODMAN, M.D.,

Professor of the Principles and Practice of Surgery and Clinical Surgery in the Woman's Medical College of Pennsylvania.

The increasing frequency of carcinoma of the breast, the demonstrated hopelessness of partial and incomplete operations for its relief, together with the more than reasonable hope of cure following a timely and rightly done operation, warrant me in asking the attention of the Academy to a paper briefly considering the relative merits of well-known operative procedures.

Before doing so, however, we should recall the anatomy of the gland, pathology of the disease, and its natural tendency to disseminate by means of the lymphatics. The lymphatic vessels are far more numerous and complicated than Sappey and former anatomists had led us to suppose; for, instead of all such vessels converging to the nipple and thence passing by main channels beneath the skin to the axillary nodes, we now appreciate, from the teachings of Mascagni, Langhans, Küster, Stiles, and Heidenhain, based upon injections, that there are several other important, if not as much frequented, channels. There are two superficial sets of lymph-vessels; in addition to the axillary set, so dwelt upon by Sappey, a second one drains the sternal half of the gland passing through the

second and fourth intercostal spaces, to discharge their contents into the lymphatic glands of the anterior mediastinum.

There are also three deep sets of lymphatic vessels. One, beginning in the mucous membrane of the milk-ducts and acini, drains the deeper portions of the axillary half of the gland, joining the superficial set in the axilla, and forming with it a network which surrounds the axillary vein, almost or quite up to the clavicle.

A second set drains the deeper portions of the sternal half of the gland, perforates the second and fourth intercostal spaces, following the course of the internal mammary artery, to finally empty, together with the superficial set, into the mediastinal glands. On the right side they intermingle with the lymphatics of the liver. Hence it is easy to explain the frequent and early implication of the mediastinal glands, which cause bulging of the bone or "sternal symptom" of Snow, in cancers originating in the sternal half of the gland.

A third deep set drains the middle of the base of the gland and retromammary tissues, then perforating the intercostal muscles and spaces to follow the course of the intercostal arteries to the spine; thereby affording a ready explanation of those cases ultimately complicated with spinal symptoms, even paraplegia.

It will therefore be at once appreciated how necessary it is to have in mind more than one avenue of possible infection.

This arrangement of the superficial and deep lymphatics also offers a ready explanation of the clinical fact, that carcinomata affecting the inner half or sternal quadrants of the gland are more quickly fatal than those occupying the outer half or axillary quadrants. I have rarely seen cancer of the inner half of the gland that was not quickly fatal, and have gotten to look upon the location of the growth and the age of the patient as the two most reliable *early* prognostic signs. While carcinoma is comparatively infrequent under thirty, when it does occur it is almost certain to run an unusually rapid course. I have operated upon only three cases of mam-

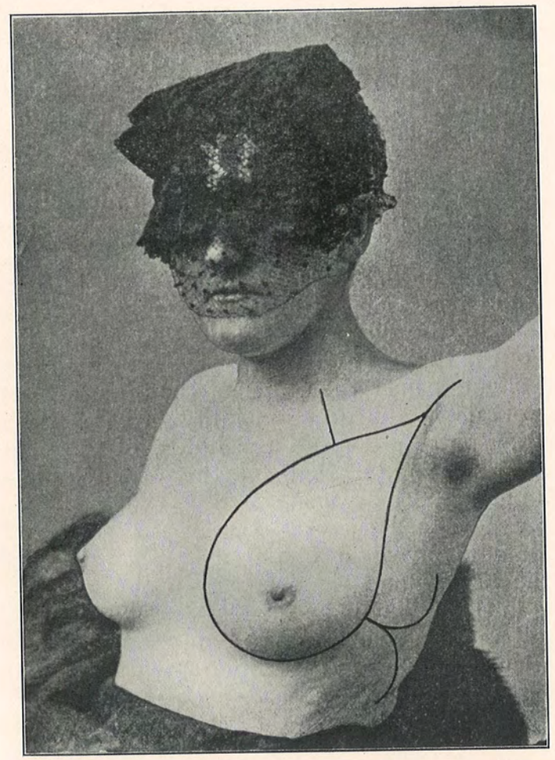


FIG. 1.—Warren's incisions in removal of breast for cancer. ("International Text-Book of Surgery.")

mary cancer in women under thirty, aged twenty-five, twenty-seven, and twenty-eight respectively. One died within six months after operation in spite of a seemingly complete Halsted procedure. Another died eleven months after operation, notwithstanding the fact that everything but her age indicated that a radical cure would be effected. The tumor was small, perfectly movable, and there was not extensive axillary infection; in truth, no enlargement of the glands could be made out before the axilla was opened. The case was such a border-line one, so far as diagnosis was concerned, that a pathologist was asked to be present at the operation, so that the tumor could be examined immediately and reported upon. It is not my practice to sacrifice the entire gland in young women with tumors demonstrably benign; and in cases of doubtful diagnosis, from a clinical stand-point, a competent pathologist is asked to be present and ready to make frozen sections and then give a reliable report, which can usually be done in less than fifteen minutes. I have taken this precaution for many years, and have been kept from making mistakes in at least two instances. An incision into the tumor with macroscopic examination is insufficient, and, now that we have a better plan, should not be relied upon. In a few minutes Professor McFarland reported back "cancer, undoubtedly." The entire gland with its covering of skin, and the fascia and superficial fibres of the pectoralis major, were removed, along with all axillary glands and fat. In September, 1898, ten months after the operation, she returned to Philadelphia to consult me, and I was amazed to find extensive carcinosis of the skin of the chest, and marked evidences of metastases in the lungs. She died about a month later. The third case is at present under my care, and, from the progress of the disease up to date, will probably end as the other two have done.

The cases referred to came close together in my experience,—one having been operated in December, 1897; another, in May, 1898, and the third in November, 1899. Until these cases were encountered, I had never seen carcinoma of the

breast prior to thirty, and therefore could not appreciate, so fully as I now do, that the malignity of the disease is directly proportional to the *youth* of the patient. Per contra, in the very old it frequently runs a relatively benign course.

Not only is the entire gland to be sacrificed in every case, but all outlying supernumerary glandular elements should be removed at the same time. Moreover, the *manner* in which the gland is detached is of importance, as it should be done from *above* downward instead of from *below* upward, the plan followed by a majority of operators. It is quite inconsistent to remove the gland from below upward and clear the axilla from above downward; yet this is usually advised by authors, and carried out by operators, on account of the supposed advantage of not having blood obscure the field as the lower part of the incision is made. The advantage of such a course is so slight, if it exists at all, that it is as nothing against the weighty reasons, anatomic and surgical, for the opposite one. The breast should be detached near the sternum first, and the dissection made towards the axilla, where a narrow tail of tissue will be cut last. The incision must include all the skin covering the tumor, and should embrace that over the entire gland. I will state it as my conviction that more recurrences are due to leaving infected skin behind than to any other one cause, and that a probability of such mistakes having been made will be furnished by a study of recurring cases. It has certainly been the case in my own practice, and I candidly admit it. I have also frequently seen other surgeons do a very complete operation so far as the axillary dissection and other steps were concerned, and yet have felt at the time that an abiding result was made next to impossible on account of the primary incision, which included between its lips only a small, elliptical piece of skin.

The mistake is always presumably due to the natural and very proper desire to secure immediate union on the one hand, and to avoid undue scarring of the patient on the other. There is, I believe, a prejudice against skin-grafting as a supplemental step in this operation which is shared by operator and patient;

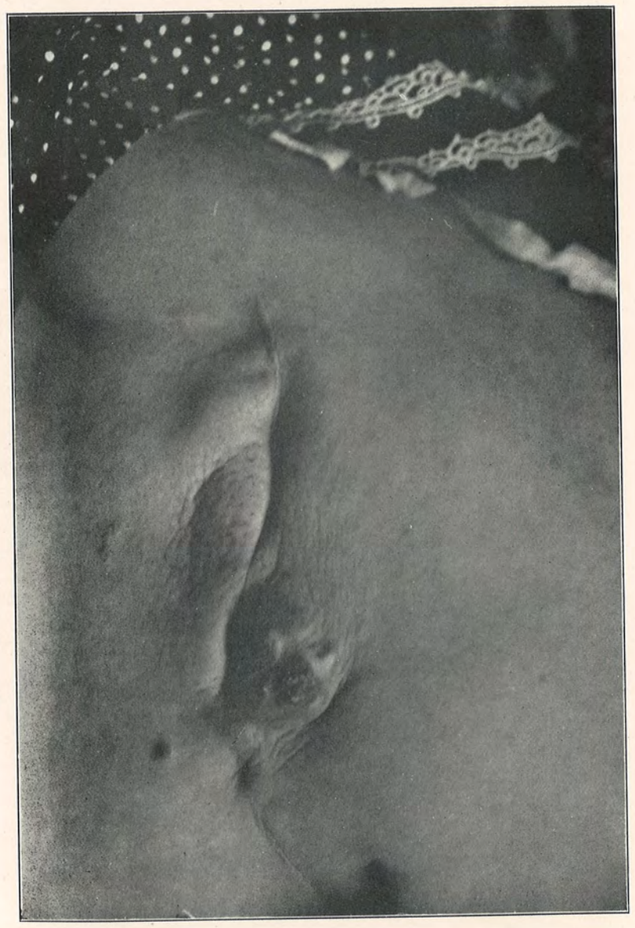


Fig. 2.—Showing Case I as it appeared before second operation.

the first, because it prolongs the operation and not infrequently fails to accomplish its intended purpose; the second, because it leaves unsightly scars. My private patients have usually objected to it. Women are very prone at best to delay seeking surgical aid for a mammary growth on account of the mutilation and asymmetry following excision. This very common operation—and I believe now becoming a life-saving as well as palliative procedure—should be stripped of every avoidable objection, so that women will be encouraged to such and submit to earlier operation: therein lies our only chance for real advance, as operative measures for breast cancer have been seemingly carried to the very Ultima Thule of surgical limits.

Remembering always the tendency to early contamination of the axillary glands, the primary incision must in every case be carried into the axilla, and this space, from base to apex, be thoroughly cleared of glands and fat, leaving, when the work is completed, vessels and nerves to stand out as plainly as in a dead-room dissection. The space of Mohrenheim, as well as the interval between the two pectoral muscles, must have careful attention in operations not contemplating their removal. It is very important to remove breast, lymphatic glands, and intervening lymph vessels in one mass, thereby avoiding cutting across lymph-bearing channels and liberating cancer cells to probably infect neighboring tissues and cause regional recurrences.

The researches of Heidenhain and Volkmann demonstrated that the fascia covering the great pectoral muscle, along with its most superficial fibres, should be removed in every case of carcinoma.

The fascia unquestionably acts as a barrier to the proliferations of the disease for a time, and in cases operated early, it is superfluous to remove the muscle. It has usually been my practice to remove both pectoral muscles only in cases of the third degree; that is to say, where the gland was adherent to the muscle beneath and immobile. There is a growing tendency with me, however, to remove the muscles in

*every* case, even though not visibly infected. I do it more because a free axillary dissection can be made with greater primary and secondary safety to the patient. One may reasonably question whether or not it is possible to clear the axilla of all glands and fat with the pectorals *in situ,* and the danger of hæmorrhage is probably too great for it to be attempted. Many of us have thought that we accomplished more than was done, and a comparison between two cases, operated by Halsted's and Kocher's methods, respectively, will undeceive any one. The latter operator and surgical genius practised and advised the removal of the pectoral muscles—major and minor,—if it seemed to be necessary, before the publication of Halsted's method. He did it exceptionally and not usually, however. In the Kocher operation, retractors are used to hold the muscles out of the way and assist in uncovering the axillary vessels and nerves.

There are, as we know, several excellent methods of removing the mammary gland, and each has its champions. The best of them are more or less imitations of Halsted's method,—the first complete operation as we now understand the term. The principles he taught were at once recognized and accepted in the main by surgeons everywhere. Many may, and do honestly, differ with him as to the necessity of this and that detail in his technic; but all agree that nothing short of a large wound and a thorough axillary dissection avails aught.

What are the essential features of the best incision in breast operations? I would answer by saying, in the first place, that it should be large enough to include all infected skin. Second, expose the pectoral muscles from origin to insertion. Third, it should uncover the axillary blood-vessels and nerves. Fourth, it should have regard for the future usefulness of the arm. Fifth, it should, if possible, admit of primary union without the necessity for skin-grafting. Sixth, the operation should be completed within a reasonable time. We may say in all fairness that most of the above conditions may be fulfilled equally by Halsted's, Kocher's, Shrady's, Senn's,

Fig. 3.—Before second operation in Case II.

Warren's, and some other methods; but I am impressed with the belief that we owe to Professor Warren a most valuable step in advance, inasmuch as we can by his method secure primary union even after the removal of the largest tumors, without the aid of skin-grafting. Of course primary union is desirable, and should be had with, if it cannot be had without, skin-grafting. Still, it is certainly better, in my judgment, to be able to bring the lips of the wound together if it can be done without too much tension, rather than close the gap by skin-grafting. Warren's device is simple, and in the three cases in which I have tried it, it was certainly satisfactory. I was able to close the largest wound I have ever made, or seen in my life, by this method slightly modified. The modification referred to consisted in making the curved incision, or what may be called the inverted Y, above as well as below the wound and undermining the flaps after the method first advised by Shrady, with the additional use of deep, relaxation sutures, which are shown in the photograph taken after the wound was closed. In each of the three cases where it was used primary union has occurred. None of them were in the hospital as long as a fortnight,—one leaving on the eleventh, one on the twelfth, and one on the thirteenth day after operation.

Another advantage that it undoubtedly has over Halsted's operation is that it takes less time, for at least thirty minutes will be occupied in cutting and placing grafts, should they be necessary. This, I submit, is an important element, more so than the sentimental one already referred to; especially is it so in elderly patients who have already been under the influence of ether from one to three hours.

The future usefulness of the arm will be as much interfered with by one operation as another. It is really surprising that none of these extensive operations are followed with as much interference with the arm as one would think. In all of my cases of Halsted's, Kocher's, and Warren's operations, the arm on the affected side has been fairly useful. Women are able to feed themselves, adjust their clothing, and even

comb their back hair, which is a crucial test, and most difficult to accomplish where there is much restriction in the latitude of motion.

Within a week I have received a letter from Dr. D. H. Keller, of Bangor, Pa., in reference to a case of his upon whom I did an extensive operation in October last for a recurring carcinoma of the left breast. In it he says, "Mrs. M. doing very nicely; can use her arm at all times; combs her hair, and does a great deal of the house work. Her health excellent; sometimes a shooting pain in her right mammary gland, but no enlargement whatever." The pain in the right breast must be neuralgia, as she has complained of it for more than a year. She called my attention to it more than once. Both muscles were removed in this case from origin to insertion, and a large amount of skin was sacrificed on account of a condition shown by the photograph here exhibited. A very large wound was made after the method of Warren,—larger than any I have ever made save the case already described; yet it united *per primam* in a woman not very robust, and past sixty-five years of age. She went to her home on the twelfth day after operation, and could have gone sooner.

DISCUSSION.

Dr. Neilson agreed with the author that the Warren incision offers a very simple solution of a difficulty which all have to encounter more or less often in closing the enormous gaps frequently left by the removal of large mammary growths. The flaps are so easily moved and brought into apposition, it is a wonder that the plan was not thought of sooner than it was.

Dr. G. G. Davis regretted that he could not state that he had always found it easy to close these wounds. As regards the procedure of Warren, he had used it on several occasions, placing the incisions, however, perhaps a trifle lower rather than extending them so far backward. In spite of the comparative ease with which the wound could be closed by means of Warren's method, it seems that Dr. Rodman had still found it desirable to add another incision to it, so that it shows that, in order for it to be efficacious, the undermining of the skin must be very extensive.


Fig. 4.—After operation.

As regards methods of operating, he did not think, with some, that the hundred odd hæmostats which are used by many in these operations were entirely useless. In fact, it was his practice to gather up all the hæmostats he possessed or could beg or borrow, and he found that he could put them all to profitable use.

The blood, of course, comes from various vessels, largely according to the methods of operating. If the surgeon goes in above, he will get the acromial thoracic artery at the upper outer corner of the wound; but the blood that comes from that region is not the only blood that troubles the operator; some of the blood comes from the anterior intercostal arteries, especially the second, third, and fourth branches of the internal mammary.

As regards the method of operating, after making his incision largely in the way that Halsted does, and raising the skin, he simply takes the handle of the scalpel, inserting it at the supraclavicular joint, between the clavicular and sternal portions of the pectoralis major muscle, and splits it clear out to the humerus; introducing the finger in that cleft, it is separated downward from the sternum, clamping the vessels on the side of the tumor and as they come from the intercostal spaces. Then, having loosened it from the sternum, it is turned outward and the pectoralis minor muscle divided. Then, as the apex of the axilla is exposed, prepare the vessels downward and outward, cut off the attachment of the insertion of the pectoralis major muscles, and then work along the subscapular vessels downward and backward to the scapula. Having detached the mass of the tumor from the side of the chest, he sweeps everything from above downward and removes it. Operating in this manner, a large number of hæmostats can be put to good service.

Dr. John B. Roberts said that he was particularly struck with the early date at which Dr. Rodman was able to discharge his patients with the wounds practically healed. He did not, as a rule, cover in the wound by a plastic operation, because it is possible usually to cover nearly the entire wound by means of strong sutures drawing the edges of the skin together. The integument should be loosened from the underlying structures by undercutting it. He had occasionally made crescentic flaps at the sides of the excision wound and used them to aid in covering the raw surface. He always raised a triangular flap in the supraclavicular region and removed the fat and lymphatic nodes before beginning the

operation proper. The entire breast and both pectoral muscles are then removed and the lymphatic nodes under the clavicle are extirpated. The fat and lymphatic nodes in the axilla are similarly removed. In making the triangular flap above the clavicle, he made the point of the triangle towards the acromion. If the point of the flap projects towards the middle line, the skin at the apex nearly always undergoes dry gangrene, because its arterial circulation is interfered with. He would be glad to know whether Dr. Rodman always removed the supraclavicular glands, and whether he excised the pectoral muscles. He looked upon these two steps in the operation as practically essential, if the surgeon is to give the patient the very best chance of non-recurrence of the malignant disease.

Dr. Rodman answered that it was not his practice to go into the neck unless the glands were visibly enlarged; and he would say further that he had never felt very optimistic about this part of the operation. If there is marked and extensive involvement of the supraclavicular glands, he questioned whether these cases were operable, since, if the supraclavicular glands were involved, the mediastinal glands would also, as a rule, be implicated.

As to the statement made by Dr. Davis, it is true that it was necessary to make this curve—the Y incision—above as well as below, and modify the operation to that extent; but it must be remembered that the case was a very unusual one,—a recurring growth with a large amount of skin infiltration. He had never seen so large a wound. In ordinary cases, it would not be necessary. In the other cases it is very easy to cover a large wound by making an inverted Y below. Dr. Warren, in a personal communication, stated that very frequently he only made one curve instead of two, and he is able to cover most of his wounds with it; two flaps will be necessary if the tumor is large and the space great.

In regard to the question of time, the colored woman left the hospital on the twelfth day. She was operated on the 19th of December last, and left on the 1st of January. She could have left earlier, if she had not had ether pneumonia. The white patient could have left on the seventh or eighth day very easily, but she had postoperative mania beginning thirty-six hours after operation, when she was found walking around the ward at midnight. It was thought, therefore, better to detain her in the hospital from



twelve to thirteen days. But she could have left on the seventh or eighth day easily, as her mental symptoms had disappeared and the sutures were all removed. This was not an extensive wound, as in the first case, and the union was firm in a week. He had had cases who had taken a railroad journey of two or three hundred miles a week after operation. He rarely failed to secure primary union, recalling but one such failure in five years. Mammary wounds unite quickly. He added as to the frequency of cancer of the breast in the colored race, there had been for many years a belief on the part of Southern surgeons that cancer of the breast was more rare in the negro, but that impression is fast passing away. It has been shown very clearly that the colored race suffers quite as frequently, if not more so, from cancer of the breast and uterus than the whites. He was convinced himself that mulattoes were more prone to cancer than the whites, as they inherit the weaknesses of both races and the strength of neither. He had encountered relatively as many cases of cancer of the breast in the colored race as he had in the white. Reference to the Louisville City Hospital records for thirty years, also the records of the City of Louisville Health Department, convinced him of this fact. There were more negroes dying from cancer of the breast and uterus in proportion to the population than whites.

## TRAUMATIC THORACIC ANEURISM.

Dr. De Forest Willard read a paper with the above title, for which see page 48.

# ANEURISM OF THE THORACIC AORTA OF TRAUMATIC ORIGIN; TREATMENT BY INTRODUCTION OF WIRE AND ELECTRICITY.

By DE FOREST WILLARD, M.D.,

SURGEON TO THE PRESBYTERIAN HOSPITAL.

J. S., aged twenty-three years; male; was injured in November, 1899, by a heavy box, weighing 500 or 600 pounds, which fell two feet, striking him upon the chest. He was unable to work for six weeks, but at the end of that time resumed his labor, complaining, however, of a tightness and pain in his chest, which he considered a heavy cold. He was able to work at intervals, though with difficulty, for more than six months, when the pain and pulsation of his chest, steadily increasing, disabled him. He was told at that time that his heart was injured, and he was put to bed. His cough soon became troublesome, and the pain in the chest was severe, especially at night. There was occasional expectoration of bloody mucus. Worked a little through the autumn. Admitted to the Presbyterian Hospital, Medical Ward, in charge of Drs. Musser and Stryker, December 9, 1900, being thirteen months after the injury to his chest. Married; one child; *no history of syphilis;* no palpable or visible change in arteries; only slight pulsation visible in neck; no tracheal tugging; no suprasternal pulsation along carotids, subclavians, or innominate.

*Right Thorax Anterior.*—Powerful distinct systolic uplifting over whole right thorax at each pulsation, most noticeable in thin area at junction of third and fourth ribs with their cartilages. Slight thrill. Right axillary vein distended. Respiratory sounds practically absent over right lung. Dulness on percussion over whole chest. Systolic blowing heard from first interspace, downward throughout entire chest, and outward to axilla.

*Left Side Anterior.*—Violent heaving pulsation of heart's apex diffused for three inches below the normal position. Loud systolic murmur and loud first sound over entire upper left thorax.

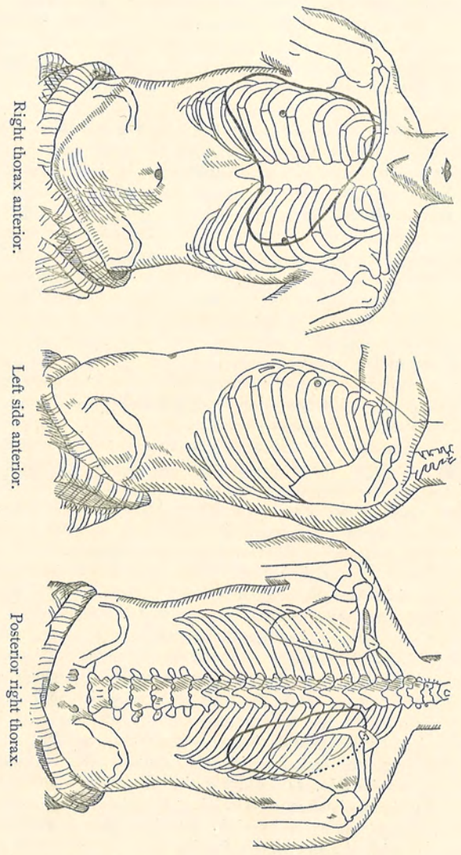
*Posterior Right Thorax.*—Decided pulsation visible and palpable over entire right chest. Long, loud systolic murmur over entire area, especially loud at base. Resonance of lung only feebly heard. Has bloody expectoration; cough; dyspnœa.





Skiagraph taken, but not satisfactory.

Patient was put at rest, with large doses of iodide of potassium and restricted diet, for five weeks. Ice-bags for pain. Dyspnœa, pain, cough,




and bloody expectoration grew steadily worse, and the anterior wall became perceptibly thinner. Pain increased, depriving patient of sleep, even under large doses of morphia.

The position of the tumor, the absence of pulsation in the neck, and the character of the chest sounds enumerated above, indicated a traumatic lesion of the descending thoracic aorta rather than of the arch or of ascending portion, unless the dilatation was at the very origin of the vessel. As the conditions were growing worse, and rupture certainly approaching, the patient consented to accept the risks of the only operation that offered any chance of success, the introduction into the sac of a certain quantity of wire as a framework or skeleton, each coil of which might form a nucleus for coagulation, producing eddies in the sac and final consolidation. (Moore, 1864.) To facilitate coagulation upon and around this wire framework, the coagulating power of galvanism was brought to bear. (Corradi.)

Ligation was of course out of the question; in the ten cases in which the aorta has been ligated, the result has been uniformly fatal.[1] Scarification of the interior of so large a sac was not hopeful, and the simple introduction of horsehair or catgut certainly did not offer as reasonable chance of success as did the more complete method advocated by Corradi, D. D. Stewart, and others. Simple galvanopuncture urged by Cinicelli, since it leaves behind no framework for deposit of clot, was obviously less certain in its permanent results. The injection of about 300 cubic centimetres of a 1 or 2 per cent. solution of gelatin was considered, but rejected on account of the large size of the sac.[2]

In this operation of wiring, it is essential that strict asepsis be secured, and that no elements of suppuration be introduced, since sepsis and faulty technique are the most frequent causes of death.

In order to protect the skin and subcutaneous tissues external to the wall of the sac from the destructive effects of the electrical current, a vulcanite cannula (size No. 7, French catheter scale) was constructed with a steel trocar (size No. 4, French catheter scale). The thickness of the vulcanite made the introduction difficult, requiring a slight nick of the skin with a scalpel. (A veterinary hypodermic needle, three inches long, and of calibre of 24, is better. It can be insulated by several coats of shellac varnish, best French lacquer set by heat, or by a porcelain coating.) The trocar was introduced in the fourth interspace, the thinnest point of the sac, just outside the costal cartilage, and was driven well into the sac. Upon the removal of the trocar a current of blood spouted three feet into the air at each pulsation of the heart, which, owing to the size of the cannula, made the loss of blood quite serious. It was, however, controlled by the finger until the wire was threaded in. Gold wire No. 35 had been procured, but proved entirely too fine, as it would not thread through the cannula without crinkling, and I was obliged to resort to silver wire No. 24. During the operation I fortunately had the benefit of the assistance of Dr. Guy Hinsdale, who furnished the following notes: "After six or eight feet had been inserted, the wire was connected with the copper conducting cord of the positive pole of a galvanic battery. The current was supplied by the electric lighting plant of the hospital, reduced by a current controller. A chloride of silver dry cell battery does well. The negative pole was attached to a large, flat, electrode sponge-covered pad, placed between the scapulæ. Five milliamperes were turned on at first, and the force of the current was increased by fives, the patient perceiving plainly each addition, and complaining of pain chiefly in his back, especially when new pieces of wire were connected. More wire was threaded in through the cannula until about twenty feet of coils were inserted. The strength of the current was increased until, during the last fifteen minutes of the hour, eighty milliamperes were measured; eighty-five only for a moment." In my judgment, the current used was too strong, and if equally good coagulation will take place under one of moderate strength, the danger of burning the walls of the sac is lessened. Finney obtained his results with only ten to twenty milliamperes. Coagulation of the blood in the cannula took place very soon after the current was applied, preventing further hæmorrhage, and, on withdrawal of the cannula, the wires having been pushed in as far as possible, there was no hæmorrhage. The opening was closed with gauze and aristolated collodion, and the patient confined rigidly to bed. Aside from the first shock at the sight of the spouting blood, the patient suffered no serious inconvenience, save for the pain in the back, at the negative electrode, and talked cheerfully throughout the operation. He slept the greater part of the night, the next day was much better, and in five or six days was anxious to sit up, although he was not permitted to do so. The only burns were at two areas, of the size of peas, upon the back. The cathodal negative pad should have been of larger size. In a week he could with difficulty be restrained in bed; was eating and sleeping well; had no pain; was able to stop the use of morphia, and had much less oppression. The pulsation in the thorax was lessened at the end of the operation; was still less on the following day, and in a week was diminished at least 25 per cent. His statement is that he is "twice as good as before operation." The original point of thinning anteriorly is much more solid, but laterally below the axilla the pulsation is slightly increasing, and will probably require a repetition of the operation.



In the third week a dilatation of the sac outward into the axilla gave torturing pains in right arm for two days, but this pain was speedily relieved, although the pulsation in axillary region has increased, and I propose to repeat the operation. His sac may be multilocular, or the coagulum in one district may have altered the direction of the blood current, causing dilatation of a new area. Nine weeks after the operation the man was so well that he could not be restrained, and he left the hospital in spite of my earnest protest. Good consolidation of the anterior portion of the sac at the seat of operation was positive.

Abstract from notes by Drs. Musser and Stryker, on admission: "Temporal artery not visible; neck full, only slight arterial pulsation; resonance in both supraclavicular fossæ; percussion resonance on right side beginning at eleventh dorsal spine, crossing to tenth rib at posterior axillary line; no distinct respiratory movements; vocal resonance and tactile fremitus greatly exaggerated, with bronchovesicular breathing over the compressed lung which lay posteriorly near the spine; outside and

anterior to this area respiratory sounds very faint, or lost. Anterior thorax very prominent on the right side over level of fifth rib and over sternum to anterior axillary line. Vocal resonance entirely lost anteriorly; upper thorax anterior, first sound soft and blowing, second sound faintly heard. Left side anterior, apex beat at fifth space from nipple to anterior axillary line exceedingly powerful. Auscultation at apex, loud systolic murmur with first sound; faint diastolic shock and prolonged diastolic murmur. Fourth interspace, fainter systolic murmur, louder second sound, with prolonged diastolic murmur; third interspace, short fainter systolic, long soft diastolic sound; second interspace, dull rough systolic, faint and prolonged diastolic murmur. Aortic, faint first sound; loud, clear second prolonged diastolic murmur. Left lung, respiration normal at apex; vocal resonance slightly increased. Tympanitic resonance from fifth interspace to axillary. With this saccular aneurism of the ascending portion of the arch there is evidently an aortic insufficiency, with hypertrophy and dilatation of the left ventricle."

The man returned to the hospital two months later suffering with increased pain and dyspnœa. The tumor beneath the pectoral muscle at the anterior border of the right axilla had decidedly increased in size, having evidently eroded the ribs. The principal suffering, however, was in the left chest posteriorly, probably from erosion of the vertebræ.

Twenty feet of No. 24 silver wire were inserted through a long hypodermic needle, and a galvanic current of eighty milliamperes applied for one hour. The patient bore the operation well and was relieved of pain even on the left side, owing probably to change in the direction of the blood-current. The wire, however, evidently failed to produce coagulation in the right thorax, and the tumor, having lost the restraining power of the ribs, increased rapidly in size, lifting the entire right pectoral. Although the walls became very thin the sac did not burst, and the patient died slowly from exhaustion four weeks after the second operation, five months after the first operation.

In spite of every effort I was unable to obtain permission for an autopsy, and the exact point of rupture of the aorta must remain in doubt.

Since the above report was written, Dr. Matas (*American Medicine*, June 22, 1901, p. 546. Transactions of the Southern Surgical and Gynæcological Association, 1900) has published an able article on this subject, and Dr. Leonard Freeman also read a paper before the American Surgical Association at Baltimore, May, 1901.

## Remarks.

*Technique.*—The size of the wire should be thoroughly graduated to the calibre of the needle, which latter should be tested to ascertain the smoothness of its bore, as it is essential that the wire should slip easily through it. I see no practical difference between silver, gold, and platinum wire. Size 27



to 30 is probably about the best diameter. Finney uses silver alloyed with copper, 75 copper to 1000. This, when drawn down from No. 8 to No. 27, makes a close coil, is very pliable, and corrodes moderately with galvanism. Stewart,[3] who has given careful attention to this subject, found that iron wire was undesirable, for the reason that the passage of the current rapidly decomposed it and liberated iron chloride and oxide in such quantities as to be dangerous if washed into the vessels, with a probability of causing thrombi. Steel wire coils better than silver, but is too stiff, and may injure sac.

The amount of wire should be regulated by the size of the aneurism, its object being to form a skeleton for a clot; the amount should be so regulated that it will fully reach all portions of the sac, for which reason it should be previously wound so as to coil and snarl in different directions. The wire for a large aneurism can be wound upon a sterilized rolled towel, so as to make large spirals in the sac; for a smaller sac, it should be wound upon a glass or spool; in either case it should be carefully arranged and prepared so that there will be no delay or kinking during the process of feeding the wire in through the cannula. If the wire kinks, other needles may be inserted at different points of the aneurism, all the wires being attached to the positive current. The arrangement of the coils can be well observed by feeding the wire into a glass flask. If the wire is properly wound before operation, it is very improbable that the initial point will strike the opposite wall. If too large a quantity is used, pressure upon the sac from within might cause ulceration and rupture, and might also interfere with contraction of the sac; moreover, if coils lie against the wall and the current is too strong, the sac may be burned. Moore used as high as 108 feet, and Abbe, 150; Roosevelt introduced 225 feet of steel piano wire, applying a galvanic current of twenty-five milliamperes for thirty minutes. Probably five to twenty feet would be the proper amount.

It is very important that the tissues be protected from the galvanism, lest an open sloughing track be made into the

aneurism. For insulation of the needle, glass, sealing-wax, caoutchouc, etc., have been tried, but best French lacquer or varnish, set by heat, seems best. Lacquer will not stand boiling nor soaking in a carbolic solution, but it can be thoroughly sterilized by dry heat carried up to 300 degrees; then wrapped in a sterile towel. A long veterinary hypodermic is better than a trocar and a cannula, even of same size, since the wire can be inserted half-way into the needle before the puncture is made, and assists in controlling primary hæmorrhage when the needle is inserted.

There is always risk that the wire may enter the aorta, as has happened in several cases, and minute or larger clots may be washed off and form emboli.

Traumatism as a cause of aortic aneurism is not largely mentioned by authors, although cases are reported by Lancesi, Munro, Sansom, and others, even where the arteries were normal.

Traumatic aneurism of the thoracic aorta is rare (Brown, of St. Bartholomew's Hospital, found only eight among 228 aneurisms), since it is better protected than most of the vessels, and the arch is more liable to atheromatous degeneration.

Riesman [4] reported a case in which there was limitation of motion in the spinal column, with no tenderness over the vertebral spines, but with torturing pains. An exploratory incision was made over a tumor in the back, but finding that the tumor pulsated violently, the operation was wisely abandoned and the wound closed; the aneurism burst later into the left pleural cavity.

A traumatic thoracic aneurismal sac may leak slightly, as in the case which I reported [5] in which a man sixty-four years of age was injured by a bale of carpet weighing three hundred pounds falling upon his shoulders. He lived two days with a rent in his thoracic aorta one-half inch long. The outer coat or adventitia, however, was not perforated. The inner and middle coats having been torn, the blood dissected its way between the muscular layer and the outer coat



throughout the entire extent of the thoracic aorta, and down the abdominal for five inches. The only symptom was the intense pain in the thorax and back, aggravated by every movement, this pain slowly extending from thorax to abdomen. There was no cough. On the second day the outer coat gave way about one inch below the original rent in the inner coats, and the patient died in a couple of minutes from the gush of blood which entirely filled the left pleural cavity. The arch of the aorta was not atheromatous, and in the thoracic aorta the only point of visible atheroma was at the area which gave way.

In aneurism of the thoracic aorta there is usually urgent dyspnœa and a sensation of distress and fulness in the chest. In time there is nearly always an erosion of the bodies of the vertebræ, and a rupture may take place either into the mediastinal connective tissue or into the pleural cavity.

Stewart,[6] Hershey,[7] and Hunner [8] report twenty-three cases treated by this method, and my own makes the twenty-fourth. The article of Hunner is most complete.

Rosenstirn, in an aneurism of the ascending aorta in a member of a rowing crew, first tried iodide of potassium, Tufnall's rest treatment, and barium chloride, then used two feet of No. 28 wire, passing a current of seventy milliamperes for thirty minutes; two years later the man was reported in good condition.

Stewart in his first and unsuccessful case, in a huge aneurism of thoracic and abdominal aorta, occurring in a wrestler, six years' duration, inserted two and one-half feet of No. 23 wire (wound upon a two and one-half inch roll to make spirals), and passed a current of seventy milliamperes for one hour. The sac was firmer on the third day, but ruptured on the ninth. Firm clots were found in all portions of the aneurism, and it was difficult to separate the clots from the wire. He used a needle insulated with shellac varnish, but the coating became softened too much by hot water. The use of carbolized glycerin as a lubricant he also found disturbed the insulation. For the negative pad he used a large moist felt plate at the back. In his second and successful case (with Salinger) of aortic and innominate aneurism, size of a fœtal head, he used ten feet of No. 30 gold wire, passing a current of thirty to eighty milliamperes one and one-quarter hours.[9] Galvanism was applied to several wires introduced through hollow needles placed at separate points and connected to the same rheophore. Pulsation and expansion lessened on the second day, also thrill. Four weeks later, second opera-

tion in upper part of sac. The patient lived three and one-half years, although he had endarteritis with extensive renal and cardiac disease at the time of operation, was syphilitic and of intemperate habits. He died from a thrombus in the middle cerebral artery. A thoroughly consolidated organized fibrous clot was found deposited about the coils of wire, and the cavity of the sac was completely obliterated.

Stewart's[10] third case was a fusiform aneurism of the abdominal aorta, which was made more prominent by a retroperitoneal tumor, lifting it forward. An abdominal section was done by Drs. Deaver (H. C.) and Neilson, and ten feet of silver wire introduced. A current of fifty milliamperes was passed by the anode for half an hour. On the fifth day the patient died suddenly. Large amount of blood in stomach and upper bowel. A tumor springing from the bodies of eroded vertebræ surrounded the aorta at cœliac axis; thoracic aorta above dilated. There was a small saccular aneurism of the splenic artery. The wire had entered both the saccular dilatation and the dilated aorta, but no clots were found adhering to the wire. The case was evidently not a suitable one for operation.

His fourth case was a syphilitic, who for fourteen months had suffered severe pain in the chest, with pulsating tumor in left posterior thorax. Fourteen feet of gold were introduced. Galvanic positive current applied, increasing from twenty to eighty milliamperes for eighty minutes; immediate diminution of pulsation and great relief from pain and other symptoms for eight and one-half months, when death occurred. No autopsy.

His fifth case[11] (with Dr. Noble), a syphilitic drunkard, had suffered from severe abdominal pain for more than a year; was greatly emaciated. Celiotomy done by Dr. Noble, exposing an aneurism of abdominal aorta. Nine feet drawn gold wire, No. 30, introduced; galvanic positive anodal current sixty-five milliamperes passed for an hour. Improvement immediate and progressive, pain lessened, and, all symptoms of aneurism having disappeared, in five months resumed his work. Died at end of nine months of acute dysentery, with no symptoms of return of aneurism.

In another case, a large thoracic aneurism, Stewart introduced wire on three different occasions, with good temporary result. Man died in nine months from rupture of sac.

In another case, seen with Dr. Hare,[12] a syphilitic man with aneurism of transverse aorta, accompanied by pain, dyspnœa, and cardiac disturbance, nine feet of gold wire were introduced through an insulated needle, and the anodal current, seventy milliamperes, passed for an hour. Pulsation and bruit diminished at end of operation, and bruit disappeared at end of forty-eight hours. Five weeks later patient was sitting up without pain. Bruit, pulsation, and thrill had entirely disappeared, cough had ceased, and patient greatly improved. Died seven months later from pressure of sac on trachea.

Hare[13] reports another case, man, thirty-eight years of age, large aortic aneurism; patient in bed for seven months and had lost sixty pounds. Ten feet of gold wire, current up to 100 milliamperes for one



and one-half hours. Contraction of sac and great relief. Second similar operation at end of several months. Died in seven months from rupture of sac. No autopsy. Life prolonged and made much more comfortable.

Hershey[14] reports a case of aneurism of the innominate and aorta which had deep-seated pain in chest beneath and to right of sternum; dyspnœa and bulging. Treated by complete rest; Valsalva's diet; barium chloride, three-quarters grain, three times a day. Later he introduced wire, 14 carat gold, gauge 28; wire snarled in order that it might bunch rather than coil, wrapped on glass vial, placed in clear carbolic solution. Hypodermic needle, 22 gauge, insulated by layer after layer of shellac varnish, each layer set by heat. Thirty-celled galvanic battery; milliamperemeter. Wire kinked after two and one-half feet had been passed. Positive pole attached to wire; negative pole, flat sponge six by eight on on back. Pain in negative electrode considerable. Increased current to seventy, continued for one hour, then diminished to forty. On removing needle, wire was cut and pushed in. Evidences of immediate consolidation; patient able to sleeep that night; gain in flesh. Nine and one-half months later was living, with considerable pain in chest, but was able to work. Died at end of a year, rupture of sac.

Kerr, in an aneurism of aorta, inserted ten feet silver wire; galvanic current one-half hour; patient feeling as well as ever one year later.

Kerr, ascending aorta, six feet wire; current fifty minutes; death eighteenth day; firm clot about the wire.

Burresi, ascending aorta, wire No. 30, seventeen inches, current twenty-five minutes; immediate signs of consolidation; death in 100 days.

Barwell, ascending aorta, ten milliamperes, seventy minutes, in twelve hours had signs of consolidation, death on seventh day; had thick, firm decolorized clot in sac.

Roosevelt, aortic; 225 feet steel piano wire, galvanic current, twenty-five milliamperes for thirty minutes. Death on twenty-third day.

Abbe, innominate; 150 feet wire. Current reversed during later part of operation, which tended to disorganize the clot, an error in technique of vital importance as pointed out by Stewart. Death second day.

Halsted. Man, twenty-seven years of age, pulsating abdominal tumor. Celiotomy performed. Five feet of No. 27 wire introduced and anodal current up to 100 milliamperes passed for one and one-half hours. Died in forty hours from rupture into pleural cavity. Wire coils found to have pressed against walls, probably injuriously. Loose, easily detachable coagula upon the wire coils.

Reeve.[15] Aneurism abdominal aorta; epigastric tumor; great pain controlled by large doses of morphia. Celiotomy. Seven feet silver-plated copper wire. Eighty milliamperes for fifty minutes. Patient lived twenty-four hours. One loop of wire was found to have passed ten inches up the aorta, while a single strand had reached the aortic valve of the heart. Aneurism distinctly sacculated; opening into sac one inch in diameter.

Corson.[16] Man, aged thirty-one years; excessive user of alcoholics. Pulsating tumor in neck. Six feet wire. Eight cells of a dry battery

for two hours. Partial immediate consolidation. Died on second day. Wire found to have coiled closely in contact with sac, probably because pure silver was used and not drawn wire, which latter coils better.

Finney.[17] (Osler.) Aneurism; thrill and pulsation. Man, twenty-five years of age. Bookkeeper. No traumatism. Celiotomy; pancreas flattened over tumor. Five feet silver copper alloy (75/1000) wire, drawn from No. 8 to No. 27. Galvanic current increasing from thirty to seventy milliamperes; one hour. Thrill disappeared in one-half hour. Sac firmer; had pain after operation; required one-quarter grain morphia every two to four hours. Temperature 103.7° F., caused probably by slough from negative pad on back and infection of abdominal wound. Temperature remained high for two weeks. Died on twentieth day, from hæmorrhage through external wound from slough. Autopsy: Diffuse arterial sclerosis. Opening in aorta one and one-half centimetres in diameter. Aneurism was of the superior mesenteric artery. Wire had entered sac, and one loop had burned side of sac, causing hæmorrhage. Transverse portion of duodenum necrotic, from interference with circulation in superior mesenteric artery, and filled with bloody fluid where oozing had taken place. Clots about the wire and in aneurism fairly firm.

Finney.[18] Man, fifty-one years of age. History negative as regards syphilis. Sternum lifted at each systole. Pulsation extending to right. Was given nine gelatin injections of 250 cubic centimetres of 1 per cent. solution before operation, and sixteen of a 2 per cent. solution afterwards. Ten feet of silver wire alloyed with copper; current of ten milliamperes for one hour; twenty milliamperes for fifteen minutes additional. Pulsation diminished after third day, but on the twelfth day pain moved towards the left side. Gelatin injections recommenced. Two months later resumed work, but died six months afterwards at sea, presumably from rupture.

Finney.[19] (Osler.) Man, thirty-nine years of age, history of alcohol, tobacco, and syphilis; also a heavy eater. Bulging right side of chest; great cyanosis and dyspnœa. Several aspirations of right pleural cavity; withdrew blood-tinged serum. Diagnosis: Aneurism near the heart or in thoracic portion. Ten feet drawn silver wire alloyed with copper, ten milliamperes, one hour. Patient felt each progressive increase in the volume of the current. Condition improved greatly for fifteen days, but right pleural cavity required frequent aspirations. Similar operation twenty-four days later. Third similar operation nineteen days later. Died eleventh week after first operation, with symptoms of pressure upon trachea. No autopsy.

Finney.[20] (Osler.) Man, thirty years of age. Abdominal aorta. Celiotomy. Eight feet of highly drawn wire of sterling silver, ten milliamperes, one hour. Section of the overlying pancreas was avoided by drawing the liver to the right and making the puncture in the upper right quadrant of the sac. Aneurism probably of the superior mesenteric. Greatly improved in symptoms; not much change in physical signs at the date of his discharge from the hospital six weeks later.



In summing up this record, we find that permanent cures are few, as must necessarily be the case in so fatal a condition as aneurism of the aorta, yet in one-half the cases operated upon life was certainly lengthened, and all of those who survived the immediate effects were rendered vastly more comfortable. This result is certainly satisfactory when the fact is taken into consideration that these cases were necessarily fatal ones if untreated.

Ten cases undoubtedly had their lives shortened by the procedure, but several of the patients had fusiform aneurisms and were not proper subjects for the operation.

Rosenstirn's case was alive eleven years after the operation. The post-mortem of one of Stewart's patients made three and one-half years later showed a solidly coagulated tumor. Kerr's case at the end of ten months showed no signs of the aneurism. In Noble's patient all symptoms had disappeared, and another patient died of dysentery nine months after the operation. Finney's fourth case was at last report living, with great improvement in symptoms. My own patient at nine weeks is too recent to permit of any conclusion save that great comfort and relief from pain and dyspnœa have been secured.

Ten cases then have been positively benefited, one is uncertain, and while the remainder died at various periods within a year, yet nearly all of those that survived the immediate effects of the operation were rendered decidedly more comfortable.

This method, therefore, of dealing with a most serious condition seems to offer a more reasonable hope of success than any other plan at present discovered.

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## DISCUSSION.

Dr. D. D. Stewart said that he had been interested in this matter since 1890, when he did his first operation, and, as he had done quite a number since, naturally he had been able to draw some deductions concerning the best technique to employ, and he would speak in a general way as to the technique of the operation.

Almost invariably, before wiring, he introduced a fine canulated needle to assist in determining the thinnest part of the sac wall, and that least protected by clot. He preferred to introduce his needle and wire where the sac was least protected. He did this at the time of operation, or shortly before. He not only punctured before, but subsequent to the operation. He had been very much interested in determining, a short time after the operation, the difference between the depth to which he had to introduce his needle, before spurting of blood occurred, prior to the operation and subsequently. In some cases the difference had been very marked indeed. In one instance, the specimen of which he afterwards showed before the College of Physicians (the operation had been done three and a half years before death, which had resulted from another ailment), needling showed a sac wall scarcely over



two lines in depth, at the point of puncture, unprotected by clot. (See *American Journal of the Medical Sciences*, August, 1896.) Four weeks after the operative procedure, "a needle of quite large calibre was thrust into the sac to a depth of two inches in several situations, in which, at the time of operation, blood spurted at its introduction when apparently only beneath the skin. The needle in this second attempt was found to firmly engage the clot, though thrust perpendicularly up to its hilt in the sac. It could not be circumducted save with effort, and escape of even a drop of blood at any depth did not occur; nor was the needle or wire (which last it had been attempted to reinsert through the needle) blood-tinged when withdrawn. This beautifully demonstrated the solidification of the aneurism." This case was one of very large innominate aneurism, concerning the specimen of which Dr. John Ashhurst made the following remarks: "It shows that the cavity of the sac was as completely obliterated by the contained clot as it could have been by either the Hunterian or the Amyllian operation; in fact, as far as this part of the artery is concerned, the circulation was as completely obliterated as it could have been even by extirpation of the whole aneurismal sac." (See *Transactions of the College of Physicians,* Vol. xix, 1897, p. 43.)

He had never had ill results from needling or wiring aneurisms. He adopted antiseptic precautions. His first case was a very large aneurism, involving both the thoracic and abdominal aorta, which had eroded the bodies of several dorsal vertebræ. The sac was twelve inches in oblique measurement. In his later operations he employed as a medium for passing the wire and subsequent electrolysis insulated gold needles, of rather small calibre, and made of gold insulated with porcelain.

The wire that he employed was either gold or silver. He had been using gold wire in preference to silver because he could have it more tightly drawn. It is important that the wire that is used shall assume spiral coils, one that may not easily be deflected by loose coagula in the sac. He used wire drawn to twenty-eight or thirty gauge. Silver wire he had used on a number of occasions, but he preferred gold wire. He had never introduced more than fifteen feet at one operation. It is of the utmost importance that there should be a relation between the amount of wire introduced and the size of the aneurism treated. There cannot be expected subsequent contraction of the aneurism to the extent

desired, that is, obliteration of the sac cavity, if too much wire is introduced. It is extraordinary the amount of wire that some of the earliest operators used, both without the employment and with the employment of galvanism. For instance, in a case operated upon by Roosevelt, he introduced 220 feet; and in one by Abbe 150 feet were introduced subsequent to the passage of 150 feet of horse-hair. He introduced two or more insulated needles, and passed the wire in equal quantities through each. By this means the whole interior of the sac is better reached by a smaller quantity of wire. If the wire is passed through but one needle, it may go in but one direction, being deflected by loose clot, and not reach so well all parts of the cavity, and none of it tend to lie against the sac wall itself, even if portions of this are unprotected by clot. An important result which may follow contact of portions of wire with the unprotected sac wall is the formation of wall, or white, thrombi, due to the electrolytic action of the current on the endothelial lining of the sac wall. White thrombi may be expected to later form here by the deposition of leucocytes from the abraded vessel wall and from the blood-stream. From these thrombi organization would tend to proceed to the red thrombi formed about the wall within the aneurism. Thus may be obtained the results of Macewen's operation by needling, plus that obtained by wire and the electrolytic action of the galvanic current on the contained blood.

If it is intended to introduce a definite quantity of wire through but one needle, and in process of passing the wire kinking occurs, a second needle should always be at hand for the passage of the additional quantity, and this needle is better introduced in a portion of the sac somewhat remote from the first needle. Of course the wire from the various needles should be all joined to the same, the *positive,* pole. It should be a rule that has no exception, to use only the positive pole within the sac. The reason for this he had entered into very fully in his various publications on this subject. If the negative pole is connected with the needle, the clot is always soft and friable. Bubbles of hydrogen tend to accumulate about the negative needle and assist, also, in softening the clot. If the negative pole is used after the positive, which has sometimes been done, it will tend to dissolve the already formed clot. Although he had pointed this out again and again, yet this point is not often attended to by operators.



Concerning the amount of current strength, 120 is the highest amperage he had used. He had continued for an hour and a half with a current strength of sixty-five milliamperes. A large current strength should not be continued too long. He had noticed in several cases operated upon that visible signs of coagulation in the sac appeared rather early, and then were not so marked after an increase in the current strength which had been continued for a longer period. It seemed as if coagulation had occurred, and that the coagulum tended to again become softer. He did not now, as he once did, favor the long application of the current, nor of the very high current strength that he at first used. He was inclined not to use a greater current strength than sixty to eighty milliamperes, and not to continue this for too long a time. The current is started from zero and gradually run to the number of milliamperes desired, say eighty, and this is reached in about ten minutes. The current is here maintained for nearly the requisite time, and then gradually diminished to zero. It is of course unwise to turn on a great degree of current suddenly. It has occurred to him on several occasions that the patient had accidentally moved from the large negative plate, thus interrupting the current, and before the current could be switched from the battery it had been closed by his again lying against the plate. Nothing had happened as a result of this, but of course it was very undesirable that it should occur. He used as the indifferent or negative pole a large clay pad, upon which the patient commonly lies. If desired, in operating on the thoracic aorta anteriorly, this pad may be laid upon the abdomen.

As to the use of iron wire, it has been advocated, but he did not recommend it. Some ten years ago he made experiments as regards the effects of different current strengths passed through iron wire, and he found that, as mentioned in his first paper on this subject (*American Journal of the Medical Sciences,* October, 1892), a large amount of detritus always results from the passage of a galvanic current of even low amperage through iron wire. An amount of ferric oxide and chloride is thus formed, which might result very injuriously through the passage of some of this detritus as emboli into the blood-stream.

He regarded it as of importance that the patient should be prepared for the operation. His physical condition should be as good as possible. It is of the utmost importance that the heart

should not be overacting, and that the blood-pressure should be low; in other words, that the condition should be favorable for the formation of clot within the sac. It is desirable that the patient should be thoroughly reassured prior to the operation that little or no risk attends the procedure, and that practically no pain is experienced. He administered morphia hypodermically prior to the operation, and if the blood-pressure was very high, aconite was given a few days before the operation. In the last case he operated on a few months before, good immediate results were apparent, although, despite the use of morphia and aconite, the heart's action could not be quieted. There was a pulse of about 180 during the operation, and yet the impulse in the sac became less marked as the current passed, and the aneurism more firm. This immediate effect from the operation had been noted by himself and others in several of his cases, and there seemed no doubt that the coagulation does occur during the operation through the passage of the current. In one of his cases that he operated on for Dr. Salinger a number of years ago, at the Philadelphia Hospital, the immediate result of the passage of the current was remarkable. This was demonstrable to all present. The needle had been introduced into the weakest part of the sac, and fell unless upheld, so utterly unprotected was this part of the sac by clot. Towards the end of the electrical session the needle was supported by the newly formed clot, and remained firmly perpendicular.

He never made an incision into the skin for the introduction of the needle, which he inserted by gentle pressure and spiral manipulation into the sac wall. Were he to use a cannula, and make a primary incision through the skin, he should be afraid to attack the weakest part of the sac wall. Before the wire is introduced, the blood spurts from the needle, and continues to leak during the passage of the wire until the current is turned on. As soon as a few milliamperes of the current have passed, bleeding ceases, and does not recur. Concerning the removal of the wire, he cut the wire close to the needle, and then simply spirally twisted his needle, making counter-pressure with the fingers until the needle was withdrawn from the sac, pulling the wire out a little. The wire was then close to the skin, and the skin pulled forward over the wire, after which the site of puncture was sealed with iodoform and collodion.

In answer to a question as to the greatest length of time that



the patient has lived after such a procedure, Dr. Stewart said that one of his cases lived three and a half years, and died from an affection distinct from the aneurism. In this case, that operated on for Dr. Salinger, before referred to, the cure was complete. The aneurism was completely solidified. It was of this case that Dr. Ashhurst made the remarks referred to.

Dr. De Forest Willard added that he had been concerned by the puncture at the thin portion of the sac. When a surgeon feels an aneurism of the size of a child's head pulsating directly underneath the skin, he naturally hesitates to make a puncture at that point, lest he weaken the sac and hasten rupture. It was for this reason, also, that he feared, if he did not thoroughly insulate the wire, that there might be destruction of skin and subcutaneous tissue by the current of electricity that would open the aneurism a few days later and cause a rupture. In removing the cannula he was careful to push the wire down thoroughly underneath the skin and into the sac, so as not to have the wire lead the blood out from the aneurism through the skin, or permit infection of the sac, along the wire from without. The point of puncture was supported thoroughly with collodion and aristolated gauze. There was no bleeding at the time of the withdrawal of the cannula, and there had been no bleeding since. That point of the sac is now apparently stronger than several other areas. The weakest point at the present time is under the axilla; yielding, he feared, was extending in that direction. He proposed, in the course of one, two, or three weeks, if the patient was as well as he was then, to repeat the operation, and endeavor to secure more clot in the outer and upper portion of the sac.

# TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

*Stated Meeting, March 4, 1901.*

The President, De Forest Willard, M.D., in the Chair.

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## LEFT CÆCAL HERNIA, WITH A REPORT OF TWO CASES.

By JOHN H. GIBBON, M.D.,

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That the presence of the cæcum in the sac of right inguinal herniæ is not uncommon has been shown by the number of cases reported since the more recent methods of operation have been in such universal use. When, three years ago, I made some investigation as to the frequency of cæcal hernia and classified sixty-three cases (*Journal of the American Medical Association,* June 11, 1898), I was surprised to find that a number of surgeons of long and extensive experience had never found the cæcum in the sac of a hernia. This, I believe, can only be accounted for by the fact that until within the past eight or ten years it was not the custom, in many operations for the radical cure of hernia, to open the sac and examine its contents before reduction. Since the publication of my paper, I have myself met with cæcal hernia on two occasions, and have seen it in the operations of others a number of times. The condition upon the right side, even in femoral herniæ, cannot longer be considered a rare occurrence, although oftentimes representing unusual and interesting pathological features. When the appendix occupies the sac for any length of time, it nearly always becomes adherent, and sometimes is the seat of inflammation rendering operation imperative, and occasionally it perforates and produces abscess formation within the sac.





The two cases here reported show a rarer form of cæcal hernia, for in each this portion of the bowel was found in the sac of a left inguinal hernia. Of the sixty-three cases above referred to, seven were of the left side, and six of these were irreducible, the condition of the seventh not being mentioned.

Case I.—S. J., aged seventy years; occupation, engineer. This patient was admitted to the Jefferson Hospital on the night of February 7, 1900, with an enormous left scrotal hernia. The patient said he had suffered from a very large irreducible hernia for several years, and that at twelve o'clock on the day of admission it had suddenly become much larger upon a violent coughing attack, and had given him great pain. The milder methods of reduction had been tried by his doctor without success. On admission, the symptoms of strangulation had set in, and immediate operation was advised. The patient was very stout and had a large and pendulous abdomen. Ether was given, and the usual incision of the Bassini or Halsted operation was made. When the sac was opened, there flowed out about a pint of dark serum. There was a large portion of the small bowel which occupied the anterior portion of the sac. It was very much congested, and in several places was adherent to the sac by old adhesions, showing a long residence in this position. At the posterior part of the sac and tightly constricted in the abdominal ring was the cæcum. The junction between the ileum and the cæcum could be plainly demonstrated, but the appendix occupied a position behind the cæcum and had not made its way into the sac. The condition of the contents greatly improved when the constriction was divided and the whole was returned to the abdominal cavity. The sac was removed, the method of Halsted being employed in the obliteration of the inguinal canal, silver wire being used as a suture. As there was considerable inflammation and an abundance of fat about the sac, I employed superficial drainage. The patient reacted very well from the operation, and, excepting for some superficial suppuration, the wound did well. On the nineteenth day after the operation, when the patient was apparently doing well, he died suddenly in the night from what was apparently heart failure. No post-mortem examination was allowed.

Case II.—W. W., aged fifty-five years; laborer. This patient was admitted to the Jefferson Hospital, September 18, 1900. He gave the history of having had a hernia since 1877. On admission, the patient had an extremely large left scrotal hernia extending nearly to the knee. Nearly

all of its contents could be returned to the abdomen, but when this was done the patient's respiration was greatly interfered with. The patient's urine contained some albumen, numerous leucocytes, and a few blood-corpuscles. Professor Keen, assisted by the writer, operated upon this patient in his clinic on October 1, employing spinal analgesia produced by Eucaine B. The sac was found to contain a number of feet of small intestine, the cæcum and appendix, and quite a large portion of the ascending colon. The whole was reduced to the abdominal cavity, producing some discomfort to the patient, and the operation of Bassini was then carried out. The patient reacted very well from the operation, but on the second day it was found that he suffered from a tight stricture of the urethra. For twelve days his temperature remained below 100° F., and his wound healed nicely without suppuration. After this, however, the patient developed symptoms of sepsis, and died of what was supposed to be involvement of his kidneys. (For the privilege of recording this case with my own, I am indebted to Professor Keen, who reported it, under the title of Spinal Anæsthesia, in the *Philadelphia Medical Journal*, November 3, 1900.)

The most interesting feature about these cases is the cause of the condition. Many of the theories regarding cæcal hernia have been revised during the past few years. It was formerly supposed that when the cæcum appeared in the sac of a hernia, it was with only a partial peritoneal covering; but a study of the cases reported has shown that it is extremely rare that a complete peritoneal investment of this portion of the bowel is not found. When the condition appears in children, it is practically always congenital, and due to an attachment between the testis and the cæcum or appendix; occurring in the adult, it is most usually acquired. Of the sixty-three cases which I classified there was not a single case of inguinal hernia, either congenital or acquired, which occurred in the female. Of the nine cases of left cæcal hernia with which I am familiar, but one occurred in a female, and it was of the femoral variety. I think from these facts we can conclude that cæcal hernia is rare in women and that left cæcal hernia is rarer still. The cause of acquired cæcal hernia would seem to be due to two conditions: first, a small but freely movable cæcum; second, a pre-existing hernia of the small intestine. The first of the two cases recorded gives a history which corresponds to that of a number of the cases which have been



reported, viz., that the patient has had for a long time an irreducible hernia, that he has had this suddenly increase in size as the result of strain, with the development of the symptoms of strangulation. If the ileum occupies the hernial sac, it can readily be understood that with a large ring, a movable cæcum, and muscular strain the large bowel could easily be drawn into the sac of the hernia. Transposition of the viscera would be an easy way of accounting for left cæcal hernia, but it is very rare that this condition has existed in the cases reported. It is my own opinion that the most frequent cause of cæcal hernia of the acquired variety, either right or left, is due to a long mesocolon and a pre-existing uncontrolled hernia of the ileum. Treves has shown us that the attachment of the cæcum to the right side of the abdomen is not nearly so firm as was formerly supposed. In an examination of 100 bodies, he was able to carry this portion of the bowel in most instances to the opposite side of the abdomen, and as high up as the liver. It is beyond question that the presence of the cæcum in a hernial sac is frequently the cause of both inflammation and strangulation. Of the sixty-three cases which I collected, twenty-eight were strangulated, two incarcerated, eleven irreducible, ten not stated, and only eleven reducible. These figures, I think, go to show that cæcal hernia is a condition which in all instances requires operation, unless it be in the congenital reducible variety found in children.

## CÆCAL HERNIA, WITH VOLVULUS OF ILEUM.

Dr. Francis T. Stewart said that he was indebted to Dr. Martin for the privilege of operating on the following case, which he reported with a view to swelling the statistics of cæcal hernia collected by Klein, Brieger, Bacardi, and Gibbon; as a contribution to the study of volvulus associated with hernia recently made by Knaggs; and to establish a third class, that of cæcal hernia with volvulus, two other cases having been recorded, one by Da Costa (Annals of Surgery, Vol. xxix, p. 280), a right inguinal hernia consisting of cæcum, most of the ascending colon, and a twisted ileum, and one by Catellani (Annals of Surgery, Vol. xxviii,

p. 708) in which, besides the small intestine, the cæcum, ascending, and transverse colon descended through the left femoral ring, the whole mass being circumgyrated, the neck of the twist lying within the abdomen.

A. B., aged fifty years, laborer, entered the Pennsylvania Hospital, December 25, 1900. For eight years he had been harassed with a right-sided inguinal hernia, at first small but gradually attaining a large size. Two days before admission, the rupture became irreducible and exceedingly painful. There were retching, vomiting, and absolute constipation. The patient was thin but muscular; the face anxious, drawn, and covered with sweat; the abdomen rigid and tympanitic; the temperature normal; the pulse 140 and thready, and the respirations 40 and entirely thoracic. In the right inguinoscrotal region was a markedly tender, tense, and tympanitic tumor about the size of two fists, irregularly ovoid in shape, and extending from midway between the anterior superior iliac spine and the pubes to the bottom of the scrotum. After but a feeble attempt at reduction, operation was immediately undertaken. The sac was thick, vascular, contained no fluid, and was easily separated from the spermatic cord; a constriction in its neck was responsible for the strangulation. The scrotal portion contained about one foot of ileum, twisted 130 degrees from right to left; just without the external ring lay the caput coli and appendix completely surrounded by sac. Both large and small bowel were deeply congested, but the endothelium was intact, and moist heat with relief of the constriction quickly restored them. The internal ring readily admitted three fingers. The appendix was not excised. The operation was completed after the method of Bassini. Strychnine and digitalis were administered hypodermatically, and one quart of salt solution was injected into the left median cephalic vein. The bowels moved within twenty-four hours, the stitches were removed on the sixth and ninth days, and the patient left the hospital on the twenty-seventh day with a firm scar.

The salient points in this case are that the small bowel descended first, and by its twisting and traction pulled down the large bowel, tending to corroborate Gibbon's view that cæcal hernia is due to the traction of a pre-existing hernia of the ileum, that the patient presented evidences of a peritonism out of all proportion to the condition found at operation, that the sac was



complete and contained no fluid, although not adherent to the bowel, and that the hernia was exquisitely tender, which might be explained by the presence of the appendix.

## EXCISION OF INTESTINE FOR ACUTE OBSTRUCTION OF BOWELS FOLLOWING STRANGULATED FEMORAL HERNIA. OPERATION.

Dr. Thomas S. K. Morton reported the following case. M. W., a single woman, aged thirty-one years, was seen December 10, 1900. She presented symptoms of strangulated femoral hernia on the right side. It had been present for several years, but had never become irreducible until some twelve hours previously. Then she lifted a heavy weight and experienced much pain in her rupture. Two vigorous efforts had been made to effect reduction, —one under ether. Operation was performed. About six inches of dark, small intestine were found in the sac, as well as a considerable amount of omentum and prune-juice-colored serum. The intestine was œdematous and, in spots, had lost its lustre. Warm applications having markedly improved its circulation as evidenced by brightening color, it was returned to the abdomen. The omentum was bruised and infiltrated with small spread-out clots, so it was excised. Bassini's radical closure of the canal was then employed. She made an ideal recovery, the bowels moving spontaneously on the second day. But two weeks afterwards she suffered from severe pains about the umbilicus for several hours. This was repeated once or twice at intervals of two days and then disappeared. She went to her home at the end of the third week, and continued in apparently perfect health for some ten days. Then she was seized with violent symptoms of obstruction of small intestine which lasted for twelve hours. Upon the third day following another attack almost as violent came on, and the woman was returned to hospital for abdominal section.

This second operation discovered the portion of bowel that had been strangulated condensed into a very hard, fibrous mass about two inches long and firmly adherent just below the femoral ring in the pelvis. It was dissected and torn off with extreme difficulty. The lumen of the bowel at the site of constriction was torn open during this procedure. The calibre of the gut through the cicatricial mass was not greater than one eighth of an inch. The whole diseased portion of gut as well as one inch of healthy

bowel on each side were excised. Downes's forceps were employed in this case and gave satisfaction. Recovery from the operation was again ideal, save for a saprophytic abscess in a portion of the wound, which probably arose from contamination by the torn portion of bowel. She has remained in perfect health up to the present time, seven weeks after.

## SARCOMA OF SUPERIOR MAXILLA.

Dr. Richard H. Harte presented again a man whom he had presented about a year before to show the result following an operation for the removal of the superior maxillary bone in which he had to place a large skin-flap to cover up a defect in the anterior part of the cheek. Since the operation the man has gradually improved in health, and has had nothing done to the persistent disease except the removal of a small mass which appeared a few months ago in the region of the angle of the jaw. This was done by Dr. Le Conte. The man has gained steadily in strength, looks perfectly well, and is able to do the ordinary work of a day-laborer. There is an opening leading from the roof of the mouth, and posterior to that there is a small cystic mass corresponding to a portion of the soft palate, which Dr. Harte expected to remove in a short time.

Dr. Le Conte said that he could thoroughly bear out Dr. Harte in his statement that this case was a most unfavorable one for operation. The growth was not only in the antrum, but had extended to the skin surface and had ulcerated, a fungoid mass appearing, possibly the size of a quarter of a dollar, over the cheek, which necessitated not only the removal of the upper jaw, but likewise the removal of the larger portion of the skin which covers the upper jaw, and necessitating plastic operation to cover in the defect.

## FRACTURES OF THE SKULL.

Dr. Richard H. Harte read a paper with the above title, for which see page 73.

# SOME OBSERVATIONS ON FRACTURES OF THE SKULL, BASED ON ONE HUNDRED AND FORTY-SIX CASES.

By RICHARD H. HARTE, M.D.,

SURGEON TO THE PENNSYLVANIA AND THE EPISCOPAL HOSPITALS.

It is not my object in this paper to go into all the numerous theories which have existed from time immemorial in regard to fractures of the skull. These theories, and the controversies they have engendered, have arisen largely from the way in which different observers have looked at the same injury, and have unduly emphasized one or another feature which to their minds has been the salient element in injury.

The skull, it shall be remembered, is a bony spheroidal case, of curious architectural construction, which varies in some detail in every case and at different times of life. Furthermore, no two injuries are produced in exactly the same manner. Even the varying muscular rigidity of the individual will influence the character of the injury. This is, of course, influenced, too, by the cause which has produced it. For example, the head may have been caught between heavy falling beams and crushed; or we may have a small punctured or stellate fracture, such as is caused by the point of a pick entering the skull, causing no injury except at the point of entrance, and not even wounding the membranes. A fissured fracture may be the result of the blow from a sand-bag, producing a simple fissure of very short extent, which closes so accurately that it can only be discovered with the greatest difficulty. Again, a fissure may radiate from the point of impact to the base of the skull, or, as has been frequently noticed, appear only on the opposite side of the skull from the point where the blow has been received, producing the variety known as

*contre-coup*. (This variety of injury is easily demonstrated by physical experiments on definitely shaped bodies.) Still other varieties are explained by what is known as the bursting theory, in which the opposite sides of the skull are brought nearer to each other, with the result that the intermediate portion gives way.

It is impossible to say what the result will be after a definite blow has been delivered upon the vault of the skull. A fracture at the base, or a fracture at the point of impact, or simply a jarring of the cerebral mass, may occur, depending upon the strength and resistance of the bony parts involved. It will be obvious that it will be hardly necessary here to go into a minute description of the different varieties of fracture of the skull. They may be conveniently divided into simple, compound, comminuted, fissured, or depressed, according to the position and the part of the skull involved, and all of them may exist with or without noticeable injury to the skull contents. Other general divisions frequently made by hospital surgeons, and made with regard to location, are fracture of the vault and fracture of the base. Not unfrequently we find the former running or extending into the latter, and both vault and base involved. (The writer is inclined to lay much stress upon these two varieties.) A fracture of the skull may be a most trifling injury, whereas injury of the base should always be considered one of the gravest of head injuries.

Fractures of the base of the skull are not produced by the same character of force that we find causing similar injuries to the vault, for the weight of the body is in this case more often a factor, driving the vertebra up against the skull and resulting in a fracture of the posterior and middle fossæ, for the reason that a concentrated force will, in all probability, produce a fracture at the point of impact, whereas diffused force is likely to cause a fracture of the base,—a result to be accounted for by the vibratory theory of *contre-coup*. Aran's "radiation" theory is that fractures of the base occur because of the radiation of fissures from the point of application of the force. He conceived that the fissures passed



by the nearest route to the base and involved it in the fracture. He furthermore discovered, as the result of experiments, that the part of the vault which was first struck would give the key to the fracture which would take place at the base. Thus, injuries produced in the front part of the vault indicate fractures of the anterior fossa, those of the middle part of the vault to fractures of the middle fossa, and those of the back of the head to fractures of the posterior fossa. In 1880, Meserer expressed the opinion that fractures of the base always occur in the direction of the force applied, or, at any rate, parallel to it, and considered these not as the result of radiation, but of bursting forces. His theory may be illustrated by subjecting a hollow sphere to pressure. The breakage will occur either at the point of immediate pressure or by bursting at the most distended part. This theory was accepted by the late Professor Ashhurst, and, from a physical stand-point, must undoubtedly carry much weight.

To sum up practically the results of diffused blows upon the skull, we find that their chief effect is at a distance from the point of their application. Blows struck on the vault produce fissured fracture in the corresponding segment of the base. Those struck on the periphery of the base produce fissured fractures on the base of the skull parallel to the direction of the force applied. It is only by the careful consideration of the initial force that an intelligent idea of the character and direction of the fracture can be obtained.

The term fracture is used generally to express any break in the continuity of the skull, and may mean the simplest fissure of the vault without any cerebral symptoms, or be employed to express a complete crushing of the skull and its contents. It is, however, usual to distinguish such fractures into fractures of the vault and fractures of the base. A fracture that is confined to the vertex is not necessarily a more serious injury than a corresponding fracture of any of the flat bones elsewhere. The danger depends on injury to the underlying structures, such as wounds to the vessels, sinuses, or brain substances. The prognosis should depend upon the accuracy of the diag-

nosis, which in its turn must depend largely on the ability to explore or determine the exact amount of destruction to the bone and to the underlying parts, which latter is by far the more serious factor in the injury. We know that in simple fissuring the bony margins, after often having injured the parts beneath, immediately return to their natural positions. Consequently inspection of a superficial wound is no index of the harm that may have occurred in the tissues below. Another variety of injury is caused by the splintering of fragments from the area of the fracture, causing wounds of the brain or membranes. A large fragment may have been separated and driven deep into the brain substance. Any of these conditions are liable to produce pressure either from a fragment of bone pressing on the brain, or from effused blood escaping either from the diploe or from a wounded meningeal vessel. It seems, to-day, to be the consensus of opinion that the latter is much the more serious condition of the two,—a condition which, if not soon relieved, is bound to be followed by fatal results.

Diagnosis of fracture of the vault is very simple if the wound leads down to the seat of injury, or if by slight enlargement the fracture may be brought into view. The cases which require the greatest amount of skill are injuries in which there is no external wound, for then much uncertainty often arises in determining whether depression in the soft parts really corresponds to a distinct depression in the bone. Frequently the only way in which such an uncertainty can be made a certainty is by making an incision; and when made for this purpose, such an incision is perfectly justifiable, provided proper aseptic precautions are observed. Sometimes the suspected margin of bone can be felt with a needle by puncturing the skin and exploring the surface of the bone. When the patient is conscious, he may be able to give information as to the character of pain when pressure is made over the injured part, especially if a fragment is loose. Still, there is no doubt that, with all aids to diagnosis, many cases of fracture of the skull go unrecognized, and are not detected until a post-mortem is made.



The writer feels that many children recover from unrecognized fracture. So long as a fracture is simple and uncomplicated, its determination is not a clinical necessity, but rather of scientific interest.

It is worth while to mention two errors that are often made in the diagnosis of fractures of the vertex,—one, the mistaking of normal fissures for fracture, especially unobliterated frontal fissure, over which a trephine has been applied on more than one occasion; and, second, simple incised wounds of the skull are frequently mistaken for fissured fractures. In cases of doubt in either of these conditions a small piece of the skull removed with a gouge at right angles to the fissure will determine the exact character of the injury.

On theoretical grounds, fracture of the inner or *vitreous* table should be much more common than we are led to believe it is, owing to the direction of the force and the character of the bone involved. It has been stated that it is impossible to sustain a fracture of the inner table without a corresponding injury of the external. This statement will hold good for delicate skulls with little or almost no diploic structure; but in skulls with thick diploic layer and thin outer table, a fracture of the latter may easily occur without injury to the inner table.

I will now pass to the consideration of fracture of the base of the skull, and speak of the treatment of the two varieties together. I have already referred to some of the causes of, and the theories that are entertained in regard to, fracture of the base of the skull. Any of the fossæ may be involved. or the fracture may extend from one into the other. Fractures involving the middle and posterior fossæ are frequently seen.

Fractures of the posterior fossa occur, for the most part, by violence applied posteriorly and from below. There is often a ring form of fracture produced by the impact of the spinal column on the base of the skull, as when an individual falls on his head, producing a fissuring of the base away from the jugular fossa, or towards the foramen spinosum,—the most

common site of fracture of the petrous portion of the temporal bone. Probably the most frequent site of fracture of the petrous bone is through its weakest part, which corresponds to the position of the middle ear; and a fracture here is often accompanied by bleeding from the ear, or with escape of cerebrospinal fluid.

Fracture of the anterior fossa may involve the central portion of the orbital plates, or may extend to the optic foramen, or to the sphenoidal fissure, or may pass transversely and involve the cribriform plate. The study of the mechanism of basal fracture is of the greatest importance, as we may thus explain how forces are distributed to certain portions of the base of the skull, and show how frequently effect follows the cause, and that blows on the side of the skull usually result in fissures of the base of the middle fossa.

During the preparation of this paper, the case of a child who had fallen from a window, striking the side of its head, causing a large hæmatoma with hæmorrhage from the external ear, came under the writer's care. The diagnosis of fracture at the point of impact, with fissuring involving the middle fossa, was made. This was verified by incising the scalp and raising a large displaced fragment, and a long fissure extending towards the middle fossa, which in all probability involved a part of the petrous bone.

A large percentage of fractures of the base of the skull are mere fissures, which are often very firm, and which close almost instantly after their production, so quickly, in fact, that blood is not found between them. Sometimes rare forms of fracture will be found, as breaking of either of the clinoid processes of the sphenoid.

Prognosis of fracture of the base of the skull depends largely upon the violence which has caused it; and the majority of fatal cases are due to contusion of the brain or the large nerve trunks, or hæmorrhage from other intracranial lesions resulting from the same violence. The longer the fissure the greater the danger, especially when it takes its origin in the vertex, thus being more likely to invade some of the air cavities and produce a compound fracture. Fissures which are definitely confined to the base are not exempt from the danger of air infection from any of the air sinuses, as the ear, frontal, sphenoid, and ethmoid, making the fracture compound in character, although no external wound is evident. Another important factor which must be carefully considered is the amount of injury to the brain substance. Any positive evidence of such injury having taken place should always be regarded as most unfavorable; although the writer recalls a case in which a drachm of brain substance escaped from the internal ear in a bad basilic fracture, and yet the patient recovered, though with impaired brain function. This shows that recovery often follows undoubted fracture of the base of the skull, sometimes of the severest character. There is no doubt that a large percentage of the cases of basilar fracture that recover do so with some impairment of sight or hearing, or some special sense disturbance due to pressure or exudate along the nerve trunks. The impairment of brain function, whether temporary or permanent, depends upon the amount of concussion received by the brain at the time of the injury.



The diagnosis of fracture of the base of the skull depends largely upon the careful consideration of three distinct phenomena:

(1) The escape of blood from the seat of fracture until it is detected at certain points beneath the skin.

(2) The escape of brain substance, blood, and serous fluid from the skull, through the nose, pharynx, or external ear.

(3) The impairment of the nerves of special senses, or functional disturbance of any of the cranial nerves. The spread of blood may be beneath the skin, or mucous membrane of the pharynx, or conjunctiva, all of which are points where ecchymosis is likely to appear when an injury has occurred; though these conditions are by no means infallible signs that fracture of the skull exists.

Ecchymosis about the eye is a most common condition following trifling injuries in the region of the eye, and appears almost immediately after the reception of the injury. Those

ecchymoses which appear two or three days after the injury are much more significant. Fractures which extend into the orbit give rise to hæmorrhage into that cavity and cause protrusion of the eye. I do not recall a case where this was the only symptom present; but when it does exist, it is significant of serious trouble, and probably indicates the rupture of a large vessel. Escape of brain substance means, of course, a break somewhere in the base of the skull. When coming from the external ear, it means some break in the wall of the upper part of the ear apparatus. It has been stated that this condition is much more liable to happen in persons advanced in years, owing to the rarefaction of the bones about the tympanum. The writer recalls a case, however, where a considerable amount of brain substance escaped from the ear of a child who had sustained a fracture of the base of the skull.

The escape of blood from the ear, nose, and pharynx are common occurrences in basal fractures. The ear is the most frequent point of exit, owing to the tunnelling of the petrous bone by canals which connect with the ear in such a way that blood is liable to escape in considerable quantities if the petrosal sinuses, or any large meningeal vessel, have been injured. Blood may, however, find its way through the external ear as the result of a slight contusion rupturing the tympanum. The origin of the hæmorrhage can often be determined by the careful use of the otoscope.

The escape of serous fluid, either mixed with blood or by itself, is a pathognomonic sign, and where it escapes there must be some tear in the dura or arachnoid, as well as a fissure in the same portion of the petrous bone. Where the two fluids—that is, blood and serum—are mixed, the latter, in doubtful cases, can be detected by rubbing the effused material between the thumb and finger, when the peculiar quality of serum will manifest itself; whereas blood alone would soon become dry and sticky. The amount of fluid that may escape varies. If the hæmorrhage only comes from the vessels in the ruptured tympanum, it will be of short duration, as the vessels are very small and will soon cease to bleed. If, however, it arises from a torn sinus or vessels of the dura, it may



be very persistent, lasting for several days. As a rule, the escape of serous fluid is not so profuse as the escape of blood, but often lasts for a much longer period, sometimes as much as from one to two ounces escaping in twenty-four hours. A case is cited where sixty-three ounces escaped in 106 hours. Some abnormal condition of the brain may have existed in this instance, however. At other times, hardly enough will escape to be recognized.

Hewitt states that nearly 50 per cent. of fractures involving the middle fossa were accompanied by distinct bleeding from the ear. In 70 per cent. of the cases which did not bleed, the tip of the petrous bone was involved, as shown by post-mortem examination. My own experience would lead me to believe that bleeding is a much more frequent occurrence, but I regret that I have no exact data on this important symptom.

The paralysis of certain cranial nerves, or groups of nerves, as before mentioned, is significant of basilar injury, as these nerves are frequently impinged in their exit where involved by the fracture; or they may be injured by a spicule of bone dividing, pressing, or bruising them, and thus result in loss of function to the parts supplied by them. Similar conditions may result from injury to the origin of the nerves in the brain. The seventh and eighth pairs of nerves are those most frequently involved; although in one of the writer's recent cases there was paralysis of the fifth, sixth, seventh, and eighth pairs of nerves; yet practical recovery ultimately resulted.

Emphysema of the tissues about the orbit and nasal passages is significant of some break in the continuity of the air passage, and may possibly exist in the region of the mastoid. It is, however, so common in other injuries, as in fracture of the nose, that its presence must be carefully considered with other symptoms before a positive diagnosis is made.

Coma is in nowise diagnostic of fracture of the skull. It may be present in a number of traumatic conditions involving the brain in which the skull is intact. It is present, however,

to a greater or less extent, in all severe fractures, especially those of the base of the skull. This condition is frequently confused with coma produced by alcohol. The value of its proper recognition cannot be overestimated, not only because it is the condition with which traumatic coma is most liable to be confounded, but because error in diagnosis may inflict so much unnecessary suffering and possible disgrace to the patient, and involve additional danger. Such an error places the most serious responsibility upon the surgeon. Many head injuries have been mistaken for alcoholism and the patient left to die in a police station. Coma should not be ascribed to alcohol except after the strictest process of exclusion, after every symptom of head injury has been considered seriatim. In discriminating between the two forms of coma,—alcoholic and traumatic,—the temperature is our best guide. In the former the temperature is subnormal, whereas in the latter it is slightly above normal, except shortly after the receipt of the injury, when considerable shock may be present. As reaction begins, however, it soon rises until it reaches a point several degrees above normal.

The prognosis in fractures of the base of the skull depends mainly upon the extent of the violence which has produced the injury. The danger arises from contusion of the brain or large nerve trunks, or other intracranial lesions, which may have resulted from the same violence. The longer the fissure the greater the danger, especially when the fissure radiates from the vertex, as there is then more danger of some of the air cavities of the skull having been opened, and thus the fracture rendered compound,—a contingency which should always be carefully considered because of the ease with which such an opening of the air-cells may have occurred, and the difficulty of detection. The fatal element in such cases, as before stated, is injury to the skull contents. Rarely is an average fracture of the base of the skull beyond repair; almost everything depends upon how much the brain has been injured, and whether septic infection can be prevented. The recovery from basilar fracture is seldom ideal; some lesion, or impairment of the special senses, or cranial nerves, is apt to remain to a greater or less extent.



Little dependence can, however, be placed on statistics of fracture of the base of the skull. Out of forty-six cases of this variety of fracture which occurred in my own practice, 69.5 per cent. terminated fatally, and 30.5 per cent. recovered so that they were able to leave the hospital in fair condition. Possibly, in some of the cases cited as having recovered, fracture may not have existed, as post-mortem verification was impossible, but all doubtful cases were carefully excluded. I find that these percentages are almost identical in both hospitals from which I have collected my data.

The *treatment* of fractures of the base of the skull is largely expectant, the part involved being practically beyond the field of surgical intervention. There is little left for the surgeon to do except to assist the tendency of nature to repair the injured parts. The salient features of the treatment might be mentioned, in brief, as: absolute rest in bed with ice-bags or cold compresses to the head; thorough sterilization of the auditory canal if blood or serous fluid is escaping, and protection of it with some aseptic dressing; the administration of small quantities of calomel and opium by the mouth, preferably in the form of Dover's powders, two grains of pulv. Doveri and one-quarter grain of calomel every three hours, and an ice-bag to the head. Such is the routine treatment usually pursued. On theoretical grounds opium should be contraindicated in head affections; but practical experience has led me to believe that it is one of the most useful remedies that we have at our command. Figuratively speaking, it puts the brain in splints, and thus places it in the most favorable condition for the repair of its injuries. Of course, it must be used with discretion, especially if there arise any signs of coma. Calomel is an old remedy in these conditions, and is valuable for, as the old writers say, its "anticipatory antiplastic effect." All those careful hygienic attentions should be paid which the thoughtful attendant's good sense will naturally suggest, but which are beyond the scope of this paper.

In the treatment of fractures of the vault of the skull,

especially from an operative point of view, the surgeon should resort to every means in his power to restore the continuity of the skull, even if no signs of compression appear. The treatment of a simple fracture of the vertex, so long as no operation to relieve depression is called for, should be of the simplest possible character, corresponding to the general principles laid down for governing injuries of the base of the skull. When depression does exist, even though the external parts are not injured, the treatment, contrary to the teachings of many distinguished surgeons, should at once become operative. The consensus of opinion of the more advanced surgeons of to-day is, that it is not only justifiable, but the best practice, to cut down and elevate the depressed fragment of bone. This opinion seems correct for many reasons, aside from those immediately apparent, when we consider the secondary and remote consequences of the lesions, if dealt with in the manner advised by the less advanced surgical teachers. If properly performed, the operation is not nearly so dangerous as failure to relieve the presence of so plain an indication. I may go even farther, and say that I think it advisable in doubtful cases to incise the scalp over the questionable point and be positive whether a depression exists or not. By following this procedure, fractures have been recognized which would otherwise have been overlooked.

In dealing with compound injuries, the course to pursue is, in the majority of cases, much plainer. The fact of the existence of an open wound makes the diagnosis easier. Here it is imperative, aside from the relief of points of pressure, to remove all loose splinters and spicules of bone which are liable to wound or irritate the dura or cortex; and, in fact, to get rid of all tissue, soft or bony, whose vascular supply is such as to make its nutrition doubtful. The wound in many cases may be closed with the view of procuring immediate union; but if there is a disposition to bleed, either from the dura or diploæ, it is much wiser to pack the wound with gauze and depend upon closing it later. If the wound be infected at the time of operation, a drainage tube may be inserted; but it is rarely necessary to carry this tube beneath the edge of the bones,



carrying it out of the most dependent part of the scalp being all that is necessary. Early and frequent dressing of the wound is imperative, especially in septic cases, as the slightest retention of pus or other product of inflammation is liable to set up meningitis, which is frequently and rapidly fatal.

A few words with regard to stellate or punctured fractures. These are invariably depressed, with ragged, irregular edges, and unquestionably call for the use of the trephine or the rongeur forceps, until the edges are smooth, and all sources of irritation to the dura or cortex are removed.

The operation of trephining *per se* in careful hands is practically without risk, and where cases of fracture of the skull terminate fatally, it was not the operation, but the condition which demanded it, that caused death. In the writer's tables this operation was performed in twenty-six cases, all but three of which recovered, making a mortality of about 11.5 per cent., compared with a mortality of over 51 per cent. in the pre-aseptic era.

The appended table is the result of the deductions made from cases which occurred in the writer's service at the Episcopal and Pennsylvania Hospitals during a period of ten years in the former and seven years in the latter.

| | | |
|---|---|---|
| Total number of cases treated | 146 | |
| Number of recoveries | 84 | 57.5 per cent. |
| Number of functions impaired | 11 | 15.06 " " |
| Number of deaths | 62 | 42.5 " " |
| Number of deaths within twenty-four hours | 54 | 87.1 " " |
| Number of trephine operations | 26 | |
| Number of trephine operations recovered | 23 | 88.5 " |
| Number of trephine operations died | 3 | 11.5 " " |
| Average number of days in hospital, those recovered (not within twenty-four hours) | | 18.8 |
| Average number of days in hospital, those died (not within twenty-four hours) | | 3.64 |
| Average number of days in hospital, those trephined; recovered | | 22.28 |
| Average number of days in hospital, those trephined; died | | 3.66 |

## NEUROPATHIC AFFECTION OF THE BONES.

DR. CHARLES H. FRAZIER presented a man, sixty years of age, by occupation a freight conductor; a moderate user of tobacco and alcohol; never contracted syphilis. At the age of twenty-five he began to complain of occasional shooting pains in the left tibia, at first referred to a portion, now to the entire, shaft. Associated with the shooting pains, which have increased in severity and frequency, is a hypertrophy of the bone throughout its entire length. Five years ago the patient began to notice some disturbance of function in the right knee; at present he can neither fully extend nor fully flex the joint.

Examining the skiagraphs that were made of the left and right knee-joints and of the left and right shafts of the tibia, one notes that the breadth of the articular ends of the bones entering into the conformation of the right knee-joint is considerably greater than that of those bones entering into the conformation of the left knee; that, furthermore, there are sprouting from the articular surfaces of the joint bony outgrowths, osteophytes, or exostoses which spring probably from the edges of the articular cartilage. The skiagraphs of the shafts of the right and left tibia differ from one another in that the shaft of the left or affected bone is broader, denser, and more irregular in outline. The medullary cavity is demonstrable in the skiagraph of right tibia, not of the left. Further than this no information can be gathered from the skiagraphs.

The conspicuous features of the case worthy of attention are these, to wit:

(1) An affection of the osseous system bilateral and asymmetrical in its distribution.

(2) Beginning at the age of twenty-five and extending over a period of thirty-five years.

(3) Not affecting in the slightest degree the patient's general health.

(4) Running an afebrile course.

(5) In which pain is the most conspicuous, in fact the only, subjective symptom.

(6) With no apparent tendency to progressive involvement of other bones or other joints.

(7) With no concomitant lesion in the bones of the face or cranium, or the bones of the trunk, vertebra included.



(8) The pathologic process being essentially a formative one, that is, one attended with generation, and not with destruction, of bone, a process which from the apparently increased density of the left tibia, as demonstrated by the skiagraph, is one akin to osteosclerosis rather than osteoporosis.

(9) An affection of obscure origin, in so far as it is not traceable to infection, to traumatism, or to any demonstrable lesion of cord or brain.

Dr. Frazier said that he (1) could conceive of an osteoperiostitis of a syphilitic nature, slow but progressive, gradually involving the entire shaft of tibia; a bone which might be said to be the seat of predilection for syphilitic lesions, an osteoperiostitis attended with generation of bone by ossification of the inflammatory exudate, which would account for the present condition of the left tibia.

(2) Knowing how many years the typhoid bacillus lies dormant in the system without setting up any inflammatory reaction, one might be tempted to hold this organism responsible for the condition of the left tibia, were it not for the fact that the patient has never had typhoid fever.

(3) Disregarding for the time the left tibia, one might say that the presence of the osteophytes or exostoses along the margin of the articular surfaces were suggestive of the condition met with in the early stages of osteoarthritis.

(4) Again, the enlargement, especially of the articular ends of the long bones, calls to one's mind Marie's disease, the so-called hypertrophic osteoarthropathy, which is for the most part a pulmonary affection accompanied by enlargement of the extremities.

No one will take exception to the statement that this case presents an unusual and an atypical manifestation of one or another of the bone-affecting diseases. That it is not of infectious origin, inflammatory in nature, Dr. Frazier was convinced. Reasoning by the process of exclusion, there remains for consideration that class of bone diseases which, for want of a better name, is called neuropathic or trophoneurotic, a class including such affections as Marie's disease, as acromegaly, as leontiasis ossea, as Paget's disease (osteitis deformans), a class having many features in common: beginning at or after middle age, *i.e.*, in the decline of life; of duration unlimited, the affected indi-

vidual dying of some intercurrent affection; the process primarily an osteoporosis, secondarily an osteosclerosis, and essentially formative and associated with hypertrophy of the bones involved; the symptoms almost wholly objective; the prognosis favorable as to life, but absolutely unfavorable as to recovery, occasionally the process being arrested; the treatment purely symptomatic.

As to the characteristic features of each of these affections: in acromegaly they are enlargement of the inferior maxilla, the supraorbital ridge of the hands and feet; in Marie's disease they are the enlargement of the articular ends of the bones, especially those entering into the elbow, shoulder, knee, wrist, and fingers. There is no lesion in cranial or facial bones; in osteitis deformans there are enlargement of the bones of the skull and of the tibias and femora together with a kyphosis in the cervicodorsal region, a symptom common to both acromegaly and Marie's disease. The lesions of leontiasis ossea are confined to the bones of the face, of which the superior maxilla is the first to be attacked.

Were it necessary to classify the affection as exhibited with any one of these classes the reporter would be disposed to select osteitis deformans, realizing that one is but an incomplete picture of the other; that instead of the lesions being widely distributed, the process is confined to but one bone of the left leg and to one articulation of the right.

## CÆCAL HERNIA.

Dr. Francis T. Stewart and Dr. John H. Gibbon read papers on cæcal hernia, for which see pages 66 and 69.

Dr. William J. Taylor said that Dr. Gibbon attributes the formation of this hernia to the mesentery or long mesocolon. The speaker, however, thought that Mr. Jonathan Hutchinson, Jr.'s, dissection of monkeys to be rather against such a conclusion. Hutchinson has shown, in a very large number of monkeys, that the mesocolon and mesentery are unusually long and free in monkeys, and yet hernia is almost unknown among them. The mesentery is very much longer than in the human being, and one would suppose that would have a tendency to the production of hernia in monkeys, if that was a factor.

Dr. Ross reported the case of a man operated on by him



for right inguinal hernia. The cæcum occupied the sac in this case, due to the fact that the arching fibres of the transversalis and internal oblique, instead of arising from the outer half of Poupart's ligament, started not more than one inch below the anterior superior spine, so that the external ring was approximately three and a half to four inches long. This man had an undescended testicle, which was removed.

Dr. Richard H. Harte said that he had seen a number of cases of cæcal hernia in his hospital practice, and in every instance in which he had operated he had found a portion of the ileum also in the hernial sac. He was convinced that the ileum was the first portion of the bowel to make its descent, and then it gradually dragged the cæcum down later. This seems undoubtedly to be the most rational cause for the cæcum's appearance as a hernial protrusion. This doubtless, on the whole, is due to a relaxation of the mesentery. In regard to Dr. Taylor's remarks in reference to the infrequency of hernia in monkeys, he would say that can be ascribed largely to the position which they maintain in walking, usually going on all fours rather than in the erect posture. If a similar position was maintained in human beings, doubtless hernia would be much less frequent than it now is.

## MORTALITY OF OPERATION FOR OBSTRUCTIVE JAUNDICE.

Dr. John B. Deaver read a paper entitled as above, for which see page 90.

# THE MORTALITY OF OPERATION FOR OBSTRUCTIVE JAUNDICE.

By JOHN B. DEAVER, M.D.,

SURGEON TO THE GERMAN HOSPITAL.

The following is the classification of causes of obstructive jaundice by Murchison, "Osler": (1) by foreign bodies within the ducts, as gall-stones and parasites; (2) by inflammatory tumefaction of the duodenum or of the lining membrane of the duct; (3) by stricture or obliteration of the duct; (4) by tumors closing the orifice of the duct or growing into its interior; by pressure of the duct from without, as by tumors of the liver itself, of the stomach, pancreas, kidney, or omentum; (5) by pressure of enlarged glands in the fissure of the liver, more rarely by abdominal aneurism, a fæcal accumulation or the pregnant uterus; (6) to these may be added lowering of the blood-pressure in the liver, so that the tension in the smaller bile-duct is greater than in the blood-vessels. In this class very probably may be placed the cases resulting from mental shock or depressing emotions.

Of the above causes of obstructive jaundice, I have only met with those caused by calculous obstruction of the hepatic and common or of the cystic ducts, where the stone was located at the junction of the cystic and hepatic ducts with obstruction of the latter; stricture and angulation of the common duct caused by adhesions which were making either pressure or traction; pressure on the common duct from carcinoma of the head of the pancreas, either alone or in connection with cancer of the duodenum. A condition to which my attention has been drawn, upon more than one occasion, is the association of attacks of jaundice with very movable kidney, and I have been inclined to attribute this in part, at least,





to traction upon the peritoneum, and consequent angulation of the common duct.

The cause of death in the cases which I have lost were consecutive and secondary hæmorrhage, exhaustion, and cholæmia. I have, with one exception, been fortunate enough to have had autopsies in these cases, and therefore have been able to rule out peritonitis as the cause of death.

Mayo Robson (Disease of the Gall-Bladder and Bile-Ducts, Second Edition, 1900) reports twenty-two deaths following operation for the relief of obstructive jaundice. Of these, seven died as the result of hæmorrhage either consecutive or secondary; five of exhaustion; four of shock; three of heart failure, one of which was complicated by nephritis; one of an abscess between the liver and diaphragm, which was not discovered at the operation; two of peritonitis, in one of these a small hole was torn in the colon by the breaking up of dense adhesions, and in the other a ligature, which had been used to tie off the cystic duct in amputation of the gall-bladder, slipped and caused extravasation and peritonitis. It would seem therefore that his experience coincides with my own, and that peritonitis is not a common factor in the mortality. It is a question with me if most of the cases which die of exhaustion or heart failure are not in reality cases of cholæmia. Shock cannot be separated from hæmorrhage as a cause of death, for it is the loss of blood, either at the time of operation or following it, that causes the shock.

From the present status of surgical interference for obstructive jaundice, it should not have the mortality credited to it from either of the causes mentioned, as I will try and show later on.

Neither consecutive nor secondary hæmorrhage should occur, and particularly consecutive hæmorrhage. The latter is due, pure and simple, to the blood changes consequent upon the prolonged jaundice. The exact changes which take place in the blood, I believe, have not been definitely determined. It is probable, however, that there is some chemical change which inhibits the fibrin-forming element, and thus prevents

rapid coagulation. The ordinary blood-counts indicating anæmia, hæmoglobinuria, leucocytosis, etc., do not account for the tendency to hæmorrhage in obstructive jaundice. The effects of the bile salts on the blood-vessels must also be taken into account. There seems to be a relaxed condition of the arteries which interferes with their proper contraction, thus encouraging free bleeding.

I have met with but two cases of secondary hæmorrhage, and in each of these there was a period of consecutive bleeding preceding the onset of secondary hæmorrhage, and which was controlled only after the wound had been packed with gauze. In both of these cases the gauze packing introduced to control the consecutive bleeding was removed on the seventh day, the removal being effected without difficulty and with practically no pain. In one case, three days after the removal of the gauze, secondary bleeding occurred, costing the patient her life. The same may be said of the second case, except that it was only by the most heroic efforts that her life was saved. Intravenous saline transfusion given by my house surgeon, Dr. Moore, upon two different occasions, full doses of opium, absolute rest of the stomach, nutritious enemata, etc., were the means to which we can ascribe her recovery.

I have seen but one death from consecutive hæmorrhage alone. This patient died within twenty-four hours following the operation. The control of primary hæmorrhage by means of the ligature is certain. I have never been unfortunate enough to wound the portal vein or any large vessel. To guard against consecutive bleeding, chloride of calcium in thirty-grain doses for three or four days before as well as after operation, as recommended by Robson, I believe good practice; yet, I am sorry to confess, I have not been able, in my comparatively limited experience, to attribute much good to it. A wider experience and greater familiarity with its use may perhaps convince me of its utility and benefits. Suprarenal extract has lately taken a place as a hæmostatic, and in one of the cases herein reported it was tried with seeming success.



Obstructive jaundice due to gall-stones is usually due to obstruction of the common or hepatic ducts; it may, however, and in fact frequently does, occur when the gall-stones are confined to the cystic duct or gall-bladder. Here the obstruction to the flow of bile is due to the associated cholangitis. This is a rather favorable condition of affairs for operation, as the removal of the gall-stones from the cystic duct or gall-bladder will be followed by a rapid subsidence of the inflammatory swelling of the common duct. Reidel (Gumprecht, *Deutsche Med. Work,* 1895, No. 15) says that two-fifths of the cases of jaundice in cholelithiasis arise in this way.

Drainage plays an important part in the above result; this is probably accounted for by the fact that the valve-like action of the reduplication of the mucous membrane lining the cystic duct is overcome by the obstruction to the flow of bile, and the slow regurgitation becomes a steady flow of bile into the gall-bladder, and the drainage provides for the escape of the excess.

There is a class of cases where the inflammation in and about the gall-bladder is so intense that the surrounding tissues and organs become gangrenous, and the patient succumbs to the exhausting effects of local and constitutional sepsis. The following case is an illustration:

C. P., aged fifty-three years; for several years prior to present attack has had "bilious attacks" without jaundice or pain. Present attack began five weeks before admission to German Hospital, December 4, 1900. He had pain in the region of the gall-bladder radiating to shoulder; he was tender over the gall-bladder, but was not jaundiced. He continued his occupation for two weeks. Three weeks prior to admission, the pain and tenderness became more aggravated, and jaundice made its appearance for the first time. The jaundice has gradually increased until the present time; bowels constipated; the gall-bladder was enlarged, and upon deep pressure tenderness could be demonstrated.

Operation.—The gall-bladder was enlarged and tied to the liver by dense adhesions. It contained many large stones, pus, and bile, and its walls were ulcerated and friable. The common and cystic ducts presented the same condition as the gall-bladder and contained many stones; there was one stone in the hepatic duct. The stones were all removed and the cavity packed with gauze and drained. On the sixth day the gauze

packing was removed, liberating a considerable amount of pus; the tissue about region of the gall-bladder was necrosed, and a large pus cavity led down behind the liver. He died of exhaustion due to local and constitutional sepsis.

Post-mortem.—Localized fibrous peritonitis, no involvement of general peritoneum.

A careful study of the causes of the mortality of obstructive jaundice leads us naturally to the consideration of the best methods to adopt to combat the disease. Shall we treat them as medical cases, with the prospect of surgical help if medical measures fail, or shall we treat them as purely surgical cases? And if so, how and when? If we take the six causes for obstructive jaundice, we can see that two, namely, inflammatory tumefaction of the duodenum or bile-ducts and changes in blood-pressure, are purely medical cases, while in the other four the indications are distinctly and positively surgical.

The most common of all causes, and more common than all the others put together, is obstruction from gall-stones. Parasites are so rare that they can be passed by with the mention, although the indication here is distinctly surgical. Every case of cholelithiasis that I have operated upon has given a history of repeated attacks treated medically, yet have not been cured of the disease or freed from its dangers. Each succeeding attack is accompanied by local and systemic changes which detract from a favorable surgical prognosis. We have seen that the most common cause of death is hæmorrhage caused by changes in the blood; that the next most common was exhaustion, or what we believe to be cholæmia, and third, most common, shock which is a result of hæmorrhage, and that these three causes are undoubtedly enhanced by delay or long continuance of the pathological factors of the disease.

It would seem, then, that operation, and early operation, offers the best safeguard to the destructive possibilities of obstructive jaundice due to cholelithiasis. Strictures or obliteration of the duct; tumors closing the orifice of the duct or growing into its interior; pressure from without by tumors of contiguous organs, or by enlarged glands in fissure of the



liver, present indications so unmistakably surgical that it is hardly necessary to argue the point.

Marked jaundice, and especially if of long duration, offers a serious obstacle to operative interference, and yet in some cases we must assume the increased risks. The class of cases in mind is the fulminating type of the disease; they run a course similar in onset, duration, and termination of the attack to the fulminating form of acute appendicitis. A differential diagnosis is oftentimes difficult to establish; yet the one most important fact can be established as a rule, *i.e.*, general peritonitis, which is the usual accompaniment of fulminating appendicitis and unusual in the case of the biliary apparatus. In either case operation should be synchronous with the establishment of a diagnosis, or even with a strong suspicion of the trouble; under these circumstances it is better to open an abdomen and find little or nothing wrong, than to do so later on in the attack and find an irremediable condition of affairs.

The time which elapses between the onset of an attack of fulminating obstructive jaundice and its fatal termination is, at the most, a very few hours; and even in this short time it is usual to find gangrenous destruction of not only the gall-bladder and ducts, but of the contiguous organs and tissues, and especially the duodenum and liver. Here the only hope is prompt relief of the obstruction and adequate drainage.

The important fact to be learned by this paper, and which to me seems to be the only logical deduction, is that early operation not only in the acute exacerbation of the disease, but in the early days of the disease itself, not only offers the best and surest prognosis as to recovery, but as to the mortality as well.

The five cases reported in this paper are used as a text; they represent the mortality of this affection in the German Hospital during 1898, 1899, 1900, and for January and February, 1901.

A. W., operated in 1898. Obstructive jaundice. Stone in common duct; had consecutive hæmorrhage, which was controlled by packing;

four days after operation a secondary hæmorrhage occurred, and, in spite of packing, she died of shock due to hæmorrhage.

C. L., operated in 1899. Obstructive jaundice. Urine loaded with bile. Gall-bladder enlarged and filled with sanguineous pus; five stones removed from gall-bladder and one from cystic duct. Patient died of exhaustion two days after operation.

C. P., aged thirty-eight years; married. Diagnosis, cholelithiasis. Admitted May 22, 1899; discharged May 27, 1899; result, death. Father, mother, one brother, and three sisters living and well; uses alcohol very moderately; married thirteen years; two living children, two died in infancy. Had usual milder diseases of childhood, had enjoyed excellent health up until three years ago, when he had an attack of enteric fever. Present trouble began one year ago, although he had not been feeling well since his attack of enteric fever two years before. Has lost fifty pounds within the past two years. The present trouble began with severe cramplike pain in the hypochondriac region. These remained localized in the position, and did not radiate. At the same time he became nauseated, and for several days continued to vomit small quantities of biliary material. At this time he was confined to bed for a period of ten days, although his pains had greatly moderated after the fourth day of onset of the symptoms. During this period, and for an indefinite time thereafter, his stools, which were infrequent, were of various colors, varying from a light grayish clay color to dark brown. During this attack his skin became yellow, but gradually faded out until he became perfectly white again. Urine was at times of a deep brown color, staining his underwear. After a time he became better and finally resumed his work, and continued at it until last November (1898), when he again had a similar attack with pain, biliary vomiting, constipation, and jaundice, differing only from the former one in severity. This attack did not confine him to bed; but since then he has never been free from jaundice or pain and tenderness over the region of the gall-bladder. During the next four months he continued moderately jaundiced, but does not know whether his jaundice moderated or became more intense at times. His stools were of a variable color, at times clay colored, at others of a deep brown color.

His present condition began four weeks ago with severe pains in the left hypochondrium, followed by nausea and biliary vomiting. Fæcal passages and urine had the above mentioned characteristics. This attack, like the preceding one, did not confine him to bed, but prevented him from continuing at his occupation. His pain (although moderate) and soreness in the region of the gall-bladder have continued until his admission to the hospital. His jaundice was gradually becoming more intense.

Upon admission, temperature and pulse are normal. Has the above symptoms, with slight tenderness upon deep pressure just below the costal arch, three inches to the right of the median line. It seems that faint gall-stone crepitus can be felt in this position. Gall-bladder and area of liver dulness are not enlarged.

Operation, May 24, 1899. Patient prepared and etherized, using 480 cubic centimetres of ether. An incision through the rectus muscle. The



gall-bladder was partly visible and projected slightly below the inferior hepatic border; it was only slightly distended. The peritoneal cavity was packed off with wet, hot sterile gauze, and the region of the gall-bladder explored by the finger. The finger inserted in the foramen of Winslow disclosed a large stone about the size of a pigeon's egg, occupying a position in the common duct, behind which the cystic duct and gall-bladder were slightly distended with bile. An incision about one and one-half inches in length in the common duct released the stone and many smaller triangular ones which had collected in the duct. The duct was then mopped out with iodoform gauze and the incision closed with a row of continuous sutures. The area just behind the common duct was drained by rubber tubing and two pieces of gauze. The gall-bladder was opened by an incision barely large enough to admit a small rubber drainage tube; the latter was packed around with two strips of gauze, the tube emerging at the lower end of the abdominal incision. The tube draining the area behind the common duct came out just below it. The gauze packing was removed and abdominal wound closed by interrupted, through-and-through silkworm-gut sutures, silver foil, and iodoform gauze dressing.

May 25, 1899. Abdomen greatly distended, not tender. Distention diminished after turpentine enema. Pulse very feeble. Facies drawn and pinched.

May 26, 1899. Pulse has become more feeble and at times barely perceptible, skin cold and clammy. Patient has begun to vomit small quantities of greenish material. This has kept up without interruption during the day. Delirium in a mild form has set in, and altogether patient is in a very poor shape. Abdomen greatly distended and tympanitic; hepatic area of dulness not marked.

Partial Postmortem.—Localized fibrinous peritonitis; no pus in general peritoneal cavity. Death probably due to cholæmia.

W. J. P., aged fifty-four years. Diagnosis, gall-stones. Operation. Admitted January 26, 1901; discharged February 4, 1901. Result, death.

Mother living and well. One brother died of enteric fever; one brother living and well. One son and one daughter living. Wife living. No history of carcinoma or phthisis.

Patient was very weak when admitted. He was emaciated, exceedingly nervous, extremely jaundiced, no fever, and fair pulse. His illness began in February, 1900, with a diagnosis of catarrhal jaundice. Gall-stones were considered, but he never had pain in any way resembling biliary colic. In the following May he was improving from the attack, and had a slight attack of colicky pain lasting twelve hours, which suggested biliary colic. After this he began to fail; he lost flesh, had marked anæmia, leucocytosis, constant nausea, and appearance of cachexia. Malignant trouble was positively diagnosed.

In July he had a second attack of colicky pain of short duration, followed by rapid improvement. He gained weight, was free from jaundice, and he thought he was cured, when on his return to Philadelphia, in November, the jaundice, weakness, loss of flesh, and nausea returned.

Gall-stones were diagnosed. Operation was considered, but was deferred, hoping for improvement. He steadily lost ground until he was admitted on January 26 with above symptoms and leucocytosis of 15,400. Pruritus was marked and distressing.

Three days after admission he was operated under ether anæsthesia. Incision was made through the right rectus muscle into the peritoneal cavity. The gall-bladder was felt to be smooth, not markedly enlarged, and the seat of a large stone. The intestines were walled off with gauze. The gall-bladder was opened on the anterior surface and a large stone (of size of first joint of thumb) was removed. The stone was free. Another stone was felt in the common duct. This was also movable. It was removed by making an incision into the common duct. A rubber drainage tube was placed into the gall-bladder and through the opening in the duct, and was held in place by a chromicized catgut ligature.

A piece of iodoform gauze was placed under the gall-bladder and left in. The large pieces of gauze were removed, and the wound was closed by through-and-through silkworm-gut sutures, except at the upper part, where the two tubes and gauze were placed.

He did well for two days after the operation; his mind was clear and alert, pulse and temperature good. He slept fairly well, expelled flatus, and took nourishment. There was slight but continual oozing of blood from the wound and a free discharge of bile. He could not urinate voluntarily. The next two days he became nauseated, restless, passed scanty amounts of urine, pulse more rapid, mind not so clear. The slight oozing from the wound was not checked by packing; the gauze was removed on the third day after, but the oozing continued. It was checked at once with a 1 per cent. solution of suprarenal extract.

On the fourth day he became delirious, semicomatose; pulse was weak; was nauseated with occasional vomiting; abdomen was flat, and he passed flatus. He was transfused, with temporary improvement for twelve hours, at the end of which time he was again transfused. After repeated enemas he had a slight bowel movement on the fifth day. After this he gradually sank, and was unable to take food by mouth or rectum; pulse could not be felt; was semicomatose; extremely jaundiced; pruritus marked even in delirium, vomited, and unable to retain anything by rectum.

He died while in this condition. Wound healed beautifully. Permission for an autopsy was refused. This was, I think, a death from cholæmia.

The cases of death reported by Mayo Robson are as follows:

No. 283. Obstructive jaundice. Several loose stones in common duct. Cause of death was violent and persistent hæmatemesis. Death on second day after operation.

No. 264. Obstructive jaundice for months. Pressure from cancer of pancreas. Died on fourth day of cardiac failure. No peritonitis.



No. 178. Obstructive jaundice. Common duct thickened and contained gall-stones. Death from exhaustion and shock on third day.

No. 149. Obstructive jaundice. Four months. Cancer of pancreas and common duct. Death from intraparietal and intraperitoneal hæmorrhage without peritonitis. Lived one week.

No. 141. Obstructive jaundice. Cholelithiasis; eighteen stones, dense adhesions. Gall-bladder removed. Ligature slipped on second day. Extravasative peritonitis.

No. 243. Obstructive jaundice. Stone in ampulla of Vater; removed through duodenum. Pus collection between liver and diaphragm. Not discovered until autopsy.

No. 255. Obstructive jaundice. Stone in common duct and one in ampulla. Well until fifteenth day; died on seventeenth day of heart failure. No peritonitis.

No. 277. Obstructive jaundice. Stone in common duct, which was immensely distended. Numerous adhesions; violent hæmatemesis twelve hours after operation.

No. 272. Obstructive jaundice. Stone in gall-bladder; two stones in common duct. Many adhesions. Persistent vomiting, and death from exhaustion on fourth day.

No. 236. Obstructive jaundice. Stones in common duct; hepatic duct and cystic duct removed. Patient died on sixth day of heart failure and exhaustion.

No. 177. Obstructive jaundice. Stone in common duct removed by incision and duct sutured. Died at end of five weeks from exhaustion.

No. 59. Obstructive jaundice. Stone in common duct; adhesions removed; incision and then suture. Death from peritonitis due to fæcal extravasation from a small hole in colon caused by adhesions.

No. 250. Obstructive jaundice. No stones or tumor felt; cirrhosis of liver and some swelling of head of pancreas. Disease probably cancer of papilla and subsequent cholangitis. Died of shock and exhaustion on third day. No autopsy.

No. 274. Obstructive jaundice. Cholelithiasis. Patient weak, and no attempt to remove stones. Bladder drained. Died on second day. Hæmorrhage, which was in the form of persistent oozing.

No. 143. Obstructive jaundice, with hæmorrhage from various localities. Stricture of common duct. Death from hæmorrhage and shock in twenty-four hours.

No. 51. Obstructive jaundice. Distended gall-bladder, no stones; head of pancreas hard. Died of shock on second day.

No. 33. Obstructive jaundice. Cancer of pancreas, with gall-stones. Hæmorrhage of nose, bowel, etc. Died of shock promptly.

No. 11. Obstructive jaundice. Cancer of pancreas, distended gall-bladder. Death on ninth day of hæmorrhage.

No. 235. Obstructive jaundice. No stones in gall-bladder or common duct. Death in seven days, of syncope. Kidneys granular and capsule adherent. No peritonitis.

No. 159. Obstructive jaundice. Adhesions, gall-stones, and infective cholangitis. Death from general oozing at site of torn adhesions.

No. 92. Obstructive jaundice. Eighteen stones from ducts; infective cholangitis, adhesions. Death on twelfth day; exhaustive, persistent vomiting. No peritonitis.

Richardson, in a paper read before the Surgical Section, meeting of American Medical Association, 1900, reports thirteen deaths in cases of biliary calculi and about 100 recoveries. He claims that early operation is not attended by any mortality, but the fatal cases were those operated late or after cholæmia had become a factor.

DISCUSSION.

Dr. John H. Gibbon asked whether Dr. Deaver had ever seen death from acute dilatation of the stomach after operation for gall-stones. He did not mean dilatation that results from constriction of the duodenum, from adhesions, but acute dilatation following operation.

Dr. Deaver replied that he had never seen acute dilatation of the stomach in the deaths following gall-bladder surgery. He had had five deaths, but had not seen a death result from that cause. He had seen what might have been diagnosed as acute dilatation of the stomach; but when he followed these cases to the autopsy table, sepsis was revealed. If there is no sepsis, there will be no acute dilatation of the stomach or alimentary canal.

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## ENTERORRHAPHY WITH AID OF THE O'HARA FORCEPS.

Dr. Gibbon said that in a case of strangulated hernia he had had an opportunity to use the O'Hara forceps, where it worked very well indeed, and it would seem to be particularly commendable in these cases. It does not require any of the methods, such as rubber bands, forceps, etc., for preventing the flow of fæces over the wound. In this case he was enabled to do an anastomosis a great deal quicker than if he had used the



hands only or the La Place or Downs forceps. The patient died very shortly after the operation from shock. There was every evidence of a perfect anastomosis post-mortem.

## THE TREATMENT OF SUPPURATING HÆMATOCELE FOLLOWING EXTRA-UTERINE PREGNANCY.

Dr. George Erety Shoemaker read a paper with the above title, for which see page 102.

# THE TREATMENT OF SUPPURATING HÆMATOCELE DUE TO EXTRA-UTERINE PREGNANCY.

By GEORGE ERETY SHOEMAKER, M.D.,

GYNÆCOLOGIST TO THE PRESBYTERIAN AND METHODIST HOSPITALS.

Extra-uterine pregnancy is encountered by the gynæcologist at widely different periods of development, ranging from the fifth week to the ninth month, or even to the condition of missed labor after term. The conditions to be met may differ as widely as the poles, ranging from the tiny, unruptured, non-adherent tube with a living ovum, to a formidable condition with a full-term child and a vascular placenta widely attached to intestine or other non-contractile site. The range is from a simple collection of fresh fluid blood free in the peritoneal cavity and easily washed away, to the enormous encapsulated blood and tumor mass walled in by adherent intestine, omentum, and thick inflammatory sac formation with suppurating contents.

The condition of the patient may be that of the young and vigorous woman in abounding health (one of my patients rode a bicycle the day before I operated and after the preliminary rupture). She may be going about as usual, with only a few cramp-like pains, considered trivial, or she may be, when first seen, in profound collapse, with general sepsis long after rupture and the death of the fœtus.

Quite recently the writer has operated on three of these various types, each requiring different management, and his previous experience covers other varieties of condition. No one can lay down a stereotyped treatment for extra-uterine pregnancy, so far as detail is concerned, for the various resources of the surgeon who is accustomed to dealing with





complicated abdominal conditions will be taxed to the utmost by some cases. It may, however, be stated that the treatment is distinctly operative. Granted that the conditions be recognized, the day of attempts to kill the fœtus by electricity or other means has probably passed forever.

If the mass found be considered residual, and Nature making an attempt to surround and absorb it, the risk of suppuration or peritonitis still demands immediate operative relief. As to the choice of route, whether vaginal or abdominal, there has been some discussion in recent years. As is well known, certain operators acquire great dexterity in dealing with intra-abdominal conditions through the vagina. A number of these have attempted and a few have advocated the vaginal route for the treatment of the ordinary, comparatively simple recent case. With this plan the writer cannot agree. A number of these operators have encountered difficulty in controlling hæmorrhage, and have had to resort to abdominal section in order to save the patient. There is much likelihood that vaginal hysterectomy might be forced upon the operator to gain room or to control a troublesome hæmorrhage.

Although the writer is accustomed to operating by the vagina for various conditions, and possesses the requisite familiarity with the technique, he would strongly advise the abdominal route only in all cases unruptured, or recently ruptured, as well, of course, as when the child has developed for some months, whether it be living or dead. Where the tube is unruptured, the anatomy is often disturbed and ligation is much surer from above. With free blood in the peritoneum, toilet and ligation are thus best accomplished. With a well developed child, living or dead, the question of vaginal treatment should not arise.

There remains, however, the condition of suppurating hæmatocele from early ruptured tubal pregnancy, or hæmatocele which Nature has thoroughly walled in and is trying to absorb. Here, with the diagnosis once clearly established and confirmed by abdominal section, instead of proceeding to break

up adhesions and deal with the condition from above, the writer believes that the abdomen should at once be closed and the collection be drained from the vagina. The convalescence will be smoother and safer, as it would be from the vaginal drainage of any pelvic collection with no sac except adhesions. An illustrative case is here given in which this method was successfully carried out.

Mrs. L. D. was admitted to the writer's service at the Presbyterian Hospital, January 19, 1901, with this history: Age, twenty-three years; white; Ireland. Married three years; one child two years old. No miscarriages. Menstruation every four weeks; lasts three to four days, not painful but profuse. No periods missed to date. Four months ago began to have leucorrhœa and obscure uterine discomfort, but periods continued normal. A flow lasting as usual about three days, stopped on December 6, but a few days later violent cramp-like pain in the left lower abdomen began. No fainting or collapse. The flow returned, and has continued daily since, that is about three or four weeks. Quantity, two napkins. Color, red or brown. Some nausea, not in morning. Loss of appetite, flesh, and strength. Patient on admission very pale, skin moist, lips blue, pulse somewhat rapid.

*Examination.*—Mass fills lower abdomen to umbilicus, highest to the right. Slightly tender. Resonance impaired, but not dull (adherent intestine partly made up its wall). Muscles not rigid. Spleen, heart, kidneys, liver negative. Vagina not blued, but some passive congestion. Cervix rather soft. Uterus appears forward, fundus just above pubis, and closely adherent to large mass below, behind, and above it. Rounded, tense, smooth, firm prominence in Douglas's cul-de-sac, apparently fluid though resistant. This mass could not be displaced, and slight movements of the uterus are independent of it. No mammary signs of pregnancy. Hæmoglobin, 55 per cent.; red corpuscles, 4,560,000; leucocytes, 13,600. The diagnosis gave rise to some speculation among those who examined the case, but as the semisolid, fixed mass, of recent formation, was outside the uterus, as there was constant recent brownish discharge, a rather soft cervix, and a history of recent pain attacks, extra-uterine pregnancy was considered not unlikely. The leucocyte count indicated inflammatory changes in the mass. On incising the abdominal wall, the parietal peritoneum, omentum, and underlying structures were inseparably matted. The incision was therefore extended upward, until in the umbilical region a point was found where the peritoneal cavity could be entered above the mass. A finger was passed around the side of the omental edge, when the fluid character of the walled-in collection was demonstrated by palpation.

Its upper wall was made up of intestine, the edges of the coils being adherent to one another by the peculiar hard, wooden, inflexible adhesions which betoken the existence of a false sac with inflammatory contents.



In front the collection was firmly walled in by omentum and bowel most solidly united to the abdominal wall and bladder. No sign of blood or blood-stain appeared free in the open upper peritoneal cavity, and all the surfaces were here smooth. The suspicions of incarcerated extra-uterine pregnancy were now confirmed.

An experience with a similar case several years before had demonstrated to conviction the extreme difficulty of safely separating omentum and bowel down to the contents of such a sac; the great rigidity of its walls and their inability to collapse when emptied; the ragged internal surface of the sac from adherent, partly organized clot; and the danger of late infection of the upper peritoneum after the sac had shrunk.

This experience occurred in a case admitted to the Methodist Hospital after various attempts had been made by dilating her cervix under ether to deliver her of a supposed full term pregnancy which she did not have. She had been treated by various physicians and was septic. I opened the abdomen above and found one of those incarcerated extra-uterine blood masses described above. I attempted to deal with it from above the pubis, but shall never repeat the effort. In the case now under discussion the abdominal wound was therefore provisionally closed with clamped sutures, without entering the sac, and the posterior prominent vaginal wall was incised. Some pints of decomposing, thin, brown blood with gray purulent streaks escaped, while large black clots of somewhat more recent formation were carefully dislodged. Gentle irrigation. No fresh bleeding. No evident large tubal mass remained. Vaginal drain of gauze and rubber tube. Returning now to the abdominal wound, the sutures were tied without drainage.

A culture made from the contents of the sac developed a pure growth of streptococcus.

The patient did splendidly from the first. The temperature never rose above 99.4° F., and the pulse showed little disturbance after the first day, when its highest rate was 128. The contrast in her condition would have been marked had I separated and stitched the bowel, and after great difficulty packed the cavity from above. As it was, the abdominal adhesion sac rapidly shrank; irrigation was cautiously continued every second day. After the first few days the discharge from the vaginal opening was slight, rather more opaque than mucus is, and never had any odor. The abdominal wound healed primarily. When discharged from the hospital, a small sinus about an inch in depth remained behind the cervix, but was rapidly closing. All that remained of the large abdominal mass was a little thickening behind the uterus, about as large as three fingers. The mobility of the uterus was still impaired. The patient was entirely without discomfort or symptoms, and her hæmoglobin had increased from 55 per cent. to 65 per cent.

While this is but a single case, it must be recalled that this form of incarcerated blood collection is not very frequently met. It is indeed remarkable how Nature proceeds to wall

in the blood, absorbing any which may have strayed, so that on opening the abdomen not a sign of blood or blood-stain appears until a very complete wall of intestine, omentum, and lymph is broken down. When the collection is not too great, it will be walled in entirely behind the uterus, as beautifully illustrated in a case operated upon at the Methodist Hospital. There the clot filled the pelvis as high as the fundus of the uterus, the edge of the adhesion wall being attached across the top of that organ, leaving the bladder free to dilate. The broad ligaments were stretched outward and then backward, exactly as though the tubes had been held out like arms. The fimbriated ends curved inward. Towards the diaphragm the colon was densely adherent, while in front of all the small intestine and omentum were attached. A strong sac had formed around the blood-clot, which was of the size of two fists. This sac could be peeled off the peritoneum at some points, but not all. Separation of adhesions was difficult, and some bowel stitching was required. As the emptied sac would not collapse and could not be entirely removed, a Mikulicz gauze-bag drain was packed into it and brought through the parietal wound. This case was not suitable for vaginal treatment, because the left tube was much distended by the pregnancy, apparently containing a mass which it would have been dangerous to leave.

This patient was thirty-three years old, had had seven children, and a miscarriage only five months before. She had had regular periods since the last, so called, two weeks before operation. The history of pain attacks and irregular bleeding lasted about four weeks. She is now in excellent condition, pulse 78, but will require careful draining for some time, owing to bowel-wall infiltration and ragged sac interior.[1] Another case of ruptured extra-uterine pregnancy I operated upon nine days ago, also at the Methodist Hospital. She may be mentioned here by way of contrast with the other cases. The diagnosis was easy and was made before operation. The patient was twenty-three years old, and had never before

[1] Patient made a complete recovery.



been pregnant. The blood-clot, about ten or twelve ounces, was free in the peritoneal cavity. It was readily removed, the adhesions separated; the left tube and ovary, shown in the specimen, tied off, and the abdomen closed without drainage. She also is doing finely, with a pulse about 76.[1]

Where suppuration is going on, as in the first case described, it is quite certain that the fœtus is dead, and that further hæmorrhage will not occur. In the early stages of ruptured extra-uterine pregnancy, of course, successive hæmorrhages are the rule, and for that reason the only good treatment includes thorough ligation of the affected area.

Vaginal incision and drainage I consider, therefore, only adapted to a very few cases, which have been thoroughly walled in, where there appears to be no undrained tube mass, and where previous abdominal exploration has demonstrated the strong incarceration of the clots. All other cases should be dealt with exclusively from above. The recognition of these suppurating incarcerated cases, and their distinction from tubal and ovarian abscess, or adherent retroversion with incarcerated intra-uterine pregnancy, will always present some difficulty. The leucocyte count will be high in the first two conditions and low in the last named. In the hæmorrhage cases, a low red-cell count and the physical appearance of anæmia suddenly established will be helpful.

It may be of interest to note that in the three recent cases referred to in this report, there was no instance of a missed period, all of the ruptures being probably in the early weeks. Not one of the patients had actual collapse. In two of the cases the walls of the tube had not ruptured, but the hæmorrhage had escaped from the fimbriated end of the distended tube.

## DISCUSSION.

Dr. Deaver said that he regarded Dr. Shoemaker's discrimination between free blood and walled-off exudate as very logical indeed, and particularly so when he mentions in one of those cases that the culture showed streptococcus. If he had at-

[1] Patient made a complete recovery.

tempted to make that enucleation through the abdominal route, he would have disseminated sepsis; and if he had, he would have lost his case of peritonitis. He agreed with him in choosing the abdominal instead of the vaginal operation. When one opens the abdomen, one can say, "I am master of what I survey;" but in these cases of walled-off abscess, which they practically resolve themselves into, the surgeon is not master of all he surveys if he evacuates them through the abdominal route, notwithstanding he may be well reinforced with gauze. Infection can be transmitted through the gauze and communicated to a healthy peritoneum beyond. He gave the details of a case of pelvic hæmatocele in the true sense, one having no connection with an extra-uterine pregnancy. This girl was menstruating and dancing. Suddenly she was taken with abdominal pains. Dr. Ross diagnosed internal hæmorrhage. The abdomen was opened for the purpose of establishing the diagnosis, and there was found a hæmatoma occupying the interval between the two layers of the broad ligament. The abdomen was closed; the broad ligament space was opened through the vagina, drained, and the patient made an uneventful recovery. He had disposed of several cases of suppurating extra-uterine pregnancy in that wise. In this class of cases, where a doubt exists as to whether pus is present, in the absence of the usual constitutional evidence of pus, the blood count is of considerable avail; so that where there is a high grade of leucocytosis, and it is not possible to detect fluctuation by vagina or reach the mass by vaginal touch, it is indicated to open up the abdomen, locating the condition, and then deal with it from below.

Dr. Ross remarked with reference to the case which Dr. Deaver had referred to, where there was a true intraligamentary hæmatocele; this girl was twenty-one years old when the accident happened. At the age of twelve she had had an abdominal abscess, which the doctor diagnosed at the time as appendiceal abscess. As a result of the inflammation, she had very strongly adherent adnexas, which rendered the broad ligament very rigid. It was probably due to the rigidity of the broad ligament that the rupture of the vessel occurred. That was the explanation that seemed most rational to Dr. Deaver and himself in thinking the matter over. He added that there were no indications of pregnancy, either objective or subjective.



Dr. Shoemaker rejoined that it was not positive that the case mentioned by Dr. Deaver was not one of extra-uterine pregnancy. He did drainage only, and saw nothing to establish the diagnosis. The early rupture of the tube is very commonly downward, and therefore between the folds of the broad ligament, and the escape of blood into the peritoneal cavity is not uncommonly secondary.

## AMPUTATION AT THE HIP-JOINT FOR SARCOMA; THE TENDENCY TO RECURRENCE.

Dr. John A. Wyeth read a paper with the above title, for which see page 110.

# TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

The President, De Forest Willard, M.D., in the Chair.

*Stated Meeting, April 1, 1901.*

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## FREQUENCY OF RECURRENCE OF SARCOMA,

### WITH ESPECIAL REFERENCE TO AMPUTATION AT THE HIP-JOINT ON ACCOUNT OF THIS NEOPLASM.

By JOHN A. WYETH, M.D.,

OF NEW YORK,

PROFESSOR OF SURGERY IN THE NEW YORK POLYCLINIC AND HOSPITAL.

The surgeon of large experience cannot fail to be impressed with the extremely malignant character of sarcoma as shown by the frequent recurrence of this neoplasm, either locally or remotely. This is true whether the tumor is removed by dissection without amputation, or when an amputation is made more or less remote from the growth. What I have to say here does not refer to that rare and most fatal variety of this neoplasm known as the melanotic sarcoma, but of the three ordinary surgical forms, the round, the spindle-cell, and the myeloid or giant-cell varieties. For a while I thought that perhaps I was unusually unfortunate in dealing with these cases, but in later years a study of the reports of other surgeons convinces me that my experience was not exceptional; that in fact sarcoma was the most malignant form of neoplasm.

In my own practice I can now recall but two cases which in strict propriety can be claimed as cured, and to these I will call especial attention. I have a number of patients still surviving, one now in the fourth year after a hip-joint amputation with no sign of recurrence; but I cannot yet count this case as cured, for I have under observation, also, a man at whose shoulder-joint I amputated five years ago for an osteosarcoma of the upper end of the humerus, but which five months ago recurred in the stump. This and other cases show how fallacious it is to pronounce as cured patients who have once become the victims of this unfortunate disease.





Within the last twelve months, while engaged in collecting the cases in which amputation at the hip-joint had been performed by my method, I was impressed with the frequent recurrence of sarcomata in the lungs or other viscera, and occasionally in the stump, even when the disease was seemingly entirely confined to the bone and well removed from the line of incision in forming the flaps.

Out of 267 cases of amputation at the hip by this method there were 131 done on account of sarcoma, fourteen of these, or 10.6 per cent., ending fatally, wholly or in part as a result of the operation. This ratio of mortality is in my opinion large, for the reason that in several of the fatal cases there were complications grave enough to have rendered success practically impossible. Gangrene existed in one instance for two weeks before the operation, the patient being *in extremis*, and showing a rectal temperature of 104° F. at the time of amputation. dying in shock soon after. Another case was in collapse and practically hopeless by reason of severe hæmorrhage which occurred, due to breaking down of a large vascular osteosarcoma; a third case recovered from the operation but died from what was termed "tubercular peritonitis" on the eleventh day; while a fourth case, after a good recovery from the operation, suffered pyogenic infection of the flaps and died from septicæmia on the twenty-sixth day. In one other fatal instance the disease involved the tissue so high up that the acetabulum and the pelvis were infiltrated, necessitating curettage of an extensive region above the tourniquet, and followed by death in shock four hours later. A sixth case is included in the death list, although the patient succumbed from asphyxia on the twelfth

day, the positive cause of death not being disclosed, but in all probability due to rapid infiltration of the lungs with the sarcomatous elements. There were, however, no complications in eight of the fatal cases, dying from four to twenty-six hours after the operation, most of them in shock, and no doubt death was due in very great measure to this formidable procedure.

If the complicated cases were eliminated and only the eight fatal and uncomplicated cases considered, the death-rate would be 6 per cent.; and Mr. Thomas Chavasse, of the Birmingham General Hospital, in an excellent paper on amputation at the hip-joint, in the London *Lancet* of July 21, 1900, asserts that in properly selected cases the death-rate by this method should in future not exceed even this low percentage.

Of the 117 cases which survived operation, I have obtained more or less satisfactory histories of eighty-three. In fifty-two of these it is noted that the disease recurred, but since, in one instance, the neoplasm could not be entirely removed, this case is properly excluded. There are then a total of fifty-one, or over 63 per cent., ending fatally by recurrence.

If, however, a careful analysis of the cases in which the disease returned is made, it is evident that this estimate of the ratio of recurrence is too low, for in many of the cases classed in the non-recurring list so short a period of time had elapsed since the operation, that judging by the statistics in the recurring tables, the large majority of these will without doubt ultimately be added to the list of fatalities. Thus, of the fifty-one recurring cases, twenty-seven returned between one month and twelve months after amputation, while in five out of the twenty-nine cases reported as not having recurred when last heard from, only three, four, six, eight, and twelve months respectively had elapsed since the operation.

From the list of cases upon which this paper is based one may infer that the location of the tumor, that is, its proximity to the line of incision in forming the flaps, or the fact of its being confined to the bone, endosteal or periosteal or involving the soft parts, has little, if any, influence upon the ultimate safety of the patient. Thus of the five patients operated upon



by the writer, in the case which longest survived, the man being now alive and well three years after operation, the tumor began as an osteosarcoma at the great trochanter and immediately below this point, and by periosteal extension had infiltrated the soft parts as high as the obturator foramen, from which a very considerable mass of the sarcomatous material was curetted. It seemed, in fact, the most unfavorable of all my cases. In another, seemingly ideal for the reason that the tumor was an osteosarcoma, and confined to the bone just at and above the condyles, with fully sixteen inches from the upper limit of the mass to the hip-joint, the patient survived only twelve months, dying from recurrence in the lungs, the stump remaining uninvolved. In another instance a neurosarcoma of the internal popliteal nerve recurred in the soft parts at the knee, and again at the middle of the thigh; and then, when a hip-joint disarticulation was done, the stump escaped, the disease recurred in the lungs, causing death eleven months after the last operation.

Two other of my cases of osteosarcoma of the femur, one a girl of seventeen and the other a youth of twenty, died respectively six months and thirteen months after the operation from recurrence in the lung with no involvement in the stump.

Professor Charles B. Nancrede reports five cases, the longest survival being a girl of fifteen, who was living, at last account, two years after the operation. Of the other four, a man, thirty-two years of age, died in six months from recurrence in the stump; another man, thirty-five years old, died within a year, the stump being involved; a third, a man thirty years old, died from recurrence in the lungs and brain sixteen months later, while a girl of sixteen had the neoplasm recur in the stump with general metastasis before death, nine months after operation.

Of the three cases of Mr. Thomas Chavasse that survived operation on account of sarcoma, two were endosteal and one of periosteal origin. There was no recurrence in the stump in either case, but the disease returned in the left lung in one endosteal case thirteen months later; in both lungs in the other

case of endosteal origin, while the periosteal sarcoma ended fatally eleven months with recurrence in both lungs.

Among the encouraging cases, the longest survival (nine years and still in good health), the disease was a myelosarcoma of the neck of the femur in a boy of fourteen, operated upon by Dr. Harry M. Sherman, of San Francisco.

In an unusually interesting case by Professor J. D. Griffith, of Kansas City, in which an enormous osteosarcoma extended from the trochanter down to near the knee, the patient still survives, four years after the operation, although the flaps were taken from immediately over the location of the growth. On the other hand, in a case operated upon by Professor H. H. Grant, of Louisville (a surgeon of large experience and well-known skill), in a man of forty-three years, the tumor being at the knee and well away from the line of operation, death ensued fourteen months later from recurrence in the lymphatics of the abdominal wall just above Poupart's ligament.

Of the eighty-three cases, twenty-nine are reported as not having returned. The longest surviving case which may be justly counted as a cure is that reported by Dr. Harry M. Sherman, of San Francisco, California, in a boy of fourteen, for myelosarcoma of the neck of femur, the patient being now alive and well, nine years after the operation.

Two cases survived seven years, one for osteosarcoma of the condyle of femur, by Dr. W. C. Dugan, of Louisville, Kentucky, still living at this date; while the second case, a boy of fifteen, by Dr. A. M. Phelps, of New York City, was living seven years after operation when last heard from two years ago.

There are also two in the five-year list, one still surviving and well at this date, by Dr. L. L. Shropshire, of San Antonio, Texas, the patient a negro of twenty years, the sarcoma involving the lower and middle third of the femur. In the second case the history terminated one and a half years ago, a girl of seventeen years at time of operation, having periosteal sarcoma of the femur, was living and well five years after operation.

Three survived four years. One of these, by Dr. J. D. Griffith, of Kansas City, in a male twenty-one years of age, was of enormous size, extending from the trochanter nearly to the knee, the flaps being cut from immediately over the neoplasm. There is no recurrence at this date. The other two cases were living and well when last heard from four years after operation. One by Dr. Leonard Freeman, a central osteosarcoma of the lower third in a man forty-seven years of age; the other by Dr. D. C. Hawley, of Vermont, an osteosarcoma of the femur in a man twenty-one years of age.



Three cases are in the three-year group without recurrence. One by the writer, situated at the great trochanter, the neoplasm having spread to the soft parts as high as the obturator foramen, from which the disease was curetted. This patient is living and well now three years after the operation, and will be again referred to. In the other two cases the histories are not complete, one by Dr. Robert Weir, with no recurrence when last heard from, and another by Dr. F. A. Dunsmoor, a man of twenty-five years for sarcoma of the lower end of the femur, had not returned when the history closed.

Three cases were surviving two and a half years after operation. One, a boy of six years, by Dr. A. M. Phelps, was living and well when last heard from two years ago. The other two of this group are still living at this date. One by Dr. J. D. Griffith, a child of five years, and a woman of thirty-five years operated upon in 1898 by Dr. Charles K. Briddon.

Nine cases are reported as surviving two years. Those living and well at this date are, one by Dr. J .D. Griffith in a child of nine years; another by Dr. Charles S. Hamilton, of Columbus, Ohio, a woman of thirty-two years, who is not only well at this date, but has borne a healthy child since the operation. The other cases were living when last heard from, but the histories are not complete, as the patients were lost sight of. One a woman of twenty-six years, operated upon in 1892 by Dr. Frank Hartley; a woman of twenty-four years, by Dr. W. N. Van Lennep, of Philadelphia, in 1895; a man of thirty years, by Dr. Charles K. Briddon; a man of thirty-five years, by Dr. R. W. Stewart in 1895; a woman of twenty-nine years,

with periosteal sarcoma, by Mr. George Heaton; a man of thirty years, operated upon in 1897 by Dr. H. P. Cooper; and a girl of sixteen years, by Dr. Charles B. Nancrede, 1894.

One case, a woman of twenty-four years, having sarcoma of the soft parts of the thigh, operated upon by Dr. W. B. Coley in 1898, was surviving eighteen months later.

One case, a child of five months with myxosarcoma of the knee, was well fourteen months later when last heard from, the operator being Dr. F. W. Parham, of New Orleans.

One case by Dr. E. W. Holmes, a man of twenty-three years of age, with osteosarcoma of the femur, had no recurrence at last report, one year after the operation

Dr. M. B. Herrman reports no recurrence in a man twenty-four years of age, eight months after operation.

Dr. W. B. Coley operated upon a man of forty-five years for osteosarcoma, with no recurrence at last report six months after operation, while in Dr. Charles McBurney's case no recurrence had taken place three months later, when the patient was last heard from, the operation being done in 1890, on a man of thirty-four years, for osteosarcoma of the femur.

The cases which recurred fatally with the period of immunity are as follows: One a boy of eighteen years for sarcoma of the thigh, operated upon by Dr. Frank Murray, of New York, in 1894, with death from recurrence in the lung four years after operation. Case 2, a woman of thirty years, operated upon in 1892 by Dr. W. W. Keen; patient lived three and one-half years, and died from recurrence, most probably in the abdominal viscera, as there was no mention of involvement of the lungs in the report. This case has an additional interest, being one of two cases of pregnancy when the operation was performed, the woman going to term and giving birth to a healthy child.

Five cases survived two years, one by Dr. W. B. Coley, in a girl of thirteen years, chondrosarcoma of the femur recurred fatally in two years, location of recurrence not given. Another by Dr. Vinke, girl of sixteen years, recurred in the stump and mesenteric glands; another by Dr. Van Lennep, in a girl with



recurrence in the lung, and a fourth case by Dr. L. L. Hill, of Montgomery, Alabama, osteosarcoma of the femur forty-four inches in circumference, male, thirty-five years of age, recurred in the stump. A fifth, by Dr. Carl Beck, of New York, an osteosarcoma of the femur, woman fifty-four years of age, recurred in the lung and pleura.

One case by Dr. A. C. Bernays, lad of eighteen years, for sarcoma of the thigh, survived twenty months, died from recurrence in the lung.

Seven survived eighteen months. One sarcoma of the soft parts recurred in the stump and iliac fossa; a second recurred at the sacro-iliac synchondrosis; third recurred in the lung; fourth in the pleura; fifth in the liver; sixth in the abdominal viscera; seventh in the lung.

One case survived sixteen months, recurring in lung and brain.

One fifteen months, with recurrence in the lung.

Three survived fourteen months. One recurred just above Poupart's ligament; second recurred in the stump, and a third in the lung.

Two survived thirteen months, both dying from recurrence in the lung.

Five survived one year. One by the writer, osteosarcoma of the lower third of the femur, recurred in the lung; a second case returned in the lungs, and a third recurrence, location not stated; fourth recurred in the scalp, orbit, and elsewhere, and fifth in the glands and viscera of the abdomen and chest.

Three cases are reported as having died "within a year;" one recurring in the stump, another case of sarcoma of the soft parts of the thigh in the lung, and a third by Dr. McRae, in a lad of seventeen years, for osteosarcoma from recurrence in the pleura near the pericardium.

Four cases survived eleven months, two recurring in the lungs, one in the liver; the fourth, location of recurrence not stated.

Two survived nine months, one dying from general metastasis; second, from recurrence in the lungs.

One case recurred fatally in eight months, the stump being intact. At time of operation this case, however, suffered from lancinating pains in the chest.

One recurred in the abdominal viscera seven months after operation, the stump being intact.

Eight cases survived six months. Three recurred in the stump, three in the lungs, one in the lungs and abdomen, and one probably in the brain, as the patient died from apoplexy as was reported.

In addition to the foregoing, one case is reported as having perished several months from recurrence, location not given, died in a few months, the disease having been left in the stump at time of operation.

Another recurred " very early" in the lungs, while another died in a few months, the disease having been left in the stump at time of operation.

The following summary gives the location of the recurring neoplasm: Lung, 23; lung and brain, 1; lung and pleura, 1; lung and abdomen, 1; pleura, 2; abdominal viscera, 3; liver, 1; abdomen and chest, 1; stump, 10; stump and mesenteric glands, 1; stump and general metastasis, 1; stump and iliac fossa, 1; lymphatic, just above Poupart's ligament, 1; sacro-iliac synchondrosis, 1; location not given, 4; apoplexy, 1. Total, 53.

In concluding these statistics, deplorable enough, yet not so unfavorable as those submitted by others who have made a study of sarcoma of the long bones, I desire to add the following cases from my personal experience.

On the 20th of May, 1884, W. P., thirty-three years of age, came under my care with the following history: About six months before this date he had been struck with the butt-end of a billiard-cue upon the abdominal wall, a little to the right of the median line and half-way between the pubes and the umbilicus. The contusion caused him no special concern, and after two or three weeks of slight soreness and ecchymosis disappeared. At the end of two months, a small induration showed itself over the original point of injury. This gradually increased in size, was



not painful, and when I saw him on the date above given there was a hard sessile mass extending from the level of the umbilicus to just above the pubes, and spreading two inches to the left and four inches to the right of the median line. The tumor was adherent to the muscles and was not painful on pressure. The notes taken at the time say that the " patient is fairly well nourished, appetite is poor, bowels regular, tongue slightly coated." He states that " during the last two months he has lost flesh and strength." He had a specific urethritis fifteen years ago which left no complications, and five years later had three small chancroidal ulcers of the prepuce which healed under local treatment, and were followed by no secondary symptoms.

On the 21st of May, under ether, I made an exploratory incision and removed a considerable piece of the neoplasm for microscopical study, the section extending as deep as the centre of the tumor, which bled slightly, the hæmorrhage being readily controlled by packing. Examination of the section by Dr. William H. Welch, now of Johns Hopkins University, Dr. William L. Wardwell, a former pupil of Cohnheim's laboratory, and myself showed it to be a sarcoma. Having about this time noticed in the *Centralblatt für Chirurgie* a report of three cases of sarcoma which were claimed to have been cured by the repeated injection into the mass of arsenous acid, I obtained the consent of the patient to try this treatment after convincing him that his condition was hopeless without it. With the ordinary hypodermic syringe I injected into the tumor around its circumference two or three drops of Fowler's solution in one spot, and then going about an inch farther repeated the process two or three times. These injections produced very considerable pain, but were continued daily or every other day for two weeks, when, by reason of the inflammation they had already caused and the increasing pain, the patient begged me to desist, stating that he would prefer death to the suffering which the treatment entailed. By this time the tumor where the earlier injections had been made was swollen, exceedingly painful, œdematous, and red, although the redness did not have the bright or polish-like character of a true erysipelas. He was by this time running temperatures varying from 100° to 103° F. with all the concomitant symptoms of pyogenic sepsis. The injections were discontinued, warm local applications were made in order to produce suppuration and allay the inflammatory symptoms which the

injections had induced, and on June 17, at his request, he was discharged and permitted to go to his home in the South. His condition was so bad at this time that I scarcely hoped that he would survive much more than the trip home, and deeming him so utterly hopeless I did not think it necessary to make inquiry by letter when he may have died. I had no doubt, however, that he was dead. Imagine my surprise when, two years later, the physician who had sent him to me originally called upon me in New York and informed me the patient was living and in perfect health; that the sarcoma had disappeared, and there was nothing now to show for it except the scar in the integument caused by my exploratory incision. He has never had any recurrence of the growth, and was living a year ago in perfect physical condition and weighing 170 pounds, which was at least forty pounds more than he weighed when he was under my care in 1884.

I believe that this patient was cured by the streptococcus infection, local and general, which the injection of arsenous acid and the consequent bacterial invasion produced.

About this time there occurred another case in the experience of a distinguished colleague, Dr. A. G. Gerster, of New York, in Mt. Sinai Hospital, where we were then on duty. It was that of a young woman of twenty-two years of age who had a spindle-cell sarcoma of the thigh, for which an amputation was made. The disease recurred in the stump, and the patient was again admitted to the hospital, but after examination, it being very properly pronounced inoperable, she was discharged, and was to have left the hospital in a day or two. Symptoms of erysipelas meanwhile developed in the stump, and she was immediately removed to the isolation ward, where the inflammation rapidly spreading over the skin of the abdomen deeply infected the sarcomatous mass, which broke down and underwent extensive sloughing. No treatment was undertaken except to nourish the patient. She gradually recovered, all symptoms of the sarcoma disappeared. She is to-day in perfect health, sixteen years after the attack.

In August, 1893, Mr. J. P., thirty-five years of age, came into my private hospital suffering from a large tumor situated between the normal location of the gall-bladder and the middle line of the abdomen and extending from the edge of the liver as far as the umbilicus, pushing the abdominal wall forward and making an elevation of several inches above the ordinary level. This patient



was very pale, greatly emaciated, and so feeble that he could not walk without assistance. He had been tapped for dropsy on three or four occasions before he came to me, and on the day after he arrived in New York I removed by measurement five gallons of fluid from the peritoneal cavity by tapping between the umbilicus and the pubes. When the abdominal wall collapsed after evacuating this fluid, I could make out a hard, round, slightly movable tumor which was globe-shaped, with a transverse and antero-posterior diameter of about six inches, and probably eight inches in the longest measurement. In view of the hopelessness of his condition, I advised him to permit me as a last resort to explore by incision this tumor, and if I could not remove it with safety, to induce a pyogenic infection of the anterior surface of the mass. On the following day, August 23, 1893, this operation was done. I exposed the tumor by an incision five or six inches in length. It was quite firm to the touch and seemed to be developed from the gastrohepatic omentum, extending from the under surface of the liver immediately over the portal vein downward and to the left in the direction of the umbilicus. It had a net-work of large vessels on its anterior surface, none of which were divided in the exploratory operation. I did not undertake to do anything at this time except to pack the wound with non-sterile gauze. Infection and suppuration rapidly supervened, and within two weeks' time there was a very marked amelioration of the symptoms. The dropsy returned very slowly. He was tapped only on one other occasion, about six weeks after the operation, and about a gallon and a half of fluid were removed. The wound was kept open and suppurating for about two months, at the end of which time, as well as we could estimate, the tumor was about one-half of the original size.

Four years later he returned to me, having suffered severe hæmorrhages from the lower bowel, which I discovered were due to hæmorrhoids, and which I removed by operation. It is now four years since this last operation and eight years since the first infection of this neoplasm. The remnant of this tumor can still be felt, but it gives him no annoyance. He is an active man, being at this time mayor of the city of Augusta, Georgia, and president of a large corporation doing a business which requires the greatest activity. I saw him within the last four months, and he was seemingly in the best possible physical condition.

In the same month, when the preceding patient was under my care, Mr. J. L. consulted me in regard to a painful trouble of the right upper jaw which he said had been pronounced an abscess, for the relief of which two or three of the upper jaw teeth of that side had been extracted, and an opening made into the antrum of Highmore, through which a small quantity of pus was discharging. Thinking that the diagnosis was correct, I enlarged the drainage opening, and advised that a plug of chewing gum be inserted into the hole when he was eating, so that foreign substances would not be driven into the antrum in the act of mastication. He did not improve as result of free drainage, and returned to me in January, 1894. I became suspicious, then, of malignant disease, and advised an exploration to determine this, to which he submitted. I removed enough of the upper alveolus to permit an exploration of the antrum maxillare, from which I curetted a suspicious-looking material, which being bathed in pus did not present the ordinary macroscopical appearance of sarcoma or carcinoma. I submitted this specimen with the history of the case to Professor J. Mitchell Prudden, of the pathological laboratory of the College of Physicians and Surgeons, New York, who reported that it was without doubt a sarcoma. I acquainted the patient with the result of the consultation, and advised a complete removal of the upper jaw, to which he immediately consented. The ordinary incision was made, the integument and the muscles lifted carefully, and all of the upper jaw removed, together with a portion of the soft palate, which I feared was involved. The incision in the roof of the mouth extended well over to the left side, and a portion of the vomer was taken away with the rest of the upper jaw of the right side. As the growth seemed to be attached more particularly to the roof of the antrum, especially to that portion forming the floor of the orbital cavity, I determined to remove this; and, in order to support the globe of the eye in its natural position, with a very delicate sharp chisel I cut away the floor of the orbit from the narrow margins of the orbital cavity formed by the maxilla, leaving a rim of bone not unlike the rim of a pair of spectacles, but removing the floor of the orbit behind this rim well back to the posterior limit of the antrum. The operation was the most extensive one of its character I have ever undertaken, but the patient recovered without any interesting complications.



The operation took place on the 1st of February, 1894, and on the 1st of March I began to induce in him a general streptococcus infection. I employed at first Coley's mixture of the bacillus prodigiosus and the streptococcus of Fehleisen, and produced with this the usual febrile reaction. About this time a case of erysipelas came under the care of one of my assistants, and I determined to use the serum from this patient in the hope of inducing a general infection which would destroy any sarcoma cells which might have been left in the operative field or which might have been already transported to other parts by the veins or lymphatics. The serum from the blebs of the erysipelatous patient, three or four drops at a time, was thrown under the skin of the abdomen, but produced no pyogenic or streptococcus infection that was noticeable. The character of this man, his patient courage, and the fact that he desired to try every possible means to effect a cure without regard to any personal risk to himself, determined me to the extreme measure of inducing, if possible, a pronounced erysipelatous infection. With this end in view I secured from Dr. Buxton, of the Loomis Laboratory in New York, a very virulent quality of the streptococcus of Fehleisen which had been increased in intensity by being passed several times through the rabbit, and these I employed until at last from an injection into the thigh just above the knee I produced an erysipelas-like inflammation of the skin which, travelling in both directions, but chiefly upward, spread on to the abdomen as high as half-way from the umbilicus to the xiphoid appendix, chiefly upon the left side, it being the left thigh which furnished the point of inoculation. Through the whole months of March and April he bore this heroic treatment manfully, and, although considerably the worse for wear when it was over, he left for his home to await the results. They are such that to this date he is entirely well, is a busy and successful lawyer in active practice, and has had constructed an artificial jaw with a movable palate, and converses so well that one unacquainted with him before the operation could not detect any unnatural intonation of voice or impediment of speech.

In October, 1895, three or four days after a preliminary ligation of the left subclavian artery in its third surgical division under cocaine anæsthesia, which was done to arrest hæmorrhage from a large osteosarcoma of the upper end of the humerus of that side, under a general narcosis of ether I amputated the left

upper extremity at the shoulder-joint, taking away the soft parts so thoroughly that there was no material to furnish the covering for the stump, which, after the hæmorrhage was arrested by ligatures and compression, was left open for subsequent pyogenic infection. This healed slowly by granulation with extensive suppuration, and two months after the operation I began to inject pure laboratory cultures of Fehleisen's coccus, producing well marked symptoms of streptococcus infection. I noticed in this case, as in the one I have just reported, that it was exceedingly difficult to induce an infection with Fehleisen's coccus until a week or two after a continuous injection of Coley's mixture, which seemed to break down the resistance of the tissues and permit the invading organisms of Fehleisen's coccus to take hold and produce their characteristic infection. Within the first six months of this amputation I infected the patient twice in this manner, and advised him to come for a few injections at least twice a year for the next two or three years. He came to my clinic to exhibit himself several times after this. On two occasions he was injected two or three times with the erysipelatous mixture. I did not see him, however, after 1898 until within about six months ago, when he returned, very much concerned about a swelling which was beginning to show itself just below the acromion process of the scapula in the scar which had covered over the wound of amputation. His condition, due, I believe, in a measure to alcoholic dissipation as well as to the recurrence of the disease in the stump, was bad. Being convinced that the sarcoma had returned, I advised him to submit to a thorough removal of the clavicle and scapula and the soft parts connected with them. He was placed in ether narcosis and an incision commenced a sufficient distance from the margin of induration. Fortunately, this incision was very slight, not more than four inches long and one-half inch deep, for the hæmorrhage was very profuse. There were no blood-vessels of any size, not even a spurt, and yet the wound bled so freely it was all I could do to control it by crowding in gauze, applying forcible compression. I waited from fifteen to twenty minutes to see if it would cease, but when the compression was removed it bled seemingly as profusely as ever. I saw then that I could not complete the operation, and abandoned it, packing the wound and permitting it again to become infected with pus organisms. I also had him return to my clinic, and introduced into the mass on three occasions from three to as high as ten drops at one time of Coley's mixture. I used on one other occasion the pure streptococcus, two minims. This induced very marked reactions each time, and were followed by improvement in the condition of the tumor and in the patient's general condition. He is still up and about attending to his business, but has kept away from the surgeon for the last three or four months. The prognosis in this man's case is, of course, unfavorable, and I do not think he will survive more than a year.



I sincerely believe, since this is the only case in which I have ever done this amputation for sarcoma in which the patient survived longer than a year, that this man's life was prolonged by the streptococcus infection; and, finally, the only one of my five hip-joint amputations for sarcoma which survived over a year, and which still survives, three years after the operation, was permitted to become thoroughly infected with pyogenic organisms by leaving a large portion of the wound open and packing it with loose gauze.

That streptococcus toxæmia, either erysipelatous or pyogenic, has an inhibitory influence upon sarcomata I have no doubt; and since, almost without exception, in cases not subjected to this infection, recurrence is the rule, I am of the opinion it should be practised whether or not the case is operable; and when an extirpation or complete removal of the part involved by amputation has been made, infection should be induced, and repeated at intervals not longer than six months for at least six years after the operation.

## DISCUSSION.

Dr. W. W. Keen said that the first thing that strikes one in connection with the subject of the paper was the great mortality, an experience which is not limited entirely to Dr. Wyeth or the cases he has collected in his paper. He had personally had four cases of sarcoma in the upper extremity and in the lower extremity two, one of which Dr. Wyeth had referred to. They were all operated on and all died. In three of those in the upper extremity, he removed not only the entire arm, but also the clavicle and scapula with it. The fourth was a very noticeable case,

because of the rapidity of its growth. She was in Dr. Weir Mitchell's clinic at the Orthopædic Hospital, and suffered great pain at the upper end of the humerus, without any indication of any tumor whatever at first. But in the course of a short time a very small, ring-like tumor developed around the surgical neck of the humerus, which Dr. Keen diagnosticated as an osteosarcoma of endosteal origin, and advised amputation at the shoulder-joint. A delay of four or five days ensued, and in this short interval the tumor had perceptibly increased in size. The amputation at the shoulder-joint was done. She got along very well for a short time; then a universal sarcomatosis set in. When she died, there were over 100 tumors on the surface.

Of the two cases in the lower extremity to which Dr. Wyeth had referred, one was in the fifth month of pregnancy. She recovered after an operation at the hip-joint by Wyeth's method. She went to Texas, was successfully confined there, and returned to Brazil to her missionary work. Three and a half years afterwards she died from an internal recurrence; of the precise nature of it the speaker was not aware. The other was a case which Dr. Chalmers Da Costa had published. The patient came to Dr. Keen at the Jefferson Clinic, and Dr. Da Costa was asked to operate on in the clinic, as his was the next succeeding clinic and speed was necessary. In this case recurrence was noted almost immediately. It was especially interesting because the tumor was so high up that it invaded the groin, and it was not possible to apply the method of Wyeth. Accordingly, the abdomen was opened by Dr. Hearn. He compressed the right iliac through the abdomen, while the hip was disarticulated. She made a recovery from the operation, but died soon after from a speedy recurrence, so speedy that it might be called a continuation of the disease rather than a recurrence.

This certainly is a very mournful list. The question occurs, in view of these facts, is it desirable to operate on these patients or not? Distinctly, we should operate on them. Only 10 per cent., or thereabouts, die, as is shown by Dr. Wyeth's table, as the result of operation. A large number have certainly a prolonged life by reason of the amputation, the recurrence taking place at varying intervals, from a few months up to one, two, three, five years, and life is undoubtedly prolonged from what it would have been had no operation been performed. But more than that, not only is life



prolonged but death is made a very much more comfortable process, if one may so speak of it; the recurrence almost always being in the internal organs, and therefore the foul discharges and very painful ulcers of the surface are avoided.

Dr. Keen was of opinion that no operation in continuity, as a rule, is allowable in these cases. If the reports of this large number of cases in which amputation at the hip-joint and at the shoulder-joint have been done are correct, and yet recurrence has taken place, it is perfectly clear that any amputation in continuity, even supposing the tumor to be in the lower end of the femur, is inadmissible. Amputation should be unhesitatingly at the hip-joint and not below the trochanters, as one is tempted to do. Thoroughness is the only possible way in which cure can be obtained. There are unquestionably a few cases which are cured for a number of years, and possibly, so far as we can judge, permanently cured. A case that is cured for even one, two, or three years is rescued from an early grave, and, therefore, though the result as to cure is small in percentage, yet only by radical operation is even that small percentage possible.

Dr. Wyeth's suggestion of a deliberate erysipelas infection is a very good one. The only question that would arise is whether it ought to be a primary infection at the time of operation, when the fatality would be very considerable; or whether it would not be better that the surgeon should strive for an aseptic operation for immediate cure, and then, as has been narrated in some of the cases, a deliberate secondary infection even with the erysipelas streptococcus itself. The results shown in Dr. Wyeth's personal cases have been such as to lead to the hope that this is a possibility; and although the percentages that Dr. Coley has reported to us are not large, yet they are encouraging.

Dr. Keen said that recently a child of six years, with a very extensive sarcoma of the soft parts of the right thigh, had been brought to his clinic. The child had already been operated at the Polyclinic by the younger Morton, but recurrence had followed. Dr. Keen was very much disinclined to operate because the child was in a wretched general condition, but the point that decided him positively against it was the one that he desired to emphasize.

About six years ago, Dr. Chalmers Da Costa published a paper, of greater importance than the profession have thus far

recognized, on the effect of ether as an anæsthetic on the hæmoglobin. He showed by a number of cases that the administration of ether, no matter for what purpose,—even without operation, and therefore when the loss of blood could not have influenced the loss of hæmoglobin,—diminished the amount of hæmoglobin very perceptibly. Mikulicz also has called attention to this, and recently in the ANNALS OF SURGERY an admirable paper by Hamilton Fish was published, in which he has borne testimony to the same effect. Mikulicz has stated that if the hæmoglobin is below 30 per cent., and ether is administered, the patient is in great danger, as the administration of ether diminishes the hæmoglobin by 10 to 20 per cent., which will make it impossible for oxygenation to go on, and therefore will invite death. In the case of this child, when he investigated the hæmoglobin, he found it was down to 45 per cent., and he rejected operation at once. He thought the rule that is proposed by Fish and by Da Costa, that we are not to operate on any case in which the hæmoglobin is below 50 per cent., is correct, and that where the hæmoglobin is below 30 per cent. we are very apt to have death on the table.

DR. WILLIAM B. COLEY said that the first patient whom he had subjected to amputation at the hip-joint was a girl, aged eleven years, with a large, acute, traumatic, spindle-celled, periosteal sarcoma of the femur. The operation was performed at the New York Post-Graduate Hospital on July 25, 1897. The patient made an excellent recovery, the wound healing by first intention. The later history of this case he had been unable to trace.

His second case was also a periosteal sarcoma of the femur, occurring in a boy aged six years. The tumor was of exceedingly rapid growth, and, although when first seen by himself in May, 1898, amputation at the hip-joint was strongly advised, the parents did not consent to an operation until the following September, and then only after a portion of the tumor had been removed by the family physician and the diagnosis of sarcoma was confirmed by microscopic examination. The tumor at that time extended over nearly the entire length of the femur. The child was considerably emaciated, and it was very doubtful whether he would survive the operation. He performed amputation on September 9, 1898, the operation being completed in thirty-three minutes. Not more than a drachm of blood was lost, and there was practically no shock following the operation. About two months later the disease recurred in the abdomen and lungs, and caused death about six months after operation.



His third case was a girl, thirteen years of age, with a chondrosarcoma of the femur. The tumor was first noticed in January, 1898, and was comparatively small when he operated on June 2, 1898. There was practically no blood lost, and the patient made an excellent recovery. The small size of the tumor, together with the fact that the growth was a chondrosarcoma, made up largely of cartilage, further, the fact that the operation was performed within six months from the discovery of the tumor, all seemed to make the prognosis extremely hopeful. The patient, however, after remaining well for about a year, began to slowly emaciate, and died one and a half years after operation from generalization of the disease.

His fourth patient was a man, aged forty-nine years, with a recurrent, spindle-celled sarcoma of the left thigh, originating in the fascia. The growth extended nearly to Scarpa's triangle, and operation was much more difficult than in the preceding case. Amputation was performed on the 15th of October, 1898. The patient made an uninterrupted recovery, but after remaining well for one and a half years, local recurrence set in, which, he believes, proved fatal the following year.

His fifth patient was a young lady, twenty-four years of age, with recurrent, spindle-celled sarcoma of the fascia and muscles of the thigh. The erysipelas toxins were tried prior to amputation, with the result that the growth apparently disappeared and the patient left the hospital. After a few months local recurrence followed, and he performed amputation at the hip-joint. In this case there was some sloughing of the flap, which caused some delay in the wound healing. The patient has remained in perfect health up to the present time. Examination made a few days ago showed no evidence of local or general recurrence.

His last patient was a blacksmith, forty-five years old, with acute traumatic periosteal sarcoma of the femur, following the kick of a horse in January, 1900. A tumor developed at the site of the fracture almost immediately after union, and continued to increase in size up to August 10, 1900, the time of his first observation. The diagnosis of sarcoma being at that time unmistakable, immediate amputation was advised, without preliminary explora-

tory incision. The operation was performed on August 19, 1900, and, although the patient's general condition was far from good,—he was suffering from valvular disease of the heart,—he nevertheless made an excellent recovery. After returning to his home, Dr. Coley advised long-continued treatment with the mixed toxins, which treatment is now being carried out by his family physician, who states that the patient has remained in good health up to the present time, there being no signs of return. While the operation in this case was practically bloodless, he omitted the precaution he had observed in all the other cases, namely, of slowly releasing the rubber tubing after all the vessels that were visible had been tied, and there was some loss of blood from a vessel that had retracted underneath a muscle in the region of the acetabulum.

Dr. Coley believes that Dr. Wyeth, in his earlier paper, advocated closing the wound and applying the dressing before releasing the rubber tubing. If this procedure had been followed in his own cases, he was certain that in at least two death would have resulted from hæmorrhage. It is better that the tube should always be released slowly, and every vessel should be clamped and tied before closing the wound, relying in no way upon pressure. The shock after operation was in no case very marked, and the condition of the patient never called for infusion.

The striking decrease in the mortality of hip-joint amputation has been largely due to better means of controlling hæmorrhage; and of all the methods that have been devised up to the present time, he believes that Dr. Wyeth's, for simplicity and effectiveness, is by far the best. Butlin's statistics show that of forty-seven cases of sarcoma of the femur in which amputation of the hip-joint was performed, 25 per cent. died of the operation; although it is only fair to state that his later collection of cases, twenty-four in number, shows a mortality of but 12 per cent. against 25 per cent. in the earlier series.

Dr. Coley strongly protested against the custom of many good surgeons of exploring a sarcoma of the femur and removing a portion for microscopical examination. He was convinced that this procedure, especially in a tumor of high vascularity, is fraught with grave peril to the patient by reason of the chance of some of the infectious agent, be it a micro-organism or an infected cell, being carried to other parts of the body. He had observed very



rapid generalization of the disease follow such exploration, and he had given it up. In case of doubt—and in early cases there may be doubt—the best plan is to prepare the patient for an operation, and, after the tourniquet has been applied, the tumor can be cut into, and the gross appearance will rarely, if ever, leave the diagnosis still in doubt; a frozen section could be made if need be.

In addition to the six cases of sarcoma of the femur or thigh treated by amputation at the hip-joint, he had had three other cases of sarcoma in which he performed amputation of the thigh just below the trochanter, all by Wyeth's method. In two of these the disease was a periosteal sarcoma of the femur, and the third a mixed cell sarcoma, originating in the soft parts. One of the patients, with a periosteal growth, died four months after operation, from metastases in the lungs. The second is now well one and a half years after operation, though another operation will remove the remaining portion of the femur, has just been performed by Dr. I. D. Bloom, presumably for recurrence. The third (soft parts) recurred in the glands of the groin, and died four months after operation.

In the case of periosteal sarcoma that died four months after operation, no toxins were used. In the second case, alive and well one and a half years after operation, and just operated upon, the toxins were used both prior to and for a considerable period after amputation as a prophylactic. In the third, with sarcoma of the soft parts, the toxins were used prior to amputation for a local recurrence with little apparent effect.

While he had had no deaths from operation in any of these nine cases of sarcoma of the femur and thigh, the final results, especially in those in which the toxins were not used after amputation, are exceedingly discouraging, and go far towards confirming the opinion of Butlin as to the hopelessness of sarcoma of the femur, even when treated with the most radical measure. Of Butlin's collection of sixty-eight cases of sarcoma of the femur treated by hip-joint or high amputation, only one was known to have remained well beyond three years.

One patient whom he saw in consultation some four years ago, a girl of thirteen, with periosteal sarcoma of the femur, and in which he advised amputation at the hip-joint, was operated upon by Dr. J. D. Rushmore, of Brooklyn, and has remained well

over three years. The only other successful cases that he knew of are, first, the patient operated upon by Dr. Geo. F. Shrady, eighteen years ago, by high amputation. The patient is still in good health. Dr. Shrady is unable to state whether the sarcoma was of central or periosteal origin; but the diagnosis was confirmed by microscopical examination, and there is no question as to the nature of the disease; and, second, the case reported by Reinhard. Even adding these three successful cases to Butlin's and those which Dr. Wyeth has been able to collect, it is clear that, in sarcoma of the femur, especially if of periosteal origin, we have to deal with a disease of the most malignant type known, and one which, in the majority of cases, has proven beyond the power of surgical resources to combat.

As to what may be expected from the toxins in these cases, while thus far there have been no cases of sarcoma of the femur cured by the toxins alone, there have been five cases of sarcoma in other long bones successfully treated,—three of the tibia, one of the fibula, and one of the radius. Only one of these cases was treated by Dr. Coley. This was a spindle-celled sarcoma of the tibia. The tumor was recurrent, and the diagnosis had been confirmed by Dr. John Caven, Professor of Pathology at the University of Toronto. The patient is well and in perfect health at the present time, two and one-half years after treatment.

He was of opinion that, instead of adopting the plan advocated by Dr. Wyeth, of using the toxins immediately after operation, before the wound has healed, the better way would be to strive for aseptic wound healing, and then, as soon as the patient had fully recovered from the operation, for example, three to four weeks later, give systematic injections of the mixed toxins for a considerable period of time, say one to two years, with occasional intervals of rest. In such a case he should advise much smaller doses than in cases in which a tumor actually exists, aiming to get only a slight reaction. Such treatment could be easily carried out by the family physician, and it would not confine the patient to bed.

The evidence in proof of the value of the toxins in preventing the recurrence of sarcoma, and even carcinoma, is slowly but surely increasing. The following are a few of the most striking examples:

Recurrent spindle-celled sarcoma of the leg and popliteal region (three times recurrent) disappeared under the prolonged use of the toxins; then recurred. Amputation at the middle of the thigh was performed, but the disease quickly recurred in the gluteal region and was entirely inoperable. Further treatment with the toxins caused a decrease in the size of the tumor, so that it was possible to remove most of it by operation. The patient was kept steadily upon the toxin treatment for more than a year afterwards; she has remained perfectly well up to the present time, four years afterwards.



Another most convincing case is that of a physician with an eight times recurrent sarcoma of the soft parts of the chest wall. The growths were recurring very rapidly and increasing in malignancy. He received injections of the toxins for nearly three and a half years, and is now in perfect health, without any signs of recurrence, nearly seven years from the beginning and four years from the cessation of the treatment.

He could cite other similar examples did time permit, but these will suffice to prove that the toxins, when persistently used, furnish us a valuable means of prophylaxis against recurrence.

Williams's collection of cases of sarcoma showed 29 per cent. of sarcoma of the bones and a considerable number of sarcoma of the femur. Of 320 cases of sarcoma he had personally observed, 25 per cent. were sarcoma of the bones, of which fourteen were sarcoma of the femur. Dr. Coley endorsed strongly the position taken by Dr. Keen, that, in spite of the very discouraging statistics, operation should be advocated. The first case of sarcoma of the femur he observed after leaving hospital was in a patient who refused operation, and whom he followed until she died. The death was infinitely distressing. The profuse discharges, the inflammation, and the foul sloughing that occurred, made the death from that recurrence following an operation infinitely preferable.

As to treatment with toxins. At the same time that he performed many of these operations for sarcoma of the femur, he had not made it the practice of using toxins as a prophylactic measure after amputation. During the last year or more he had been advocating the toxin after all operations for sarcoma, not at the time of wound healing. He thought the position taken by Dr. Keen to be the better one, that of getting the patient over the operation in the way of aseptic wound healing. But after the

wound healing has taken place, he would adopt the suggestion advocated by Dr. Wyeth, or a course that is preferable, viz., putting the patient upon a continued systematic treatment with the mixed toxins for at least one or two years after operation. The treatment should be given for one or two months at a time, giving the milder doses, not causing the high temperatures, but getting a mild reaction, and not in any way preventing the patient from attending to his or her duties.

As bearing upon the value of such treatment, he cited a few cases in which the toxins had been used as prophylactic treatment. One was an especially interesting case, being a sarcoma which started in the bones of the foot; operated upon originally by Dr. Bull, and later by himself in 1894. The foot was first removed by Dr. Bull, and afterwards he also removed a tumor—size of a child's head—in the popliteal space and thigh. The tumor recurred locally, and after having disappeared with the toxins, recurred a year and a half later in the stump; a high amputation just below the trochanter was done, and about a year later the disease recurred in the gluteal region, a place where it could be no longer removed. Then the patient was put on systematic treatment with toxins for about a year by himself, and later the treatment was carried on by Dr. Risk, of Summit, New Jersey. He had a recent letter from her stating that she was still in perfect health, more than four years after she was treated by himself and two years after all treatment had been left off. In another case, of a spindle-cell sarcoma of the soft parts of the chest occurring in a well-known surgeon not far from New York, he had eight operations for this disease, and the recurrences were taking place at shorter and shorter intervals, and, from any other stand-point than the toxin treatment, the patient seemed absolutely hopeless. The growths were changing in character from fibrous spindle-celled until they had become almost entirely round-celled and very vascular, and the round cells predominated. Toxins were given to this patient for a space of nearly four years at small intervals, part of the time by Dr. Coley and part of the time by the surgeon's assistant, in such small doses that he was able to continue his work all the time. He has had no treatment for nearly four years. He weighs 190 pounds and is still in perfect health. He could mention other similar cases did time permit.

Dr. Coley did not claim that the toxins will cure all cases,



or even most cases, but that a sufficient number have been cured to make it worth while to give these hopeless patients the benefit of the only chances of life. As to final results, he stated that in the older cases, prior to 1898, fifteen remained well from three to eight years. All of these cases were hopeless and inoperable, and in all but two the diagnoses were proved by microscopical examination in the hands of competent microscopists. The other two cases in which the examination was not made were cases in which the clinical aspects of tumor with a history of repeated recurrences placed the diagnosis beyond any reasonable doubt.

These are but a few cases compared with the large number (140) treated, but of cases of spindle-cell nearly 50 per cent. have yielded to treatment. Of the successful cases treated by this method in the hands of other men, ten were round-celled; four cases of round-cell sarcoma have been treated with success, one being a round-cell sarcoma of the lip occurring in a little girl five years of age. The disease disappeared, and the child has remained in perfect health four years after treatment.

He had had one case of sarcoma of tibia, recurrent spindle celled, treated with success, and the patient is now well, nearly two and a half years. Amputation was avoided, and the leg is perfectly strong.

Dr. Deaver said that in view of the frightful mortality of this disease, why would it not be better not to close the wound, but treat it as an open wound and infect it immediately? If cure can be brought about in this way, it is justified. His experience with amputation of the shoulder-joint had been limited. He had amputated for sarcoma at the shoulder and hip-joint in two cases; both died within a year. Another case he referred to in which Dr. Keen was associated with his brother, Dr. H. C. Deaver. That case involved the whole of the upper extremity. The patient died with sarcoma within a year. He recently had seen a case, that Dr. Coley had also seen of sarcoma of the neck and of the jaw, in which there had been several operations. He had seen her recently, and believed her now to be attacked with sarcoma of the mediastinum. With osteosarcomata of the jaw his experience had been more satisfactory.

Dr. Bloodgood said that within the last few months he had studied carefully all the cases of sarcoma of bone which had been observed in Professor Halsted's clinic from the opening of the

hospital in 1889 to the present day; the ultimate results had been encouraging. The relation between the character of the tumor and the ultimate result impresses one that there is a difference in the malignancy in the different sarcoma of bone. This seems especially true of those cases of sarcoma which are made up chiefly of giant cells. König ("Text-Book on Surgery") called attention to this many years ago, and claims to have cured a number of cases by curetting or chiselling of the tumor only. Karewski (*Berliner klinische Wochenschrift,* August, 1898) and Hinds (*British Medical Journal,* February 26, 1898) each report a case of giant-cell sarcoma situated in medullary cavity apparently cured by chiselling.

Although many authorities agree with Dr. Wyeth in performing an amputation at the highest joint for every case of sarcoma of bone, yet there are a number of authorities whose experience has taught them that, in many cases of sarcoma of the long bones, resection rather than amputation will yield equally good results. Mikulicz first advocated this in 1895 (*Archiv für klinische Chirurgie,* 1895, Band i, p. 661). Weisinger (*Deutsche medicinische Wochenschrift,* October, 1898), reporting a number of cases of resection for malignant sarcoma of the long bones, refers to Mikulicz's previous article, and agrees with his conclusions. Morton (*British Medical Journal,* July 23, 1898) and Karewski (*Berliner klinische Wochenschrift,* August 22, 1898) also report cases of resection for malignant sarcoma of the long bones. All authorities seem to argue that the chief danger in sarcoma of the bone is internal metastasis, and that local recurrence is uncommon even when the low amputation or a resection is performed. Dr. Wyeth's cases demonstrate this. The higher amputation, of course, cannot give immunity to internal metastasis; and if further experience demonstrates that the lower amputation, or, better, the resection, gives equal immunity to local recurrence, such operations, of course, give the patient more useful limbs in both upper and lower extremity. In some of Mikulicz's cases, ten centimetres of the femur or tibia were resected; bony union and a very serviceable limb resulted. In the upper extremity extensive resection, although it leaves a flail joint, yet the patients are able to use their hands to great advantage. One of Halsted's earliest cases demonstrated this. The patient was a colored woman. About seven years ago, seven centimetres of the radius and ulna, including the wrist-joint articulation, were resected. The tumor was a pure giant-cell sarcoma, originating in the periosteum, but had infiltrated the medullary cavity of the ulna bone and some of the surrounding muscles. The patient is living and well to-day, and earns a living by ironing.



Of course, as Mikulicz wrote some years ago, the earlier we operate in sarcoma of bone the better are the chances for a complete removal of the disease by resection.

A greater number of cases, however, observed over a period of at least six years, must be collected before the question of resection rather than amputation for sarcoma of the long bones can be settled. His own limited experience in the clinical observation and pathological study forced him to agree with König and other authorities that there is a difference in the malignancy of sarcoma of bone. These less malignant tumors can be recognized at operation by the gross pathological picture, and these tumors can be cured by less extensive operation. Mikulicz's and Weisinger's position, that even the most malignant sarcoma of bone, even if the tumor has infiltrated into the surrounding muscles, can be cured by resection, is not yet confirmed; but nevertheless the experience of these two authorities and others would justify the operation of resection for the most malignant sarcoma, providing that the disease is still confined to the bone and the periosteum.

Dr. De Forest Willard said that there was present a physician, Dr. McCollin, in the amputation of whose thigh he had assisted Dr. Agnew more than ten years ago. He had a medullary sarcoma of the lower end of the femur, so far advanced that the bone broke on slight force in getting out of bed. The amputation was made at the upper third of the thigh. He has been doing ten years of good, solid professional work since that time.

In sarcoma, fracture is not infrequent. In another case of amputation for sarcoma of the lower end of the femur he had the same accident occur as he picked up the limb to amputate. This person later had sarcoma in almost every organ of the body, even in the heart walls and in the endocardium. He was now treating a fracture of the femur produced by voluntary muscular action in a case of recurrent sarcoma, and had seen a number of such instances. In one case both humeri broke within three weeks from trivial causes.

In a case of amputation at the shoulder-joint which he per-

formed three years ago for small round-celled sarcoma there has been no recurrence since.

Dr. McCollin said that it was eleven years, the twelfth day of June, since he was operated on by Dr. Agnew. He believed that all present wanted to take off the left leg at the hip-joint except Dr. Agnew, who insisted on there being a short stump left. It had been a great comfort to him. He had been able to walk and do his work. He had not had any recurrence or pain. It healed up rapidly, and on the sixteenth day after operation he went out to see a patient.

He was exceedingly interested in the toxin treatment. It recalled to his mind a case upon which Dr. Barton operated, a young man who had a sarcoma of the abdomen. Upon making an exploratory operation, it was found impossible to remove it. The wound was closed and the young man put to bed. Great inflammation started up immediately afterwards. Six weeks after, when he got out of bed, he had no tumor, and never has had any since. That has been at least four years ago.

Dr. Rodman spoke of the only case of a successful amputation for sarcoma that he had ever known, and it was in the preaseptic era. He was operated in October, 1879, by the elder Gross. The wound suppurated very freely, and the man went home to Texas. Five years afterwards he was in good health.

Dr. Rodman believed that infection should be invited, and thought the same principle should be made use of in operations for tubercular glands. It is a well known fact that suppuration is more apt to cure tubercular glands permanently than excision followed by primary union. There is an antagonism between the germs of suppuration and tuberculosis, and there is far less risk to recurrence if suppuration occurs. One often sees middle-aged and old people with scars indicating scrofulous glands in childhood.

The only successful case of operation for sarcoma he had had was after excision of the lower jaw. The patient lived many years afterwards. In a second case, excision of upper jaw, eighteen months since operation have elapsed, without recurrence.

He believed that the toxins should be used in all cases after operation. He had seen betterment in many cases, but had never seen positive cure.

He had been using the toxins ever since 1893, in all of his



cases of inoperable sarcoma, but has only seen temporary betterment, unless the case now under observation should prove to be the exception to a very general rule.

Dr. Coley remarked apropos of the question as to whether the early results of operations for sarcoma were better than the recent ones, and the statement that if the theory of infection held true they ought to have been better, that a very careful reading of Gross's classical article on sarcoma, published in the *American Journal,* 1879, will convince any one that those results were better than those which had been given by Dr. Wyeth. This bears out the fact that infection occurred, and in pre-antiseptic days had better effect and gave better results. There is no way of explaining these better results except on the theory of infection. As to later recurrence, he had two cases of sarcoma of the jaw, one recurring ten years after excision of the lower jaw, and another lower-jaw sarcoma occurring five years after excision of the lower jaw.

Dr. Robert G. Le Conte said that there was one point that had been touched on but lightly in the discussion, namely, the degree of malignancy of the growth when compared to the age of the patient. In an experience limited to six cases of sarcoma of the extremities, he had noticed that the speed of recurrence had been directly proportional to the youth of the patient, in other words, that the most favorable forms of sarcoma are more malignant in the young than the most malignant forms are in elderly people. Dr. Coley had spoken of a chondrosarcoma of the condyle of the femur in a young girl, where, from the situation and character of the growth, he had every reason to expect a favorable result after operation, yet recurrence occurred very quickly, and death soon followed. As an antithesis to this case, Dr. Le Conte reported the history of a farmer aged forty-seven, whom he saw in March, 1898. The man had suffered severely for more than ten years with rheumatic gout, and urate of soda had been freely deposited about the finger-joints. In one finger the chalky deposit was as large as an olive, and the joints were ankylosed so that it interfered with his work. He wished to have it amputated. In examining him there was found a hard, lobulated tumor at the right femoral ring as large as an orange, which he stated had appeared about a year previously as a small nodule. The right popliteal space was also the seat of an ill-defined tumor.

The later growth he had only noticed a couple of months. The growths were evidently malignant, and amputation was advised, which was refused; but Dr. Le Conte was given permission to remove the femoral tumor at the time that he amputated the finger. The femoral tumor proved to be a mass of lymphatic glands, the seat of melanotic sarcoma. Nine months later the man returned to the hospital during the service of one of his colleagues. The popliteal growth had increased to the size of two fists, and interfered very much with locomotion. There was no local return in the femoral region, nor any evidence of metastasis to internal organs. The thigh was amputated at the middle, as he positively refused a hip removal.

Six months after the amputation recurrence occurred locally in the stump and also in the abdominal wall, and he finally died in July, 1900, from internal recurrence. He therefore lived eighteen months after the amputation, twenty-seven months after the removal of the femoral glands, and thirty-seven months from the first appearance of the femoral tumor, which was surely secondary to the popliteal growth. The contrast between these two cases is certainly very great, and it makes one feel that, in estimating the malignancy of a sarcoma, the age of the patient is of more importance than the type of cells in the tumor.

Dr. Wyeth said that he had learned by experience that the safety of the patient lies in the early recognition of these malignant neoplasms, and their immediate and radical removal. He approved most earnestly of the remarks of Professor Keen to the effect that they should be operated upon, no matter where the lesion may be located. It is certain death to permit a tumor to run its course.

In regard to the question of the advisability of an immediate infection of a stump after an amputation, or a secondary infection induced after all the acute inflammatory symptoms caused by the operation have subsided, he would be determined somewhat by the condition of the patient at the close of the operation. In an anæmic subject with low resistance it would be probably more dangerous and increase the mortality of the operation to infect the stump at the time of operation. Where the patient was, however, in good condition, he would prefer to infect the stump at once. Fortunately, the majority of cases of amputation at the hip for sarcoma are in excellent condition after the operation. In these



he insisted upon immediate infection, for the following reasons: First, it does not materially add to the danger of death from the operation; in the second place, these patients, when they have recovered from the immediate effects of an amputation, feel so well that it is difficult to get them to return for an infection, and the tendency to recurrence is so great that it is safest for them to run the small additional risk of the streptococcus infection than the return of the disease. It may seem dangerous, and may be construed by some to be unsurgical, but this form of cruelty may be compared to that which Hamlet expressed when he said, "I must be cruel, only to be kind."

Another important point in the consideration of sarcomata is the fact that in many instances the germs of the disease have already escaped from the tumor before the operation is undertaken and have lodged in distant viscera, where they lay dormant in these secondary deposits until the conditions are favorable to their development, and then grow rapidly, as shown in the cases reported. Streptococcus infection, if it does not cure, will without doubt weaken the germs which have undergone metastasis and retard their development.

# TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

*Stated Meeting, May 6, 1901.*

The President, DE FOREST WILLARD, M.D., in the Chair.

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## TWO CASES OF LIGATION OF THE EXTERNAL CAROTID FOR SEVERE HÆMORRHAGE,—ONE AFTER TONSILLOTOMY, THE OTHER AFTER A SLIGHT INTRANASAL OPERATION.

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THE following two cases are of sufficient rarity to make it desirable to record them. Persistent hæmorrhage from the tonsil or the posterior nasal cavity, while infrequent, is a cause for the greatest anxiety when it does occur.

I do not wish to advocate indiscriminate ligation of the carotid, but, in view of its effectiveness and of the slight danger which attends modern operations, I would urge that it be resorted to more frequently and not postponed too long. The prompt recovery of both of these and other patients similarly treated warrants a relatively early operation. Of course, when I say ligation of the carotid, I mean the external carotid. It is a perfectly easy operation, requires but a few minutes, and is followed by no evil consequences. To ligate the common carotid when the bleeding vessel is a branch of the external carotid is an inexcusable surgical blunder. Not infrequently the cutting off of the circulation from the brain through the internal carotid has resulted in cerebral softening and death.





Another encouraging feature of the operation in both cases was that the operation wound did not bleed. The natural fear that renewed uncontrollable bleeding might attend the new wound may have deterred surgeons in the past from resorting to the operation, but this fear is not generally realized, and should be cast aside.

CASE I.—*Ligation of External Carotid for Hæmorrhage after Tonsillotomy.*—Mr. L. B. R., aged twenty-three years, had long suffered from a greatly enlarged left tonsil, which Dr. Walter J. Freeman removed on November 6, 1897, by a tonsillotome between 9 and 10 A.M. No special hæmorrhage occurred at the time of operation, but the bleeding did not cease. Dr. Freeman applied cold and, later, hot water, pressure, packing, styptics, etc., and all in vain. I was called to see him at 3.30 P.M. At this time Dr. Freeman estimated that the patient had lost not less than three pints of blood. He was very blanched and faint. We decided at once on ligation of the external carotid, which was done as soon as he could be taken to my hospital.

He made an uninterrupted recovery, the highest temperature being 100.6° F. the day after the operation. The hæmorrhage ceased immediately upon ligation of the vessel, and he left the hospital nine days after the operation, having remained there that length of time in order to regain his strength.

CASE II.—*Ligation of External Carotid for Severe Hæmorrhage following an Intranasal Operation.*—Mr. Van D. was first seen by me at the request of Drs. B. A. Randall and Walter J. Freeman on February 12, 1901, at 4.30 P.M. Dr. Randall has very kindly furnished me with the following detailed earlier history, showing the necessity for the operation, which is so instructive that I give it in full.

"I first saw the patient on January 24, finding a postnasal catarrh with marked grayish hypertrophies on both sides of the septum, decided that mild measures would prove insufficient for his relief. The anterior nares were rather unduly free, as if by shrinking after previous hypertrophy; the accessory sinuses seemed unaffected; the sphenoids being readily probed, and the trouble apparently limited to the septal cushions. These half-filled the choanæ and overlapped the back edge of the septum in a heart-shaped mass, larger on the right. History of polyp removal four years before made snaring of the posterior turbinal ends seem the real operation. There had been sharp primary but no secondary hæmorrhage at that time, and the proposal to curette the hypertrophies was promptly accepted. This was done with a sharp curette under aseptic precautions, making from the front one firm sweep on each side from the back of the septum forward one inch. There was not more than a drachm of bleeding from each side. Cocaine had been very sparingly mopped upon the surfaces attacked.

"He returned two days later with good retraction on the left side; but on the right the lower part only of the cushion was smaller, while the

large upper portion was little reduced. It was therefore again curetted at the higher point, and the instrument seemed to grate along the periosteum. The bleeding was again slight. He was to return on the 28th, but did not come in; was pressed with work at the office till rather late; felt stuffy and headachy, so he took a short Turkish bath and hurriedly dressed and dined, then took a lady to the theatre. Towards the close of an exciting play he was attacked by sharp hæmorrhage, and had to summon medical aid, as it proved uncontrollable.

"I was called just after midnight, and found him with the bleeding nearly controlled, thanks to the firm anterior packing of both nostrils which had been done by two practitioners who had been earlier called. He had lost not less than twenty ounces, and more than an hour had been spent in the efforts to stop it, before I could help him to a cab and place him in bed in the Polyclinic Hospital. There was then a firm, dark clot filling the posterior nares, around which traces of blood still oozed, and both anterior nares, and even far back on the right, were tightly packed with sterile gauze. Bleeding recurred several times during the night, requiring the replacing of the packing; a spray of hydrogen dioxide seemed very helpful in controlling the flow. In the morning there was quiet; but sharp bleeding recurred during the day, incompletely controlled by packing and dioxide only after an hour. I removed the packing and worked back with adrenal glycerole until the bleeding points were definitely located at the curetted areas on each side of the septum, and these were lightly seared with 25 per cent. trichloracetic acid. All clot was removed and a clean, bloodless tract found. Slight recurrence of hæmorrhage in the evening called for renewed but superficial searing with the trichloracetic acid.

"All seemed secure on the 30th, and I told him he could leave the hospital, but a trace of bleeding when he packed his bag led him to remain that evening. He came next day to my office showing no signs of oozing, and was dismissed to his boarding-house, but warned that care must be exercised in a couple of days, when the eschars would be loosening. I was summoned in haste that evening to find him again bleeding severely from the *right* side, but with free flow into the throat and from the left nostril when impeded on the right. Not until a firm postnasal plug was introduced could full cessation be secured. That left naris was also packed from the front, as he felt insecure without it, and he was taken back to the hospital. I was recalled to him at midnight, and stayed by him during the night, although there was but slight oozing at intervals.

"February 1 was almost undisturbed; but on the 2d bleeding recurred, and after brief control baffled all efforts at its complete control. Dr. Freeman saw him in consultation, and emulsion of adrenal, melted gelatin, and other styptics were injected from back and front without avail. Dr. Agnew's recommendation of a tampon of ham-fat was then adopted, and it was introduced from the front until its end protruded from the choana, and its anterior end was secured by a ligature and supported by a small gauze tampon. Little oozing was noticed during the evening, but when an enema was given at ten o'clock he vomited some ten ounces



of blackish blood, and his following stools were tarry. All seemed quiet on the 3d, and Dr. Kyle, who had once treated him, saw him in consultation, but thought the plugging too efficient to be disturbed for study. Opium and lead acetate were substituted for the calcium chloride which he had been taking. Little portions of dark clot came away at times on the 3d and 4th, and tenacious mucus worked out along the plug front and back, but there was no fresh bleeding. On the 5th the plug was quite offensive, and so loose that it seemed best to remove it after gentle spray with Dobell's solution. A linear adhesion was apparently torn loose, and bleeding recurred as vigorously as at any previous time. Dr. Kyle was summoned, as he had asked to see it if again bleeding; but no measures availed to more than lessen the flow until the galvano-cautery was lightly applied to the curetted area, when immediate control was gained. A ham-fat plug was replaced, but too tightly, causing crushing of it in pressing it back, and it disintegrated, especially on the second day, and permitted fresh hæmorrhage. A better plug was introduced after renewed cauterization and, with careful cleansing and use of aristol, was retained until the 10th, when brief bleeding recurred frequently during the day and twice sharply in the night. On the 11th Dr. Freeman saw him again in consultation, and advised that the external carotid be tied, as he felt that his condition was growing critical and that local measures had been tried to the full. Dr. Keen was called in on the 12th, and, concurring in this advice, tied the external carotid that afternoon. The nasal plug was at once removed without hæmorrhage, the nasal passages thoroughly cleansed and dusted with aristol, and no further bleeding has since taken place, except that some crusting at the anterior nares caused at times trifling excoriations, and a drop or two of blood oozed at these points. The patient left the hospital in two weeks after primary closure of the cervical wound. Pulsation in the vessel above the ligature was very uncertain until the eighteenth day, when it became positive and fairly strong."

Dr. Randall estimated that he had lost probably ten pints of blood in all. So much blood had been swallowed that the stools were tarry. When I first saw him his pulse was weak, his face blanched, and it seemed pretty clear that he would soon succumb if the bleeding was not stopped. I therefore concurred in the judgment of Drs. Randall and Freeman that immediate ligation of the external carotid was indicated. This was carried out an hour later, the artery being tied with silk without any difficulty. The wound through which the artery was reached did not show any tendency to bleed, and no ligature was required. While I was ligating the external carotid, Dr. Stern gave the patient a quart of saline solution by hypodermoclysis.

He made an uninterrupted recovery. His highest temperature only once went above 99.4° F., and he left the hospital on February 27, fifteen days after the operation. On February 18, six days after the operation, about a drachm of blood was lost, but from the *left* nostril near the vestibule, where a crust had been torn away. There was occasionally a little oozing from the left nostril, probably from superficial excoriation, but no bleeding whatever on the right side, and that on the left was very insig-

nificant. Fifteen days after the operation, pulsation had not returned in the artery, but three days later there was a slight but distinct pulsation perceptible.

## CARBOLIC ACID TREATMENT OF ANTHRAX.

Dr. Louis H. Mutschler read a paper with the above title, for which see page 147.

# A REPORT OF TWO CASES OF FACIAL ANTHRAX TREATED BY INJECTIONS OF CARBOLIC ACID, WITH RECOVERY.

By LOUIS H. MUTSCHLER.

At a meeting of the Philadelphia Pathological Society in December, 1899, Dr. Jopson reported a case of anthrax that came under his care at the Episcopal Hospital dispensary. In his paper he mentioned three other cases besides his own, making four in all that had been reported in Philadelphia. Of these four cases, three terminated fatally, and the outcome of the fourth was unknown. During the past few months I have had two cases of anthrax under my care, and on investigation I have learned of three other unreported cases that have occurred in Philadelphia. Briefly, they are as follows:

The first case was seen, five years ago, by Dr. Harry Deaver. The man was employed in a tannery; the point of infection was on his neck; he had slight fever; his head, neck, and chest were œdematous; he died in a few days. Pure cultures of anthrax bacilli were obtained from this case.

Dr. Loeb supplied me with notes of the second case. The patient came to the dispensary of the Jewish Hospital about one year ago. His occupation was that of a tanner. The point of infection was on his neck, and when he applied for admission his neck and chest were œdematous; he had a slight fever, otherwise he felt well. Microscopical examination of the discharge from ulcer showed the presence of anthrax bacilli. He was refused admission to the hospital and referred to his own physician. Dr. Loeb called to see the patient the following day and found him dead.

The third case came under the charge of Dr. Ellis Given while a resident at the Episcopal Hospital. Dr. Given kindly

furnished me with the following notes. In May, 1900, J. McM., thirty-six years old, a wool-sorter, presented himself at the Episcopal Hospital dispensary. The point of infection was on the left forearm (Fig. 1), which was swollen; he had a temperature of 104 1/5° F.; pulse, 122; respiration, 35. He was denied admission at the Episcopal Hospital and referred to the Philadelphia Hospital. At the latter place he was treated by injecting pure carbolic acid about the ulcer. This patient recovered. Pure cultures of anthrax bacilli were obtained from this case.

Case I.—The first case of my own which I wish to report came to my dispensary at the Episcopal Hospital on December 21, 1900. C. S., a robust German, twenty-one years old; for the past three months he has been working in a morocco factory. He said lately he has been handling goat-skins principally, and that most of the skins came from China. One week ago a small pimple appeared over his left eyebrow; this he squeezed with his fingers. Three days later he noticed the pimple getting red and larger. When I first saw the patient, which was about five days after he infected himself, he had a sore two centimetres by three centimetres over the left eyebrow. In the centre was a dark slough and about the margin, which was elevated, were papules and vesicles, there being a free discharge of serum from the latter. He had some œdema extending above the ulcer, also in temporal region, eyelids, cheek, and some slight œdema of the neck. (Fig. 2.) He said he had no pain, and complained merely of slight discomfort caused by the swelling. I could detect no enlargement of any glands. His temperature was $99^{1}/_{5}$° F. I suspected the case as one of anthrax, and an examination of the discharge by Dr. Ghriskey revealed the bacillus of anthrax in large numbers. The patient being refused admission at the hospital, I agreed to treat him at his home. The method of treatment was as follows: On the first day I injected twenty-five minims of pure (95 per cent.) carbolic acid about the periphery of the ulcer, introducing the needle at eight different points. He complained of some pain as the acid was injected, but this readily subsided as the tissues became anæsthetic. I saw no other ill effects from the acid. A wet bichloride of mercury (1 to 2000) dressing was placed over

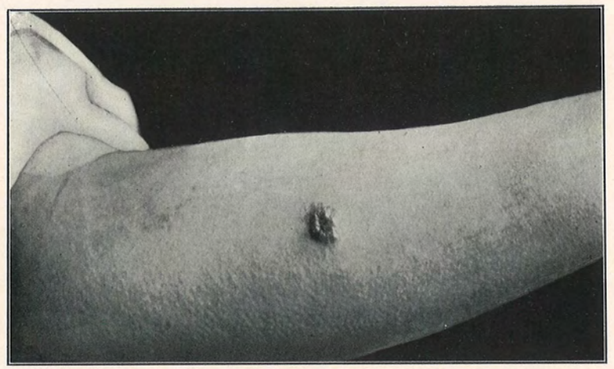

Fig. 1.—Anthrax of forearm about thirty hours old.—(Given.)

the ulcer, and hot applications ordered to be kept over the face. I instructed him as to the hygiene of the case. The following day the œdema was more extensive, his eye being entirely closed and the swelling of neck greater. The treatment of the previous day was repeated. On the third day the swelling had subsided somewhat, and the injections were omitted, the ulcer being dressed with the wet bichloride only. During the remainder of the course of the disease the bichloride dressings were continued. He received no internal medication. The slough separated in about three weeks, and when I last saw him, one week ago, he had a scar not as large as a quarter of a dollar over his brow; otherwise he seemed to be perfectly well.

Case II.—My second case, although he is still under treatment, is so far along the road to recovery that I feel safe in reporting him as cured. He came to the Episcopal Hospital dispensary in April, 1901. As he was denied admission to the wards, the superintendent asked me to treat him at his home. I elicited the following history.

E. B., aged forty-four years, married, born in Poland. He is employed in a leather factory. Recently he has been working on goat-skins. He says the skins came from Russia. I first saw him on Saturday. One week previous he had a small red spot on his left upper eyelid. This grew rapidly, so that when he reported for work the following Monday his employer thought he had been fighting, and sent him home. He was treated at a drug store in his neighborhood, and when I first saw him, about one week after the commencement of the disease, he had the appearance shown in the photograph (Fig. 3). The picture shows fairly well the amount of the swelling. The œdema extended up into his scalp and down on to his neck. The distention was so great under the jaw that the patient asked me to incise it at this point, being under the impression that he had an abscess. The œdema was confined entirely to one side; it extended up to but not beyond the median line of the body. I could find no glandular enlargement in this case. His cheek was very red, firm, and had a few vesicles at different points, so that it looked not unlike erysipelas. The black slough which was originally on the upper lid had extended to the lower. Around the periphery of the slough there was an ugly, elevated margin of papules and vesicles, from which there was a copious discharge of serum. This pa-

tient, like the first, had no pain, and complained only of a sense of fulness in his head. He had a few chills; his temperature was not above 100° F. at any time I saw him. His sleep was disturbed, and when the disease was at its height there were a few nights that he did not sleep at all. Pure cultures of anthrax bacilli were obtained from this case. The first day I saw him I injected twenty-five minims of the pure carbolic acid at six different points of the base of the ulcer, and followed this by a wet bichloride of mercury (1 to 2000) dressing. This treatment was repeated the next day. The patient was advised to keep hot applications on the face. I saw him every day for one week, thereafter less frequently. The œdema gradually disappeared and the slough separated in about sixteen days. At present he has two granulating surfaces, one on each lid. There is a strip, about one centimetre wide, of healthy skin intervening between the sore and the free margin of the upper lid; the same condition exists on the lower lid. He will have some eversion of upper lid, also slight ectropion of lower. A thorough bacteriological study was made of these two cases by Dr. Ghriskey. The appended is Dr. Ghriskey's report.

Bacteriological report on the case of C. S. (Case I), referred to the clinical laboratory of the Protestant Episcopal Hospital for examination.

Cover-slip smear preparations were made from beneath surface of the lesion, the fluid obtained being rather clear serous. Agar-agar slants (Esmarch dilutions) and a bouillon tube were inoculated. The cover-slip preparations, stained with Löffler's alkaline methylene blue, showed microscopically the presence of polyneuclear leucocytes in fair number, and a few large bacilli deeply stained, singly, in pairs, and short chains with square ends and clear interspaces between the segments. Some involution forms were found, indifferently stained, and appearing as short and longer filaments. In several of the polymorphonuclear leucocytes were three and more bacilli. Numerous micrococci then were noted. All of the slant agar tubes, after twenty-four hours in the incubator, showed a universal surface growth. Smears from these tubes examined microscopically showed the presence of micrococci. The bouillon culture was diffusely opaque, and a small, tenacious growth was evident in bottom of tube when shaken. Cover-slip preparations from this showed long chains of

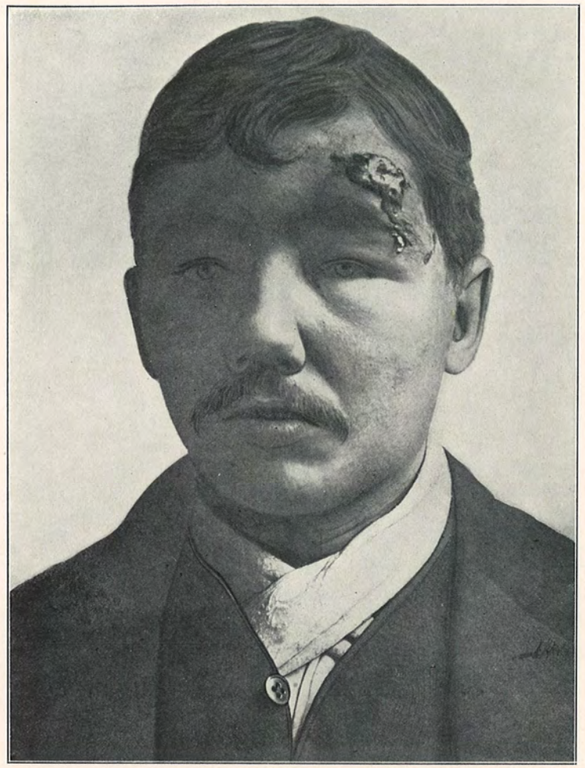

FIG. 2.—Anthrax of brow.

a large bacillus, suggesting the Bacillus anthracis in its morphology. Inoculations with agar-agar (Petri plates) were made from the bouillon culture, and two organisms observed, a staphylococcus, later identified as the Staphylococcus pyogenes aureus, and a bacillus; the latter, from subsequent inoculation in various culture media, was identified as the Bacillus anthracis. A white mouse, inoculated with this bacillus, was found dead after thirteen hours, and a pure culture from heart's blood was recovered.

[NOTE.—The above bacteriologist found spores on bacillus serum.]

In the case of E. B. (Case II), the Bacillus anthracis was very numerous in the smear preparations, being likewise found within the leucocytes, and was recovered as well as the Staphylococcus pyogenes aureus in pure culture from the primary cultures. This organism was virulent for white mice, the animal dying in less than twenty hours.

Bacteriological examination in case of J. McM., patient of Dr. Given.

Cover-slip preparations made from the clear serous fluid of vesicle stained with Löffler's blue showed the presence of large bacilli singly, in pairs, and short chains. Only stray polymorphonuclear leucocytes were seen, and none was observed enclosing bacilli. A bacillus was recovered in pure culture, and a detailed study was made. In its behavior in various culture media,—growing characteristically in gelatin,—stab inoculations, the microscopic appearance of the colonies, and the slow liquefaction of blood serum, the organism was found to be identical with the Bacillus anthracis. The agar-agar culture unfortunately died out during the writer's absence from the city, and no animal inoculations were made.

Doubtless there have been other cases of anthrax that have occurred in Philadelphia and never been recorded. Probably some of the cases of sudden death that have taken place in people employed in handling wool, hair, hides, etc., have been due to either pulmonary or intestinal anthrax. I trust this report will show the frequency of sporadic cases of anthrax in Philadelphia. As most of these cases can be traced to the direct importation of the disease from foreign countries, it is

my intention to call the attention of the Department of Agriculture to the importance of establishing some form of disinfection on the class of imported animal products that is most liable to convey the disease.

DISCUSSION.

Dr. Jopson said that he had reported a case eighteen months ago, with Dr. Ghriskey, which he had observed at the Episcopal Hospital, where, it will be noticed, a number of cases had been first seen. The Episcopal Hospital is located in a large manufacturing district, where woollen mills and tanneries are in operation. Many of the workmen who apply there for treatment are particularly exposed to this form of infection. He had collected four cases occurring in Philadelphia, besides his own, including one, which Dr. J. Chalmers Da Costa had given him notes of, seen at the Jefferson Hospital. His own cases—five—and those referred to by Dr. Mutschler made ten cases of this rare and malignant disease occurring in this city.

He found on questioning his patient, and several other tanners at the Episcopal Hospital whom he treated, that they had no knowledge of any such disease as anthrax, and that there were no precautions taken in their work to prevent infection. In the article on Anthrax in Clifford Allbutt's system, written by Bell, who was the first to point out the true nature of the pulmonic form of the disease, he mentions that in the wool-working district in Bradford, England, where anthrax has frequently occurred, a number of measures have been instituted to protect the workers. Ravenell, of this city, has done some work on the possible sterilization of hides for destruction of anthrax germs and spores. It seemed to him that the attention of the Agricultural Department and of the business community, especially the employers of men who handle such things as hides and wool, should be called to the possibilities of protecting them against such a malignant condition as anthrax.

Dr. J. Chalmers Da Costa said that in the case which came to the dispensary of Jefferson Hospital, it was recognized clinically as undoubted anthrax, and the culture developed the characteristic organisms. He never knew what became of the man, who refused treatment and was not traced.

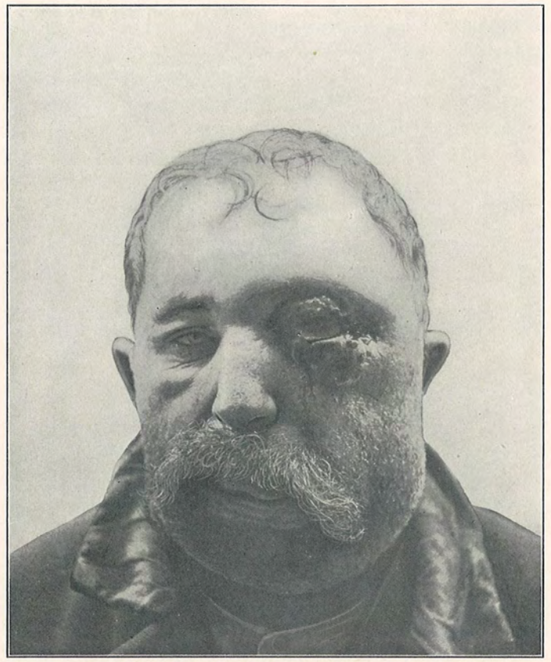

Fig. 3.—Anthrax of eyelids.

The Philadelphia Hospital case which Dr. Jopson had mentioned he saw, and was misled as to the condition, thinking it was malignant œdema; the œdema was so marked it led to diagnostic confusion before cultures were obtained.

It seemed to him important to remember that leather-workers are liable to other forms of ulceration, one being undoubtedly the tubercular ulcer probably identical with the verruca necrogenica of Wilkes, the other being an ulceration resulting from the acids employed in tanning.

Dr. De Forest Willard. Those who handle hides occasionally suffer from a very peculiar form of ulceration which he had observed eight years ago. It is apparently due to coccidia or yeasts, and is possibly a dermatitis due to blastomycetes.

Dr. Mutschler remarked that in the case of the ulcer on the arm, had this been his case, he would have dissected the ulcer out entirely, then applied the pure carbolic acid to the raw surface, and left it open as a granulating sore. That would have materially shortened the course of the disease. In his cases, the sore being so near the eye, he did not think it justifiable to do this.

## THE ULTIMATE RESULTS OF AN INTERSCAPULO-THORACIC AMPUTATION.

Dr. Robert G. Le Conte reported the latter history of A. E. T., a patient subjected to interscapulo-thoracic amputation in April, 1899, and shown at the May, 1899, meeting of the Academy of Surgery (see Annals of Surgery, September, 1899). The man had a recurrent sarcoma of the shoulder, which microscopical examination proved later to be mostly composed of spindle-cells. Five weeks after the operation the man went on duty as elevator-boy in the Pennsylvania Hospital, and remained at work until twelve hours before his death. During the summer and fall of 1899 his health was very good, except for an occasional slight attack of asthma with dry cough. In November, 1899, he noticed a small nodule the size of a split pea under the skin, at about the tubercle of the first rib. By January 1 this had grown to the size of an almond, and he consented to have it removed. It was excised, the periosteum of the rib being removed with it. By the end of April, 1900, a second nodule was made out in the same relative position as the first. This was excised in June, when half

the thickness of the first rib was removed with it. No further local recurrences occurred. His chest was carefully examined about every three months for signs of metastases, but nothing definite was ever demonstrable. He continued in fair health, neither gaining nor losing much in weight, but having asthmatic attacks, with shortness of breath, at recurringly shorter intervals, until the evening of February 24, 1901, when he complained of severe pain in the chest, very difficult respiration, and a short, hacking cough, with bloody expectoration. The pulse was small and rapid, heart action feeble, and temperature 100° F. He did not respond to free stimulation, gradually growing weaker and respiration more difficult, until he died, the morning of February 25, 1901.

The post-mortem examination was made by Dr. Newlin, the resident physician, who kindly furnished the following notes:

*Post-Mortem Examination.*—Body of poorly nourished man. Rigor mortis absent.

*Chest.*—Both lungs markedly emphysematous. The right lung adherent in many areas, anteriorly and posteriorly. A few pleural adhesions of left lung.

*Left Lung.*—Seat of fibroid degeneration at apex involving pleura and few scattered patches beneath it; otherwise negative.

*Right Lung.*—At apex the pleura is slightly thickened, and at this area the lung has undergone fibroid degeneration. In the posterior portion of the middle lobe there is a hard mass the size of a small orange, dirty white in color, tough, and resistant on section. Bronchi in neighborhood of growth filled with reddish, mucopurulent casts. Bronchial glands in the region are enlarged and hard.

*Heart.*—There is slight thickening of the aortic valve; otherwise negative.

*Liver.*—Seat of slight fibroid change more marked at its edge, which is quite sharp.

*Spleen.*—Normal in size and is the seat of yellowish-white growth, occurring on its anterior aspect and curling over edge of organ, one inch in thickness, very resistant on section, with areas of chalky deposit. There are also numerous small fibromatous nodules scattered over surface of spleen, many of which are chalky.

*Pancreas* normal.



*Stomach* and *Intestines* normal.

*Mesenteric Glands* slightly enlarged and infiltrated.

The pathological sections were examined by Dr. Simon Flexner, who kindly gave me the following notes:

(1) *Lung* with tumor nodule; tumor circumscribed; separated by fibrous capsule from lung tissue; capsule infiltrated with numerous small round cells; tumor proper composed of strands of spindle cells with elongated, spindle-shaped nuclei and distinct nucleoli. There are scattered irregularly among these main tumor cells larger cells with several or numerous nuclei; nuclei are sometimes peripherally, at others centrally placed in protoplasm, and in general they are superimposed. They are not uniformly distinct among other cells, are more numerous in some areas and rare in others. Blood-vessels of tumor are imperfectly developed, having thin walls. A microscopical area of coagulative necrosis in centre of tumor.

(2) *Apex* of lung. Section includes thickened pleura and adjacent lung substance. There is coal pigmentation with thickened tissue and focal accumulation of round lymphoid cells; alveoli are emphysematous.

(3) *Liver Capillaries* in general are dilated. No increase in connective tissue of liver generally, but the capsule shows irregular thickening: new tissue penetrating a short distance into liver tissue; in this there is moderately rich new formation of bile ducts.

(4) *Spleen.* Splenic tissue not especially altered. In places the pulp contains a great deal of blood. Malpighian bodies are strikingly apparent; the capsule is thickened throughout, but not uniformly.

The thickened capsule consists of dense hyaline, almost cartilaginous, connective tissue. No tumor present.

Bronchial lymph glands contain much anthracoid pigment, which is present especially in the lymph cords and the endothelial cells of sinuses, and only rarely in the lymph nodes. There is no evidence of tumor in the sections examined.

*Kidney.* Section shows only some contraction of glomerule and increase of capsular space. No increase in connective tissue and no special degeneration of epithelium. No tumor.

*Tumor.* Composed chiefly of spindle cells, and contains a moderate number of giant cells of the megacaryocytic type.

## VESICAL CALCULI DUE TO LIGATURES AND BONE SPICULE IN THE BLADDER.

Dr. John B. Roberts reported that a year ago a patient was brought to him for a urinary fistula in the anterior abdominal wall. She had been recently operated on in a distant part of the State for what was supposed to be extra-uterine pregnancy. The fistula formed before the wound healed, and closed spontaneously under Dr. Roberts's care. She came to him about a year after the operation, complaining of vesical pain, and showed a little concretion that she had passed per urethram. It was about the size and shape of the little finger-nail, and from it a little piece of silk ligature protruded. The patient was suffering intensely with vesical pain.

He examined the bladder twice with a sound and found no stone, but thinking that there might be other calculi, and seeing that she had an active chronic cystitis with intense pain, he decided to make a vaginal cystotomy, so as to find any stones and give the bladder rest and drainage. As soon as he opened the bladder, he came upon a stone, about as big as the thumb-nail, which had a silk ligature attached to it. The ligatures used in preventing hæmorrhage at the time of the original operation had evidently ulcerated into the bladder and acted as nuclei for the phosphatic concretions.

He also mentioned a case operated upon about a year ago, in which he extracted a stone from a female bladder by vaginal cystotomy, and found that a spicule of bone was the nucleus. That woman had been shot in the right hip months before with a Winchester rifle. The shot wound in the hip was still suppurating; but it was the bladder symptoms that caused the woman to seek surgical aid. She was very comfortable after the calculus was removed.

Dr. Roberts frequently explores the bladder with the finger introduced through the dilated urethra, but in this case, and some others, he prefers making a vaginal cystotomy, because it gives such free drainage and affords rest to the bladder for several weeks. One can do the cystotomy with cocaine with great ease.



## VESICAL CALCULUS FOUND ABOUT A SILK LIGATURE.

Dr. Wharton said that he had operated upon a woman some four or five years ago for strangulated hernia. The patient did well after the operation, but developed some time afterwards —five or six weeks—symptoms of intestinal obstruction, due apparently to an adhesion of the gut in the hernial ring. He opened the abdomen and found this to be the case, very marked adhesion producing a kink of the intestines in the region of the internal ring. He tied off with heavy silk ligature and closed the wound, and heard nothing from the patient, who did well for a year. Then he heard that she had a great deal of irritation with her bladder. Finally he saw her, and she showed him a silk ligature, which looked very much like the one he had applied, covered with a phosphatic deposit, which she said had passed from her bladder.

# TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

*Stated Meeting, October 7, 1901.*

The President, DE FOREST WILLARD, M.D., in the Chair.

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## GUNSHOT WOUNDS OF THE ABDOMEN.

DR. ROBERT G. LE CONTE presented a negro man, twenty-seven years old, who was admitted to the Pennsylvania Hospital, September 7, 1901, at 11.57 A.M. Fifteen minutes before admission he was shot twice with a thirty-two calibre revolver. The first bullet caused a superficial wound of the left thigh; the second struck him in the back while he was running away from his antagonist. The estimated distance at which this shot took effect was twenty feet. Dr. Le Conte saw the patient two and a half hours after the injury was received. He was then in a highly excited condition, in part, perhaps, due to the fact that his antemortem statement had just been taken by a magistrate, and the necessary legal procedures had terrified him. He complained of intense cramp-like pains in the abdomen which made him cry out every few minutes. He was moderately shocked, with a rapid pulse and labored respiration which was almost entirely costal. The wound of entrance was three inches to the right of the fifth lumbar spine and on a level with the crest of the ilium, and a probe refused to pass beyond the latissimus dorsi aponeurosis. There was no wound of exit. The abdomen was universally tender, distended, and resistant, tympanitic in front and dull in the flanks. Liver dulness in front reached to the costal border. The man was etherized, placed on his face, and the skin of the back carefully disinfected. As the probe still refused to enter, the skin wound was enlarged sufficiently to see where the bullet had separated the fibres of the aponeurosis. These were divided and a finger was carried along the track of the bullet to the crest of





the ilium, where two or three splinters of bone were encountered. The bullet had then passed beyond the reach of the finger. It being thus certain that the missile had penetrated the peritoneal cavity from behind, a rubber drainage tube was inserted in its track and the skin incision closed. The patient was then turned on his back, the skin of the abdomen carefully disinfected, and a six-inch incision made in the median line, the centre of which was the umbilicus. On opening the abdomen, fluid blood immediately gushed out. The quantity was estimated at six pints. The whole of the small intestine was hastily drawn out of the abdominal cavity to the left of the incision, and surrounded with hot, wet gauze. In doing this a perforation of the small gut was seen. Its position was noted and the place covered with gauze to prevent further extravasation of fæcal material. The abdominal cavity was then cleared of blood by scooping it out with the hand and with gauze sponges, and it was seen that the bullet had perforated the upper portion of the mesentery, severing one of its large vessels. As it emerged from the mesentery it had torn an opening one inch long in the transverse colon. The hæmorrhage was readily controlled by suture, the wound of the colon repaired, and the perforation of the small gut closed with silk. No further damage was found. Twenty pints of hot salt solution were used in washing out the abdominal cavity and the surface of the intestines, a glass drainage tube was inserted, and the wound hastily closed with through and through silkworm-gut sutures. During the operation the patient's pulse had become very rapid and feeble, and an assistant opened the median cephalic vein and introduced five pints of hot normal salt solution. As the bullet had almost certainly lodged in the anterior abdominal wall and was out of harm's way, no search was made for it, the patient's condition being so precarious as not to warrant any further interference.

Immediately after operation the patient's temperature was 98.4° F., the pulse 160, and respiration 60. Eight hours later the temperature had risen to 101°, while the pulse and respiration had dropped to 124 and 44, respectively. He vomited twice while coming out from the effects of ether. The convalescence was uneventful. At the end of twenty-four hours one-sixth of a grain of calomel with a mouthful of water was given hourly for six doses. This was followed by an enema which was very

effectual. As soon as the bowels were opened he was placed on peptonized milk, and the diet gradually increased from day to day. At the end of forty-eight hours the abdominal drainage tube was dry, and it was removed. At the time he received his injury he was suffering from a mild bronchitis, and during the convalescence he had some cough with free expectoration. This was partially controlled by heroin; but the paroxysms of coughing everted the edges of the wound in three places, although none of the sutures gave way. The stitches were removed on the eleventh and the patient was out of bed on the twenty-second day.

In connection with this case, Dr. Le Conte said that until within a few years ago a gunshot wound which opened any part of the alimentary tract was considered fatal unless operation was undertaken, and even then almost all cases died. At that time gunshot wounds were alike in that they were dirty, usually infected, lacerated wounds, made by a comparatively large lead bullet of slow velocity. To-day one meets with a wound of very different character, made by a clean, small, steel bullet, of high velocity. When such a missile has attained its true flight, it leaves a clean, sharp-cut wound, splitting the tissues as a wedge rather than tearing its way through. Penetrating abdominal wounds with a lead bullet he believed to be as fatal to-day as ever they were, if expectant treatment is pursued; but military statistics of field operations show that wounds inflicted by the modern weapon have proved much less fatal under expectant treatment than when operation has been undertaken. This is scarcely to be wondered at when one considers the surroundings under which operations were performed after battle in field hospitals, where the medical department had an immense work to do with scanty supplies and few assistants. But if such wounds presented themselves in a city hospital, with all the modern conveniences for aseptic work, no surgeon would hesitate between expectant and operative treatment. Wherever one could open an abdomen with safety he believed that every penetrating gunshot wound demanded operation, no matter what may be the character of the bullet that inflicted it.

Shock in such cases is almost invariably associated with hæmorrhage, and its severity is almost directly proportional to the amount of blood lost. Occasionally, however, it is profound



where hæmorrhage has been slight, and in such cases it is probable that the bullet has done very extensive injury to the hollow viscera, or perhaps some important nerve trunks. Under such circumstances what benefit can accrue by delaying operation? An anæsthetic is of course much more dangerous in the presence of a profound shock, but its increased danger in no way counterbalances the benefits derived from its use. It permits the surgeon at once to get at and control the cause of shock by preventing further hæmorrhage or greater soiling of the peritoneum; it enables him to repair the injuries inflicted and to reduce the dangers of septic infection to a minimum, and at the same time permits the use of the two most valuable remedies for combating shock, namely, intravenous injection and douching the abdominal cavity with hot salt solution. He would therefore urge that if operation is to be undertaken it be done immediately, as every half-hour of delay proportionately decreases the chance of success.

When the wound of entrance or of exit does not give a positive sign of penetration, as protrusion of omentum or escape of fæcal material, it should be carefully enlarged until the peritoneum is reached, when sight or touch will tell of penetration. One should never take for granted that the abdominal cavity has been invaded from the apparent course the bullet has taken, nor from the tenderness, distention, muscular rigidity, or shock that may be present. All of these signs may be present without an opening in the peritoneum. Four or five years ago he saw a woman who had been shot with a revolver. The wound of entrance was on a level with the anterior superior spine of the left ilium and about two and one-half inches to its inner side. The apparent course of the bullet was directly inward and there was no wound of exit. The patient was considerably shocked, slightly tympanitic and distended, with rigidity of the left rectus and marked local tenderness. He was confident the abdominal cavity had been opened, but proceeded to assure himself of it by exploring the wound. It was then proved that the bullet had ranged downward, and had penetrated to but not opened the peritoneum, passed under Poupart's ligament, and lodged in the muscles of the thigh. The woman was very stout, with a pendulous abdomen, and as she reclined on her back the wound of entrance was on a level with the anterior superior spine of the

ilium, but in the standing position, the position in which she was shot, the wound assumed a relatively lower place.

Penetration having been ascertained, where the incision for exploring the abdominal contents should be made should depend upon two factors,—the position of entry and the course the bullet has taken. If the missile has penetrated outside the semilunar lines and at a right angle to the anterior abdominal plane, he should prefer to open the abdomen in the semilunar line, rather than enlarge the wound sufficiently to make careful search of the abdominal organs. If it has entered in the same plane but passed inside the semilunar line, he should prefer a median incision, unless it is in the region of the liver, when a curved incision below the border of the ribs gives the best exposure. When the bullet has entered the flank or back, and ranged across or diagonally across the abdomen, he should always prefer a median incision, except when the liver is probably the only organ perforated. An incision through the median line or semilunar line saves time, as it can be enlarged or closed more quickly than when through several layers of muscle; it permits of a more extensive and thorough examination of the abdominal contents, and also a better cleansing of the same.

In operating for gunshot injuries, it has always been his practice to treat the track of the bullet as septic until it has proved itself otherwise, and he had drained such wounds in all portions of the body. If, in addition to a septic bullet, the alimentary canal has been opened, the indications for drainage become doubly imperative. If the bullet has penetrated the lesser peritoneal cavity, this also should be drained by an opening in the flank. When the patient's skin has been properly cleansed, and the drainage tube carefully attended to, the risk of infecting peritoneum from outside sources must be very slight, certainly very considerably less than the dangers arising from the presence of septic material in a closed cavity.

As to a search for a bullet that remains in the body being made at the time of operation: If in the examination of the abdominal organs for injuries received, the bullet is not encountered, it generally proves that the missile has passed beyond the peritoneal cavity, and probably lodged in muscular tissue. Under such circumstances he would make but a very short search for it when the patient's condition is good; if his condition is serious, he



would not hunt for it at all beyond the peritoneum. When embedded in muscular tissue, its presence causes no immediate danger. At some later period it can be accurately located by a radiograph, and it may then be removed without danger. Time spent in cleansing a large area of skin around the proposed incision is always well expended; and if the patient's condition is so grave that one dare not spend the time for this, operation should not be undertaken.

Several years ago, before the days of normal salt solution or intravenous injection, when speedy operations seemed the most successful, he operated on a case of gunshot wound of the liver. The wound of entrance was in the back, the ball having passed through the pleura, diaphragm, and whole thickness of the liver, and lodged under a rib in front. The man was profoundly shocked from loss of blood. He enlarged the opening in the back and packed the liver wound as thoroughly as possible from this position, and then made a curved incision along the border of the ribs and completed the packing of the liver from the front. The patient's condition was so serious that he did not spend over three or four minutes in cleansing the skin of the abdomen. He was dying from hæmorrhage, and it had to be stopped soon. He reacted well from the operation, but died on the fifth day from septic peritonitis. A post-mortem examination revealed the wounded liver in excellent condition. No further hæmorrhage had taken place, and the bullet-track was filled with organizing sterile clot. The infection had started from the skin of the abdominal incision, and was traced layer by layer through the abdominal wall to the peritoneum, where it became diffused. In trying to save the man from a death by hæmorrhage, he had condemned him to one from peritonitis. Had ten or twelve minutes been spent in disinfecting the surrounding surface of the abdomen, infection most probably would not have taken place, and the man would have undoubtedly recovered.

Dr. Richard H. Harte reported the case of a man, aged nineteen years, who, while out gunning on the afternoon of July 27, attempted to remove his rifle from one boat to another, and in so doing discharged the weapon so that its contents, a long 22-calibre bullet, entered his abdomen along the right side of the rectus muscle, one and one-half inches above the umbilical line. He was hastily removed to the Pennsylvania Hospital,

which necessitated a long drive in a wagon, so that nearly six hours had elapsed from the time of the receipt of the injury until Dr. Harte saw him in his bed in the hospital. His condition at that time was fairly good,—temperature, 99.2° F.; pulse, 102; respiration, 30. On examination a small wound was found, its point of entrance being one and one-half inches above the umbilical line, and just at the right margin of the rectus muscle, with no corresponding wound of exit on the posterior part of the body. The abdomen, on examination, was tender, with marked muscular rigidity, especially in its upper right segment, leading to the belief that the missile had punctured and wounded some of the abdominal contents; although a probe could not be carried any distance into the wound owing to obstruction apparently from some fibres of the rectus muscle. The patient was made aware of the gravity of his condition and told that an operation was necessary, to which he readily assented.

At eight o'clock, six hours after the receipt of the injury, he was etherized, and the abdomen opened in the line of the wound corresponding to the right edge of the rectus muscle. Considerable hæmorrhage was present and some blood-clots found close to the parietal peritoneum. Careful cleansing soon revealed its source in the margin of a penetrating wound of the upper part of the duodenum, the missile having made an opening which would admit the little finger, producing what Mr. Making calls a grooved wound of the intestine; in fact, it was as sharp and clear as though it had been cut from the upper margin of the intestine with a gouge, from the edge of which there were several small vessels freely bleeding. The opening was easily closed with a single row of continuous sutures, again fortified by a row of Lembert sutures approximating the edges of the intestinal wound transversely, which is less liable to reduce the lumen of the gut than if closed longitudinally. In the mesentery, just below, was quite a large hæmatoma, which was incised, the clot removed, and the cut edges of the mesentery closed with a continuous suture. This apparently controlled all bleeding in the anterior portion of the abdomen. On tracing back the supposed course of the ball, a large amount of fluid blood was found in the fossa posterior to the liver, and alongside of the vertebra, which was removed, where another large hæmatoma was discovered extraperitoneally and in close relation to the kidney, but



no other point of bleeding was found in the abdomen, which was then thoroughly cleansed and the abdominal wound closed, three pieces of gauze being left in for drainage.

A temporary dressing was applied and the patient turned upon his face. Another incision was then made in the back, exposing the kidney, and enabling the blood-clot to be removed and several small vessels tied. Apparently no injury was done to the kidney or to its circulation. The posterior wound was closed and the layers of fascia brought together with buried sutures, leaving a small space for a gauze drain, and a permanent dressing was applied over both wounds. The patient reacted very well and passed a fairly comfortable night.

On the fourth day all the packing was removed from the abdominal wound and one piece replaced. This was followed in a few days by some slight suppuration; otherwise the convalescence was uninterrupted, save a rise in temperature at the end of the fourth week and a corresponding rise a week later.

Dr. Harte said that this case was interesting as illustrating how little can be determined in abdominal injuries until the abdomen is opened and explored. If it had been treated expectantly, the result would have been disastrous. Mr. Making, speaking of gunshot wounds of the small intestines which occurred during the Boer war, says that in the majority of cases which recovered spontaneously, the injury was not of a perforating nature, and that in five cases in which the injury was certainly diagnosed in the hospital death occurred.

He divides these injuries of the small intestines into three classes:

(1) Those which die shortly after the receipt of the injury, where the external wound is large, with consequently much hæmorrhage and shock, and which are regarded beyond the bounds of surgical aid except if immediately seen after the injury.

(2) Those cases which find their way to the field or stationary hospital, whose symptoms are of moderate severity, or even of an insufficient character, in which evidence of septic peritonitis suddenly develops and death ensues.

(3) Cases in which the position of the wound raises the possibility of injury to the intestine, but in which the symptoms

are slight or of moderate severity, and which recover spontaneously.

In military surgery it would appear, for various reasons, that the expectant treatment of abdominal wounds, especially from small calibre bullets, is the one on which most dependence can be placed. Mr. Making again says that he only saw one successful case in which the small intestine had been treated by excision and the insertion of a Murphy's button; he learned of two cases in which the large bowel had been successfully sutured, and a similar case where the small intestine was sutured with a favorable result.

In the case just reported no special attempt had been made to locate the bullet. In his opinion too much stress is often placed upon the removal of bullets, and much harm often results from unnecessary interferences in seeking for bullets which otherwise would be harmless. In fact, they should not be interfered with unless some obvious reason exists. Of course there are exceptions in bullets lying immediately beneath the skin, or quite superficially to it, or at the bottom of an infected tract where they cause secondary suppuration, or where they cause pressure upon important structures, especially nerve trunks, or, again, where the bullet is in close proximity to a joint, interfering with its function. These, of course, all demand removal by surgical interference. On the other hand, bullets sunk in the great cavities of the body, or in positions difficult of access, are much better left alone, and should never be interfered with unless the symptoms demand surgical interference for their removal.

Dr. William L. Rodman said that in cases of gunshot wound of the abdomen one should not wait for the subsidence of shock, but should proceed at once to open the abdomen, because in the great majority of instances shock is due to hæmorrhage, and if one waits for the subsidence of shock, he will wait until the patient dies. Nothing has been more exaggerated than the amount of shock that arises from gunshot wounds of the abdomen unaccompanied by hæmorrhage. He had seen seven perforations of the intestine, and yet the patient had a normal temperature and a pulse of 72. In a second case he had seen a normal temperature and pulse of 80. If there was a great deal of shock due to hæmorrhage, it was not best to wait, but to proceed at once to do a laparotomy.



There was one position taken by Dr. Le Conte which he would be disposed to question a little. He did not say he would never enlarge the incision, but his testimony would be to let the bullet opening alone and to open in the middle line or semilunar line in the majority of cases.

There is much to be gained by following the bullet. In the first place, the danger of converting the non-penetrating into a penetrating wound of the abdomen is avoided by following up the bullet. If done with the finger instead of the probe, the perforations in the gut are found more quickly immediately under the bullet-wound than when the abdomen is opened in the median line. There is a disadvantage in opening the cavity well to one side, and yet he had done so in two instances: one where there was a double wound of the intestine. In this latter case the man was in general peritonitis, and had been shot fifty-one hours before the operation, but he made an excellent recovery. The line of the bullet should be followed in the great majority of instances; then, if it be found that the incision does not give access to all abdominal contents, it is easy to supplement it by median laparotomy.

Time is usually saved by following the bullet, and this is oftentimes of the greatest moment. He thought that wounds made by balls of large calibre should always be regarded as septic wounds, as these balls will, in the vast majority of cases, if not always, carry in foreign bodies with them. It has been very rare not to find pieces of foreign body along with the bullet, or probably find the foreign body and not the bullet. He remembered one case where he took out a piece of felt that had been agglutinated to the intestine. Drainage should practically always be made in penetrating wounds of the abdomen. He never knew of a case of shot-wound of the intestines or stomach to recover where drainage was not made.

As to the reference made by Dr. Harte to the treatment of such injuries on the battle-field. Treves and MacCormac during the Anglo-Boer war, and practically all of our American surgeons in the late war with Spain, taught that soldiers with gunshot wounds of the abdomen did best if not operated upon. We cannot question the position military surgeons have taken for the past four or five years concerning penetrating wounds of the abdomen on the battle-field. In the first place, everything is

unfavorable for operating such cases. The congestion along the firing line and in field hospitals, with their poor equipment, make it simply out of the question to do ideal surgical work. In the second place, the modern rifle-ball, which is .30 of an inch in diameter, is made of steel or steel jacketed, or covered with cupro-nickel, and goes with the greatest velocity, revolving on its long axis at the rate of over 2000 revolutions a second, and when it enters the tissues cuts like a knife; therefore extravasation of the alimentary contents, even in case of undoubted injury, may not occur, as the opening may quickly close. That many soldiers in our own and the British armies recovered after undoubted perforation of the alimentary tract cannot be doubted, though we may question whether so large a per cent. as many think recovered from *undoubted intestinal wounds*. Who can say that many of the *supposed* cases of perforating wounds of the intestines really were of such nature? They may have been perforating wounds of the abdominal cavity, and yet, on account of the empty state of the alimentary tract, it might have escaped injury. We know that soldiers often fast when on forced marches; that they frequently suffer from diarrhœa, both of which conditions would favor emptiness of the gastro-intestinal tract and make wounds of the stomach and intestines less likely to occur. He had seen a man shot through and through, the ball entering just below the ensiform cartilage without injuring either stomach or intestine. It lodged behind the eleventh dorsal vertebra, and unquestionably traversed the peritoneal cavity. He was a telegraph operator, who could not leave his key, and had taken nothing in his stomach for twenty-four hours. He was shot with a pistol-ball of large calibre (44). He had not the slightest symptom referable to the stomach or intestine. He was immediately paralyzed in his lower extremities, and some months after the injury Dr. Rodman did a laminectomy, and removed the ball from the spinal cord opposite the eleventh dorsal vertebra. At last account he was still living; the paralysis, however, remaining.

Dr. Le Conte rejoined that Dr. Rodman had probably misunderstood him when he said that he did not advocate opening in the line of the bullet. Dr. Le Conte always does that until he finds out that the peritoneal cavity has been entered, and then prefers abandoning this exploratory incision and opening the abdomen in either the median or semilunar line, believing that such openings can be extended and closed much more quickly, and the abdominal cavity can be explored more thoroughly and better cleansed.



Dr. Harte agreed with the last remarks of Dr. Le Conte in regard to the opening of the wound. Of course he always explored the external wound and determined, if possible, whether it be perforated or not. If so he makes an opening, preferably in the median or semilunar line, since it is a mistake to sacrifice muscular tissue except where it cannot be avoided, as there is always more or less difficulty in closing the wound later on, and there is much more liability to hernia than if the abdomen is opened in either of the above-mentioned places. In regard to the possible presence of foreign bodies in the wound, this is a condition which we are liable to see a great deal of in civil practice, especially where missiles are used of slow velocity. Here we invariably have particles of clothing carried in before the projectile and left in the wound, leaving all the conditions favorable for infection later on. It has been the experience of surgeons that wounds thus received are very much more apt to become infected than where the modern high velocity missile is used, as in military practice; and this explains why a certain percentage of abdominal wounds that were received in the Spanish and Boer wars recovered, which otherwise, if they had been inflicted with a slow velocity bullet, would unquestionably have resulted fatally.

The character of the wound as ordinarily seen is a lacerated, contused wound, such as was seen during the late Civil War. The modern bullet, on the other hand, with its high velocity, produces practically an incised or punctured wound. As to drainage, he was strongly in favor of drainage in these wounds, especially when there is any involvement of the bowel. He preferred the use of gauze rather than the tube as being much better in absorbing any leakage, and it is certainly very much better borne by the intestine, with which it is bound to be more or less in direct relation. A glass drainage tube carried down and left in the abdominal cavity in contact with the intestine is very often responsible for the fæcal fistulæ which so often follow abdominal operations, especially when there is some involvement of the bowel.

Dr. De Forest Willard emphasized the septic condition of these wounds and the necessity for drainage. With all slow-moving missiles some septic infection is almost necessarily carried in.

As to the question of shock, he remembered one Fourth of July night seeing a man accidentally shot at fifty feet. He reached him within two minutes from the time he dropped in the street. Although he had only received a small bullet wound in the muscles of the back, yet that man was apparently dying from shock, so profound and complete was it. Hæmorrhage was but slight. The element of fright was undoubtedly largely accountable for the depression, which lasted for twenty-four hours.

## INTRA- AND RETROPERITONEAL HÆMORRHAGE AND TRAUMATIC RUPTURE OF THE MESOSIGMOID.

Dr. George G. Ross reported the case of a man, aged twenty years, who had been always in good health until eight hours before admission to the German Hospital, having been injured in a fight by being struck or kicked on abdominal wall. Two days prior to admission he had been struck in the left loin by a piece of machinery. Following the fight he felt weak, but otherwise all right. He walked several blocks to the Park to cool off. About 11.30 P.M. he had severe pain in abdomen and went home and to bed; felt somewhat better for a short time, but the pain again became severe. He then came to the hospital and was admitted about 4 A.M. on June 17. On admission the temperature was 98.2° F., pulse 72, and of good volume. The abdominal wall showed no evidence of traumatism. His face was severely bruised and showed numerous ecchymoses and one contused wound on the upper lip. The abdominal muscles were somewhat rigid, no dulness, no tympany, but he had severe cramp-like pain, for which a hypodermic injection of morphia, one-fourth grain, and ice-bags to the abdomen were ordered. Patient went to sleep; about 8.30 A.M. again complained of pain; temperature 98° F., pulse 84, good volume. Abdominal muscles rigid, but no tympanites. Ice-bags removed about 9.30 A.M., as patient complained of feeling cold; temperature 97.8° F., pulse 124, skin cold and clammy. A mass could be felt in the right iliac fossa.



Immediate operation advised; but there was considerable delay in gaining consent of parents.

At the time of operation patient was in a state of collapse; temperature 97° F., pulse about 160, but could not count with any accuracy.

Patient given intravenous injection, saline solution, 3000 cubic centimetres, temperature 120° F. prior to operation. Under ether, an incision, about five inches long, was made through left rectus muscle. On opening the peritoneum a large quantity of free blood escaped. General cavity washed out with saline solution. Intestines found intact. There was an extensive hæmorrhage between the layers of the mesentery and some hæmorrhage under the peritoneal coat of the large bowel at several points. The outer layer of the mesosigmoid was denuded of its serous coat for about four inches, giving origin to the intraperitoneal hæmorrhage. In addition to the intraperitoneal hæmorrhage, a large collection of blood was discovered behind the peritoneum. The origin of the retroperitoneal collection was not discovered or searched for.

The serous coat of the mesentery was sutured with fine silk. After completing the toilet of the peritoneal cavity, two pieces of iodoform gauze were packed in to stop the oozing from the mesenteric wound, and to aid in controlling the retroperitoneal hæmorrhage by pressure. The abdominal incision was partially closed with silkworm-gut sutures.

During the operation the pulse was very weak. Saline again injected into the median basilic vein (4000 cubic centimetres). The pulse fell after operation from 152 to 96, and his temperature came up from 97° to 99° F., so that he reacted promptly from shock. This prompt reaction was the result of the intravenous transfusion and the controlling of the hæmorrhage.

The convalescence of the patient was interrupted by the development of a fæcal fistula, which made its appearance on the eighth day, or twenty-four hours after the removal of the gauze packing. The fistula was due, apparently, to the pressure of the gauze upon a weakened and badly nourished portion of the bowel, as the torn mesenteric vessels would naturally favor necrosis of the area which they normally supplied. The fistula healed spontaneously on the sixteenth day. The subsequent history was uneventful, and on August 1 he was discharged, being

the forty-fifth day after operation; his temperature and pulse having been normal for seventeen days.

The patient was readmitted to the hospital on August 6, having been home six days. Upon admission, he complained of severe pain in the epigastrium, running into left loin and lower abdomen. Vomiting, profuse and dark brown in color, began the evening previous to admission. He said his bowels had not been moved for twenty-four hours, but he had a stool shortly after admission.

Upon admission the patient had a temperature of 99° F. and a pulse of 96; great pain and tenderness upon palpation in the epigastrium and left loin. The abdomen was not distended, but there was an area of tympany corresponding to the position of the stomach and gastric flexure of the colon. The loin space was flat posteriorly; the tongue was coated; each act of vomiting temporarily relieved the nausea. The vomited matter was not fæcal in odor or appearance. His condition generally became worse; the pulse increased in rapidity until it reached 160 on August 8, two days after his readmission. The temperature reached 100-102° F. His bowels had moved on the 6th and on the morning of the 7th of August. After this stool the obstruction seemed to be complete, for he passed no flatus and his condition grew steadily worse. A diagnosis of slow obstruction, the result of contracting adhesions, was made; on the 8th he was operated for its relief.

The old cicatrix was excised. Upon opening the peritoneum, the small bowel and sigmoid were found to be matted together in numerous places. The obstruction was not due to a single band of adhesion, but to compression of the adherent mass of bowel caused by the contraction of the entire mass. The adhesions were broken up and the bleeding points ligated, but in doing so the serous coat of the bowel was torn in several places. The rents were repaired, and an opening in the bowel at one place was closed by Lembert's sutures. The abdominal wound was closed by through and through sutures. He never fully reacted after the operation, and died on the third day thereafter.

On the second day after operation he had a very good bowel movement and passed considerable flatus. His temperature gradually became higher until it reached 100-104° F., and the pulse ran up to 150, weak and running. The cause of death was a general purulent peritonitis, probably from infection through the weakened and denuded bowel.



The autopsy proved the correctness of the diagnosis and the fact that the obstruction was not the immediate cause of death.

The cause of the retroperitoneal hæmorrhage was not discovered. The urine did not contain blood at any time during the illness, so the kidney must be excluded as a causative factor. It seems probable that it arose from the torn mesenteric vessels before they entered the layers of the mesentery.

## COMPOUND FRACTURE OF THE ANTERIOR FOSSA OF THE SKULL.

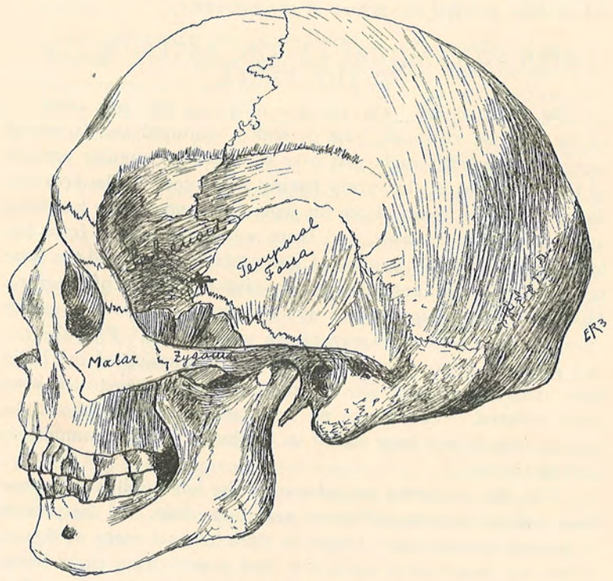
Dr. Ross reported also the case of a man who was admitted to the German Hospital, June 6, with a contused and lacerated wound of the left temple just over the external angular process of the frontal bone, the injury having been received the previous day. There was oozing from the wound. Hæmorrhage had been quite free from the nose, and there was some oozing from the left external auditory meatus. Upon probing the wound the bone could be felt, but there was no positive symptoms of fracture. His pupils were equal; there was no paralysis. He was mildly delirious and restless. Temperature was 100-104° F., pulse 96, and strong. A provisional diagnosis of concussion of the brain was made, and calomel, Dover's powder, and ice-bag to the head were ordered. There was an area of emphysema about the wound, which was later found to be due to the communication with the nose.

The day following his admission the left pupil had become fixed midway between dilatation and contraction, and the periods of unconsciousness were longer in duration and more profound. Thirty-six hours after admission and nearly forty-eight hours after injury he developed a paralysis of the left side of the face involving the muscles of the eyelids, the mouth, and cheek. His left pupil remained fixed. There was no paralysis of the body at any time. He was more profoundly unconscious, but not comatose.

The diagnosis was revised to fracture of the anterior fossa with contusion of the brain, with areas of hæmorrhage in the cerebrum. It was a matter of doubt as to whether there was a depression of fragments and extradural hæmorrhage arising

from laceration of the anterior meningeal artery, or whether his condition was due to the contusion and cerebral hæmorrhage.

There was also some doubt as to the involvement of the base of the skull. The external auditory canal was full of blood and there seemed to be some oozing, but it could not be said with positiveness that the blood had not run backward from the external wound and collected in the canal. In view of the doubt, it was decided to explore the wound.




Line of fracture to the mark × was plainly seen, from × backward the fracture is a surmise.

The original wound was enlarged, and a fracture of the external angular process of the frontal and a portion of the malar bone was discovered. Upon further search, a fissured fracture of the orbital plate of the frontal bone was made out. The line of fracture extended backward and downward, involving the greater wing of the sphenoid. This much of the fracture was



plainly demonstrated. The accompanying diagram illustrates the line of fracture. Beyond the mark × the line of fracture is a matter of surmise, as the patient recovered, and it was impossible to demonstrate the exact facts.

It seems probable that the petrous portion of the temporal bone was involved, as evidenced by the bleeding from the ear and the line of fracture. The emphysema about the eyelids and external wound points towards a communication with the nose. There were no depressed fragments.

The wound was drained and dressed. The external auditory canal and nose were cleansed and packed with gauze.

The patient recovered, and was discharged forty-two days after operation. His temperature and pulse ran a practically normal course throughout the convalescence. He developed a pachymeningitis, and continued to have attacks of mild delirium, which became gradually less marked, and finally disappeared altogether. The left pupil remained fixed, and the paralysis of the eyelids remained at the time of his discharge.

## ANEURISM OF THE THORACIC AORTA OF TRAUMATIC ORIGIN; TREATMENT BY INTRODUCTION OF WIRE AND ELECTRICITY.

Dr. De Forest Willard submitted a supplemental report to the original paper presented February, 1901, to the Academy, and published in the Annals of Surgery, July, 1901, p. 143.

The man returned to the hospital two months later suffering with increased pain and dyspnœa. The tumor beneath the pectoral muscle at the anterior border of the right axilla had decidedly increased in size, having evidently eroded the ribs. The principal suffering, however, was in the left chest posteriorly, probably from erosion of the vertebræ.

Twenty feet of No. 24 silver wire were inserted through a long hypodermic needle, and a galvanic current of eighty milliamperes applied for one hour. The patient bore the operation well, and was relieved of pain even on the left side, owing probably to change in the direction of the blood current. The wire, however, evidently failed to produce coagulation in the right thorax, and the tumor, having lost the restraining power of the ribs, increased rapidly in size, lifting the entire right pectoral. Although the walls became very thin, the sac did not burst, and

the patient died slowly from exhaustion four weeks after the second operation, five months after the first operation.

In spite of every effort, he was unable to obtain permission for an autopsy, and the exact point of original rupture of the aorta must remain in doubt.

Since the above report was written, Dr. Matas has published an able article on the subject ("American Medicine," June 22, 1901, page 546; also Transactions of Southern Surgical and Gynæcological Association, 1900), and Dr. Leonard Freeman also read a paper before the American Surgical Association at Baltimore, May, 1901.

One of the dangers of gelatin injections is reported in the *Journal of the American Medical Association,* October 5, 1901, page 923; two deaths being reported from tetanus.

# TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

*Stated Meeting, November 4. 1901.*

The President, De Forest Willard, M.D., in the Chair.

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## AN INSTRUMENT FOR FACILITATING INTESTINAL ANASTOMOSIS.

By OSCAR H. ALLIS, M.D.,

SURGEON TO THE PRESBYTERIAN HOSPITAL.

My first intestinal anastomosis was with the Murphy button. With its magic assistance I united the small intestine to the stomach to overcome pyloric obstruction. As the button was not subsequently found in the stools, the blame was visited upon the attending nurse. A year or more later it was found at the autopsy in the stomach.

In my second employment of the button for fæcal fistula, the walls of the intestines to be approximated were thick and infiltrated and unsuited to the buttons in ordinary use. I did the best I could with the button, but the thickened walls held it a prisoner and would not let it pass on. The result was a second fistula at the point of operation. In due time I cut down and removed the button. Several months later I again attempted to close the fistulous orifice. I had to resect the gut, and when I had done this, I found the spring out of order in the button that I had depended on for my closure of the parts. Left to my own resources, I was obliged to unite the severed gut-ends as best I could. The result was satisfactory, and since then I have depended on no other instruments than those described in the present communication.

I think that surgeons, after a little experience in anastomoses, rely more confidently upon their fingers and simple forceps and the suture than upon any of the appliances that

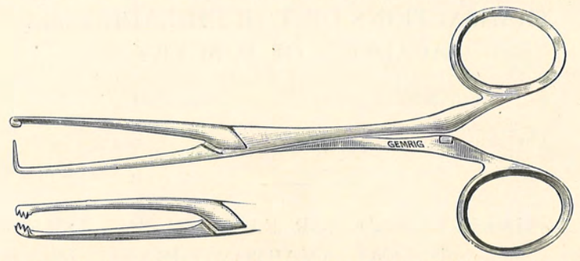


FIG. 1.—The tenaculum or basting forceps above; below are the rat-tooth forceps. By a misunderstanding, the teeth are placed at the end instead of at the side.

have been specially contrived for the work, and the reason is obvious. No single instrument and no series of instruments can meet all the requirements; and it not infrequently hap-

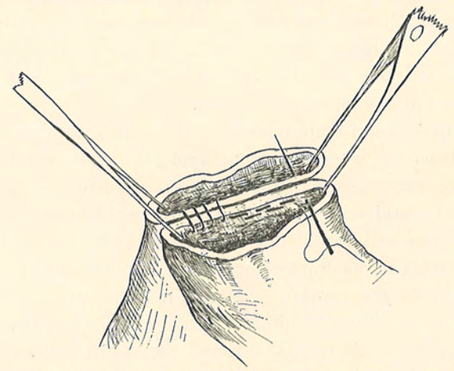

FIG. 2.—The first attachment of the tenaculum forceps holding the separated gut-ends for suturing.

pens that an anastomosis is demanded when none of his kit of special instruments is at hand. Such, at least, has been my experience.



If one notice a tailor at his work, he will observe that before he takes a single stitch he prepares his work by basting

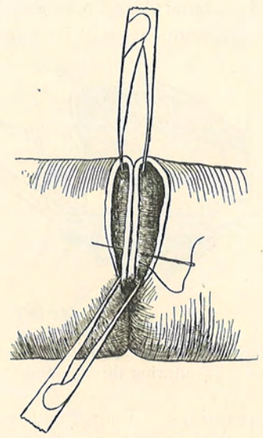

FIG. 3.—Advanced stage of suturing, *i.e.*, Fig. 2 advanced farther towards completion, suturing still the same as in Fig. 2.

it. The surgeon in his anastomotic work needs to do basting more than in any other part of the body. This is done to some extent by the Murphy button. The Laplace and O'Hara

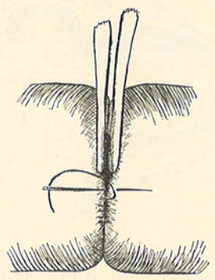

FIG. 4.—Final steps in closing the bowel. Figs. 2, 3, and 4 form a series.

instruments are convenient forms of basting while the surgeon secures the approximate parts with suture.

The first instrument that I describe is my basting forceps. They will probably be known as tenaculum forceps, since the end of one blade is a tenaculum concealed in the loop of the other blade. These instruments will be found very serviceable

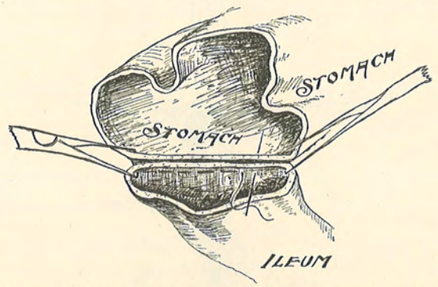


FIG. 5.—The small ileum is represented as being sutured to the stomach—end to end—suturing through and through.

in many minor operations. They make excellent retractors. I have often found them of great service in securing a piece of protective along the cut edge of the wound with a view to protecting the field of operation. In operating for varicocele

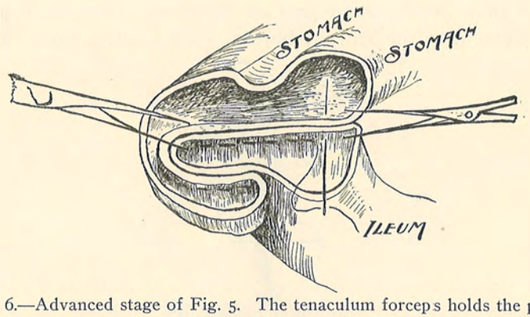


FIG. 6.—Advanced stage of Fig. 5. The tenaculum forceps holds the parts for easy suturing, which is through and through.

(open method) I secured a clean piece of muslin to the edge of the wound, and thus shut the penis, scrotum, and pubes from the field.



In using these instruments on an ordinary anastomosis, I seize the parts that I wish to unite and bring their serous surfaces together, just as one would bring the two ends of his coat-sleeves together by placing them side by side. Having transfixed them as shown in Fig. 2, I begin my suturing, sewing through and through or over and over. The kind of suture employed is immaterial, provided only that it transfixes both walls. The gut being clasped as in the figure, fully half the circumference of the gut-ends can be closed. I now take off the forceps on the left (Fig. 2) and reclasp them where

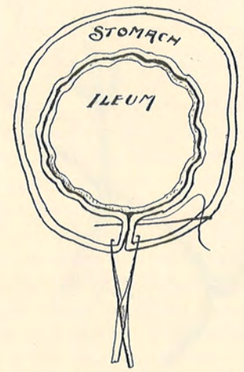


FIG. 7.—The suturing in Fig. 6 has finally united the whole circumference of the ileum to the stomach, and the needle has begun to close the remaining part of the stomach.

the suturing terminated; taking off the forceps on the right, I can reattach them still farther to the right, basting more gut surface for the permanent suturing (Fig. 3). In this way ordinarily fully two-thirds of the circumference of the gut can be sutured from *within the gut*. Indeed, it is possible to entirely unite two divided gut surfaces by end-to-end suturing, with every suture starting from the mucous surface. The advantage, however, would be very little over a *serous* suture, and the disadvantage of delay will be something.

The final closing of the gut-ends will be very conveniently

done by means of a pair of forceps with teeth on the sides. By means of these the border of the gut can be seized and inverted, after which both forceps can be held in the left hand while the right is suturing (Fig. 5). At a glance the amount of suturing from *within the gut*—fully two-thirds can be seen—is made to perforate all the coats of the bowel. This secures enough tissue for a safe closure, and insures the passage of the suture into the lumen of the bowel.

I have never resected a part of the stomach and made an

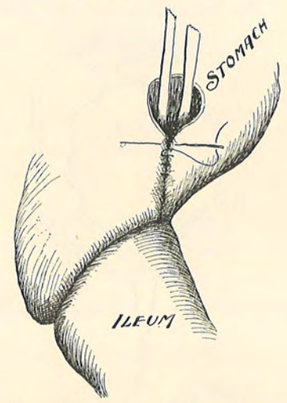


FIG. 8.—The entire circumference of the ileum has been attached to the stomach without a suture showing on the outside, and the remaining part is being turned in by the forceps, with teeth on the edge for convenient suturing. Figs. 5, 6, 7, and 8 form a series.

anastomosis between it and a part of the small bowel, but the following method, somewhat unusual, is entirely feasible. The two structures to be joined are brought together and basted by the forceps as in Fig. 6. This done, the forceps on the left are carried over to the point where the suturing ends and reclasped, while the forceps to the right are made to clasp unsutured parts and hold them until sutured.

In the figure, the needle is supposed to enter at the point where the suturing ceased. The part between it and the forceps on the right is still unsutured. Since the cut border of the stomach will in most instances be greater than that of the small intestine, it will be entirely practical to sew the two together as represented in Fig. 8. (Compare Figs. 7, 8, and 9.) Having sutured the small bowel to the stomach end-to-end, the remainder of the stomach approximation can be readily completed by means of the forceps (Fig. 5), which seize the borders and turn them in while the sutures are applied.



## DISCUSSION.

DR. CHALMERS DA COSTA said that he had used these instruments of Dr. Allis in general surgery but not in intestinal work, and had found them signally useful in operations, especially in hernia and for catching isolated blood-vessels and perforating vessels of the chest wall. He had used them with satisfaction in a goitre bleeding profusely from the surface of the gland. They are extremely useful in opening the peritoneal cavity, and for that purpose are to be preferred to the dissecting forceps.

DR. DE FOREST WILLARD said that in Connel's operation of intestinal anastomosis, leaving all the knots inside the lumen, all the coats of the bowel are sutured as in Dr. Allis's method, except that he makes a loop or rectangular stitch. To secure the final suture, when he comes to the last one he leaves the two ends untied; then inserts a fine threaded needle, eyed end first, from the opposite side of the gut between two of the stitches, catches the untied ends in the loop of thread, draws them out upon the opposite side by pulling up the lower wall of the bowel and flattening the cavity. The knot is then tied through the small opening between two stitches, the ends cut off, and the knot then allowed to escape back into the lumen of the gut. Every knot is thus left inside the lumen and will take care of itself. He has demonstrated both by experiment and by operations on the living subject that suture of all the coats is perfectly safe and that there is no leakage. There is no infection as to the peritoneal cavity. The peritoneum will cover over the line of union in a few hours.

DR. RODMAN said that Dr. Allis had recognized the trend in favor of direct suturing in interstitial work, and his instrument simply facilitates this method. It provides one with more fingers, and enables one to do without assistants what possibly could not

be done so well with them. Dr. Rodman had up to that time felt perfectly satisfied with the Murphy button. His results had always been good, and he had, therefore, not felt justified hitherto in giving it up, although theoretically there are objections to its use. It may not be ideal, but it is life-saving oftentimes. In using the button much depends upon the case, the size and shape of the button used, and, above all, one should be certain that it is manufactured by a reliable instrument maker. This is most important. He had known cases where the button was retained for several weeks, but in all of his patients it had promptly passed when the patient assumed the erect posture and began walking about.

Dr. A. A. Davis asked whether the use of the through-and-through suture had been tested in a sufficient number of cases to demonstrate that there is no danger of leakage. The tendency to leakage in the bowel is quite marked in cases in which there is even such a small opening as a hypodermic syringe needle makes, the liquid contents of the bowel oozing through.

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## DISTAL LIGATION OF COMMON CAROTID AND RIGHT SUBCLAVIAN ARTERIES FOR ANEURISM.

Dr. John Chalmers Da Costa reported the case of a man, aged forty-five years, a blacksmith by occupation, who was admitted to the Jefferson Medical College Hospital December 4, 1899. When he was twenty-seven years of age he contracted syphilis, and was treated for it for a year or more. Seven years before his admission to the hospital, he began to have severe headache in the occipital region. The pain would come on without apparent cause, was of a sharp, boring character, and was aggravated by recumbency or by the use of the eyes in reading. He was given iodide of potassium, which relieved him; but whenever the drug was discontinued the pain would return. These attacks came on suddenly, in distinct paroxysms, and were not accompanied by sick stomach. During each attack he was compelled to abandon work for two or three days. He took iodide of potassium, off and on, for about five years. The dose was then increased, and for three months he took 280 grains a day. After



a time these large doses seemed to lose their effect, and the drug was discontinued.

During the seven months immediately preceding admission, he had taken no idodide of potassium whatever. During the antecedent two years the pain had become localized at a point two inches posterior to and a little above the mastoid process of the right side. It was not associated with tenderness, but at times became so violent that it was necessary to administer morphia to give him relief.

The eyes were examined by Dr. De Schweinitz, who reported as follows: "The eyes react normally to light, to accommodation, to convergence, and consensually. The media are clear and the fundus is normal. The nerve is of good color and the margins are distinct. The field of vision is normal, and there is no indication of a central nervous lesion."

The patient apparently had two varieties of pain. He has occasional attacks of undoubted neuralgia in the supraorbital and occipital regions, and also attacks of more deep-seated and persistent pain which, it may be, arise from some gummatous intracerebral condition. An examination of the patient showed that he had an aneurism of the right common carotid artery, in the root of the neck, and an aneurism of the innominate artery. The innominate aneurism caused very distinct bulging of the first and second costal cartilages, great pulsation, marked bruit, and distinct thrill. It seemed that the aneurism of the carotid was distinctly separated from the aneurism of the innominate artery. In view of this belief, it was determined to ligate the right carotid artery, the ligature being distal to the innominate aneurism and proximal to the carotid aneurism, and to also ligate the right subclavian artery, for the effect upon the innominate aneurism.

On the 13th of December, nine days after the patient's admission, he was operated upon before the class in the Jefferson Medical College Hospital by Dr. Da Costa, Professor Keen assisting in the operation. He first made an incision in the neck and explored the carotid artery. Through this incision he was able to outline the aneurism of the carotid and to feel the vessel between that aneurism and the larger aneurism of the innominate. He found that the vessel was glued to its sheath by adhesions, and was undoubtedly diseased between the two aneurisms. He therefore decided that it would be inexpedient to apply a ligature

between the aneurisms. The vessel was exposed just below the bifurcation, and a ligature was applied, which was distal to the carotid aneurism as well as to the innominate aneurism. This ligature was of chromicized catgut. After the common carotid artery had been ligated, the wound in the neck was closed, and an incision was made to expose the subclavi n artery in the third part of its course, which was ligated with silk, after which the superficial wound was closed.

There was practically no shock from the operation. The temperature never went below normal. Immediately after the termination of the dressing of the case, the right arm was wrapped in cotton, and was kept warm with bottles of hot water for forty-eight hours. On the 16th of December (that is, at the end of the third day after the operation), the radial artery of the right arm was found to be pulsating. On the sixth day after the operation, the patient was given a hypodermatic injection of thirty-two cubic centimetres of Carnot's solution of gelatin, with the hope of aiding coagulation in the aneurismal sacs. It was noted at this time that the pulsation and thrill of the innominate aneurism were much less, and of the carotid aneurism distinctly less.

On the 10th of January the patient was allowed to sit up for part of the day; and on the 11th he sat up for most of the day. From this time on he improved, having occasional paroxysms of neuralgic pain in the head coming on at night; and he was placed on iodide of potassium, which seemed to give him relief. He was discharged from the hospital on the 18th day of January, a little over a month after the operation. At this time the aneurism of the innominate artery could be detected with difficulty. The very distinct bulging of the chest had passed away. There was still a perceptible murmur or bruit, but scarcely any thrill. The carotid aneurism was very much shrunken, and the pulsation felt far away.

For a time the man seemed to have been wonderfully benefited by the operation. Against advice he returned to his work as a blacksmith, an occupation in which he even shoed horses. From that time to this he has still gotten along very well, although he has recently noticed an increase of pulsation in the neck. On the 28th of October (1901) the patient again called at the Jefferson College Hospital, and was examined by Dr. Da Costa.



It was then obvious that he had disease of the carotid artery of each side, and that the circulation in the right carotid had been re-established. Throughout its entire extent the right carotid beat forcibly, and at one part, about the seat of ligation, was apparently aneurismal. The left carotid was dilated and pulsated forcibly. The re-establishment of the circulation may have been due to the early absorption of the ligature of chromic catgut. It is probable that the direct cause was the reckless return to violent labor. There was no bulging apparent at the seat of the innominate aneurism; and, comparing his present condition with that of two years ago, he was still wonderfully better, in spite of having labored at his most dangerous occupation.

The urine report of October 29, 1901, shows that fluid to be of a clear, amber color; acid reaction, and with a specific gravity of 1030, containing 1.9 per cent. of urea, a few leucocytes and epithelial cells, and a trace of albumen, but no casts.

The blood examination made October 31 shows erythrocytes, 5,462,000; leucocytes, 10,200; hæmoglobin, 78 per cent.; color index, 71 per cent. The differential count is as follows: Polymorphonuclear neutrophiles, 71 per cent.; small leucocytes, 14 per cent.; large leucocytes, 14 per cent.; eosinophiles, 1 per cent.

The eye examination, made by Dr. William Sweet, October 31, is as follows: "Media of both eyes, clear; pupillary reactions, normal; marked arterial and venous pulsation present in both eyes, but more marked in the left; no disease of either eye-ground."

The physical examination by Dr. Julius Salinger, November 7, is as follows: "The impulse of the heart is best seen in the midclavicular line, at the base of the sixth interspace, and is diffused to the ensiform cartilage, being quite forcible in the midclavicular line. There is marked pulsation of the vessels of the neck, especially of the right side. No thrill is perceptible in the mitral area, but just above the clavicle, on the right side, a coarse systolic thrill is manifest. There is no diastolic shock and no tracheal tugging. All over the precordium, a coarse, blowing, systolic murmur is perceptible, its area of maximum intensity being over the aortic cartilage. The second aortic sound is scarcely perceptible, and the systolic murmur is transmitted to each carotid artery."

# MISAPPLIED MECHANICAL SUPPORT TO WEAK ANKLES OF CHILDREN.

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THE vast majority of the human race who wear sandals or moccasons or go barefoot escape the tortures and malformations that follow the wearing of such shoes as those in use in our country at the present time; it would appear, therefore, that the shoe or kind of shoe is responsible for at least some of the disabilities of the foot and ankle. The shape of the sole of the shoe has received much attention from orthopedic surgeons, and reforms in some have been secured. It is the purpose of this paper to consider only weak ankles in childhood, and forms of mechanical compression and restraint commonly in use which are at variance with common sense.

The cases usually seen may be conveniently grouped as follows:

(1) Undeveloped normal feet in normal bodies.
(2) Normal feet in fat children.
(3) Apparently normal feet in rhachitic children.

There appears to be a growing tendency to apply to all children's shoes some more or less rigid support in the form of high uppers, stiff leather counters, whalebone, and even arch-raisers of various materials. Many of these appliances are strongly advocated by shoemakers and by them applied; but not infrequently physicians prescribe their use, and add their testimonials to favor still further sale, and even text-books are found which recommend them.

Given a case of an apparently normal child beginning to walk. It is natural that functions that have not been em-





ployed heretofore would be faultily performed. The muscles that have not been employed in this capacity are not capable of sustaining the weight of the body or of holding the arch up into its subsequent normal position; and the advocates of mechanical support accept these conditions as clearly indicating the necessity of holding the foot and ankle fixedly to avoid still further relaxation of muscles and ligaments until the child grows strong enough to dispense with support.

If this theory is correct, its application elsewhere would indicate that the proper treatment for muscular weakness in any part of the body would be rest induced by mechanical apparatus or by confinement to bed. Still further, fatigue, sprains, and muscle strains, likely to accompany or follow physical exertion such as in foot-ball, boat-races, and athletic sports, would be prevented by keeping the muscles in a state of inactivity in preparation for use. This sounds absurd, but it is not more so than the application of restraint to weak ankles and feet of infants about to walk.

All children are flat-footed because the muscles have not developed the arches of the foot, and use is required to bring the muscles into full development; proper development can only be obtained by perfect freedom from restraint.

Civilization is undoubtedly responsible for a vast array of ills and disabilities of the human frame, but nowhere is this more manifest than in the feet of young children. Those that escape the sole-leather-crippling apparatus are subjected to milder forms of restraint in the leather shoes with high uppers which, even if made of soft leather, must necessarily bind the ankle and foot, thereby preventing full function. The resulting sprains and faulty uses of the feet of children from six to ten years of age are a natural sequence. The faulty position and uses of the toes are often remarked. T. S. Ellis, in his monograph, "The Human Foot," says, "The toes play a far more important part in the ordinary functions of the foot than is generally admitted. One sees statements (where better things might be expected) to the effect that their services could be dispensed with. If they were not used, the muscles

moving them would be found to be wasted." It must be recognized that the absence of function is at first normal, and that the subsequent deformities are incidental to the customs of civilization, being confined to shoe-wearing people.

The softer the material of which the infant shoe, including the sole, is made, the less hinderance will there be to the normal development of the encased foot. The knitted sock or the Indian moccason is entirely free from objection and criticism; by their use the foot is protected from cold and is free for natural movement and development. The avoidance of prolonged weight-bearing, the avoidance of fatigue and muscle exhaustion, will enable the feet to properly and normally assume the strain of use. The fact, which is beyond dispute, viz., that the process of civilization deforms the feet and produces loss of proper mechanical functions, is clearly sufficient indication that the correct course to pursue is to avoid all restraint to full perfect function.

The most beautifully formed adult feet that I have seen have been in those who never, as child or adult, have worn shoes; they may have worn sandals which required the action of muscles to retain them in place, but this was in the line of correct use. In contrast, the most serious sprains of the ankle that I have seen in children have been in those who have had inadequate muscle and joint function. Careful inquiry has almost always elicited a history of weak ankles from early infancy and the use of high-counters or some such equally reprehensible and mechanical restraint to normal function. After the acute pain caused by the sprain has subsided, these cases require massage and carefully applied physical culture to develop the muscles and establish full function to prevent recurrence, in contrast to maintenance of immobilization previously employed.

The medical profession has accomplished many needful reforms in fashions and customs by directing attention to their dangers. There appears to be a necessity for discouraging the use of the extensively advertised and too generally used so-called supporters for weak ankles, the use of which is not only



irrational, but also decidedly harmful, and it is my conviction that they are never beneficial.

The routine plan alluded to, of applying restraint to normal infant feet, appears to have its basis in the fact that in some cases support or even rigidity may be necessary as a temporary expedient while remedial measures are carried out, but should be discontinued as quickly as possible. The cases that may require some form of mechanical support are those that are enfeebled or rhachitic. It must be accepted that in the cases just alluded to destructive changes may occur before muscular coördination can be established, and therefore support without rigidity is often required. The most convenient and efficient form of brace for this purpose is one that is constructed of sheet-steel with a movable joint at the ankle and which is placed within the shoe. The temporary use of this brace does not interfere with full muscular development of the foot, and yet it provides efficient lateral support. Whenever a joint is prevented from action, the muscles which actuate it become atrophied from disuse, and the longer the time that such rigidity is applied to a joint the greater is the disability.

In infants the feet are the most notable in their faulty mechanical use from their more exposed position; but in fact the knees and hips are, upon inspection, generally found to be equally undeveloped, and therefore faulty in action, but are never subjected to similar forms of rigid appliances. The mandate of fashion, however, dictates that the infant foot should be prepared for shoe wearing, and therefore the process is started early in life. When the unnatural foot covering is used in a way unsatisfactory to the trainers, when the little encased foot turns over on its side or becomes pigeon-toed, early recourse is had to the high-counter, corset-shoe, felt or steel arch-raiser, or wedging of the sole. The natural method of removing the cause, *i.e.*, the shoe, appears to be considered objectionable for some unaccountable reason. Proof that removing the shoe is the best procedure can readily be found in the strong, active, correctly shaped feet of young children who have not worn shoes.

The methods pursued in the high-caste Chinese woman's foot should teach a lesson. The little girl was formerly, in many districts, allowed to run barefooted until the age of five years in order to develop the feet. At this age the deforming bandages were applied, and at the end of two years had permanently distorted the feet to an unrecognizable mass and rendered them permanently useless. The plan pursued by shoe-wearing people begins earlier, is slower in accomplishing the results, but the disfigurement and disability ofttimes differ only in degree.

The least objectionable shoe for young children is a low shoe or slipper which possesses the advantages of sandals. Nothing can be gained by the upper, which has the constant disadvantage of cramping the ankle, and thereby preventing its full free use and development. The serious disadvantages of the upper are greatly increased by the various methods of increasing its stiffness, by the addition of movable strips of sole leather on each side as in the pocket shoe, by strips of whalebone or steel as in the corset-shoe, by the high-counter, by the sole leather so-called weak-ankle supporter made independent of the shoe. All of these appliances by inhibiting joint motion naturally induce atrophy from disuse, and therefore make the ankle weaker and less capable of assuming normal functions.

The arch-raisers of steel, felt, or other material may make the appearance of an arch, but it is a faulty arch in that dependence upon this form of mechanical support increases with use, while the tie-rods upon which the arch normally depends are cramped out of usefulness and made to deteriorate by disuse.

The wedge-shaped sole is equally objectionable because its use merely overcomes the appearance of the feet turning laterally, while in reality it hampers normal latitude of motion, and thereby aids muscle disuse.

The constriction of the rubber elastic anklet is without a single rational explanation based upon sound mechanical laws, and yet its use is very common. The strongest argument against the employment of these aids to permanent deformity and false mechanical use of the feet may be found in cases where entire freedom from restraint has obtained, and where physical culture has been relied upon to develop muscles and function. In these patients the ankles, as well as the knees, hips, and other joints, have been trained to their normal standard of use and function and rendered capable of sustaining extensive usage without injury. The wonderful recuperative power of the human being makes it possible to greatly interfere with its functions, and yet not show great deterioration, or even obtain a fair semblance of normal use. These cases that appear to recover by the use of appliances here referred to pay tribute to their own wonderful recuperative powers and not to the irrational means used to hinderance.



In that group of cases of weak ankles classed as rhachitic may be found the explanation of all the evils irrationally applied to really normal feet. In rhachitic children it often becomes necessary to apply aids to mechanical function not alone because of muscle insufficiency, but also on account of the lack of stability of the bones. Deformities of the feet are frequently associated with malformations of the long bones, such as the valgus foot and bow-legs and knock-knees, each depending more or less upon the other and upon the constitutional disease for their development.

No routine plan of treatment can be laid down, for discernment is required to meet the mechanical inefficiencies by mechanical aids that will be of benefit and not prove injurious. When some form of splinting becomes necessary care should be exercised in securing a freely movable joint to correspond with the ankle, thereby favoring proper usefulness of that joint without producing deformity. Internal medication, attention to hygiene, diet, guarded exercise, and similar measures will facilitate establishment of normal function in enfeebled apparatus.

I would direct attention to the following conclusions:

The natural human foot best performs its functions when it has been freest from restraint.

The natural foot can be quickly crippled into inefficiency by high-counters, corset-shoes, arch-raisers, wedges, and elastic anklets.

The natural foot, when burdened by misapplied mechanics, is rendered weak, and therefore susceptible of sustaining injury, such as sprains and the formation of bunions, flat feet, wabble joints, etc.

The natural foot in a constitutionally weak or rhachitic child may demand mechanical aids specially adapted to the individual requirements and peculiarities of the case.

That it is the duty of the medical profession to discourage the indiscriminate use of high-counters, corset-shoes, elastic anklets, arch-raisers, and sole wedging, which are known to be injurious, unmechanical, and productive of permanent loss of function.

APPENDIX.

The following extracts from an advertisement recently received are illustrative of the absurd and unfounded statements of those who will sell their goods whether they produce injury or not.

Comment is unnecessary.

Children's ankle supporters. Will fit any shoe—button or lace. Especially adapted for children learning to walk. When ordering, please state the size of shoe usually worn.

The toe-in shoe. It is really surprising how many children need a shoe to prevent the awkward habit of toeing-in, and need it most just when they are beginning to walk; when, if our little "Toe-in" shoe is worn habitually, this tendency can easily be overcome, almost unconsciously, and wholly without discomfort or annoyance. It is a very simple device in the construction of the shoe, and, although so effective, is not noticeable except as attention is directed to it.

To prevent or cure bow-legs in children. The shoe to prevent or cure bow-legs has to do with a still more serious deformity, as, after the bones of a bowed leg are fairly hardened, nothing less than a surgical operation will afford a remedy. This shoe is so designed as to throw the weight of the body in a way to completely counteract the tendency of the legs to curve outward, and they straighten of themselves. There is nothing to attract attention—no conspicuous brace or bandage. We recommend their use as early as the child shows any inclination in this direction.

Ankle and arch supporting shoe. Our new shoe to strengthen weak ankles is the best thing of the kind we know of. It holds the ankle with a firm but gentle and yielding pressure; it also supports the arch of the foot, which in most cases is the real point of weakness, and the cause of turning ankles. It also effectually prevents flattening of the foot—one of the very worst of orthopedic evils.

Instep-arch supporters. A positive cure for flat feet. These supporters are extremely light in weight, can be easily worn in any shoe, and, owing to their flexibility, are far superior and vastly more comfortable than the old-fashioned rigid devices of steel and bronze employed to correct the above condition.

DISCUSSION.

Dr. G. G. Davis said that while the parents of children will direct their attention to the weak ankles, they will practically ignore the conditions which produce them; in other words, they will direct their attention to a local condition, and the general condition will be entirely ignored. Of course, weak ankles can come from various causes, but in young children it is often associated with rickets. Weak ankles are a single symptom. It may be the symptom which attracts most markedly the attention of the parents. They will then proceed to adopt one of those contrivances which are for sale in the dry goods and shoe stores, and which fail to correct the cause of that condition. If such a child is examined, it will be found not only to have weak ankles, but likely bow-legs, and show other evidences of rickets. The remedy is to be directed in an entirely different direction. It is to be directed to a strengthening of the parts rather than simple support. The object desired in these cases can be achieved in a different way. Oftentimes an ankle support is used to prevent abduction or adduction of the foot. That can be guarded against by raising, for instance, the inner or outer edge of the sole, and will not prevent the full use of the joint. He was personally not much afraid of restricting the motions of the joints. In small children, a brace on bow-legs is just as efficient with or without an ankle-joint, and he did not think that the foot or the lower limb would seriously suffer; but if one simply puts a support on an ankle-joint in a child whose general life is absolutely wrong, who is not living on the right food, then, of course, one fails to cure the case, and for that reason these appliances are most objectionable.



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## GASTROSTOMY.

Dr. John B. Roberts said that in August of this year he saw in consultation with Dr. Albert A. G. Starck a patient who had fallen from a step-ladder and sustained a fracture of the femur. The man was in the neighborhood of sixty years of age and was treated by extension.

About two weeks later Dr. Starck asked him to see the patient again, saying that he had discovered some difficulty in the œsophagus, and that on inquiry he had found that the man had not been able to swallow properly for a number of years. On examination with a tube they found a stricture at the lower end of the œsophagus; and it became evident that the patient for months had been half starved because of the interference with deglutition. The condition was so bad that two days later he did a gastrostomy.

The patient was so prostrated that operation under local anæsthesia was done. About half an hour before the time of operation the man was given a hypodermic injection of codeine sulphate, one grain, hyoscine hydrobromate, one-fiftieth of a grain, and strychnine sulphate, one-sixtieth of a grain. He had seemed a little drowsy before this injection, and promptly went to sleep while they were preparing for operation. He was asleep at the time the incision was made, though the skin was frozen with ethyl chloride. A two-inch incision was made parallel to the left costal border, about half an inch from that border and beginning nearly an inch and a half below the tip of the ensiform cartilage. The rectus muscle was split at the left side of the wound, and two ropes were made of its fibres; these were crossed. The operator drew a portion of the stomach out of the peritoneal cavity and slipped it through the space made by these displaced and crossed muscular fibres. A tunnel was made through the subcutaneous tissues, and the end of the projecting part of the stomach was brought out of a second incision which had been made, after freezing the skin, close to the costal border. After the sutures had been applied, the stomach was opened and a large rubber tube introduced.

Two or three times during the progress of these manipulations the patient moved as if he felt some pain. He was then given a few whiffs of chloroform. The amount given, however, was so small that it could have had very little effect; for the towel upon which the chloroform was poured was held to his face for only a minute or so. When the skin sutures were applied at the end of the operation, he flinched a little; but otherwise he was quiet, except for the motions mentioned above. He slept a long time after the operation.

A few days later some suppuration was noticed in the wound. It was probably due to a slight amount of leakage alongside of the tube. The small amount of pus was evacuated by taking out sutures, and the wound then did well. The recovery from the operation was prompt, and the man was fed with liquid food. He died sixteen days after operation from debility. This was probably due to the chronically starved condition from which he suffered, and the added depressing effect of the fracture of the femur and of two small bed-sores which had formed, despite the greatest care on the part of the family and nurses. No autopsy was obtained.



The case is reported merely to put on record the ease with which the operation was done under local anæsthesia and the comparative innocuousness of aseptic gastrostomy. The operation, of course, should have been done at an earlier period; but the patient had not been under the care of Dr. Starck until he received the injury by which the femur was broken.

The opening made into the stomach permitted during the latter part of his illness some leakage of the fluid introduced. It is probable that if he could have assumed the erect posture, the stomach would have held the food satisfactorily. The fixing of a portion of the stomach in the subcutaneous tunnel and the construction of the artificial sphincter by crossing the two portions of rectus muscle would probably have been sufficient to keep the gastric orifice closed around the tube used for feeding.

# TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

*Stated Meeting, December 2, 1901.*

The President, DE FOREST WILLARD, M.D., in the Chair.

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## CHRONIC PHAGEDÆNA DUE TO MIXED INFECTION.

By H. R. LOUX, M.D.,

CHIEF CLINICAL ASSISTANT, GENITO-URINARY DEPARTMENT OF THE JEFFERSON MEDICAL COLLEGE HOSPITAL,

AND

W. M. L. COPLIN, M.D.,

PROFESSOR OF PATHOLOGY AND BACTERIOLOGY, JEFFERSON MEDICAL COLLEGE; DIRECTOR OF THE LABORATORIES OF THE JEFFERSON MEDICAL COLLEGE HOSPITAL.

HISTORY OF CASE BY DR. LOUX.—J. B. McC.; aged twenty-five years; occupation, dentist; nativity, England.

*Family History.*—One sister died at the age of nineteen from diabetes; father is suffering from gall-stones; other than this the family history is negative.

*Personal History.*—Patient denied ever having chancre or chancroid. He states that at the age of sixteen years he contracted gonorrhœa, which was followed by stricture, and was treated by gradual dilatation. There was a tendency to recontract (apparently from the history of the case of resilient stricture), so much so that the patient was trained to pass his own instrument, and was instructed to do so, with the view of preventing a stricture of small calibre. He further states that there was ever present at the meatus a slight discharge of a mucopurulent character, and, as the discharge had never been examined microscopically, its character and the contained flora are not known.

Whenever the patient indulged freely in the use of alcoholic liquors, he would suffer with retention of urine, requiring catheterization.





*Present History.*—In January, 1901, after a night's debauch (followed by retention of urine), the patient attempted to catheterize himself, using considerable force. In the attempt he broke the catheter about one inch behind the meatus, causing a free hæmorrhage. Following this trauma to the urethra (discovered two weeks afterwards), a hard induration on the floor of the urethra appeared one inch behind the meatus; the nodule rapidly increased in size. It developed into a periurethral abscess, rupturing externally. He now consulted a surgeon, who incised the abscess freely, followed by irrigation and the usual antiseptic precautions. He further states that under this careful treatment he noticed a rapid destruction of the surrounding parts and a communication into the urethra. He was then advised to remain in the hospital, but this he refused to do.

I saw the case in consultation for the first time on February 20, 1901. The tissue on the under surface of the penis (from the frænum back one and a half inches) was destroyed apparently through a phagedænic process, involving the skin, subcutaneous tissue, and floor of urethra, including the corpus spongiosum; the skin showed the greatest resistance to the necrotic process, since the destruction extended well underneath the overlying skin, which was irregular along the edges.

The base of the diseased area was markedly indurated, not limited, but was gradually lost in the surrounding tissues, resembling the œdematous infiltration of chancroid.

On examining the urethra I found two strictures,—the first was a filiform stricture about three and a half inches from the meatus, and the second was at the bulbomembranous junction.

On March 6 I operated upon the strictures, doing an internal urethrotomy on the anterior stricture and a modified rapid dilatation on the posterior one, with continuous drainage of the bladder with a soft catheter. At the same time I curetted the necrotic area, cutting away the diseased overlying edges of skin, followed by a free application of carbolic acid to the diseased surface. Unfortunately, this did not control the phagedæna. I then decided to drain the bladder through the perineum, using a Watson tube, and attempted a plastic operation on the penis, which was done a few days after the perineal drainage was established. The plastic operation was done with great precaution, first cauterizing the surface of the ulcer, which was then removed,

including the adjacent induration; a second set of instruments was used for the plastic work, which consisted in making a new urethra and covering the same and adjacent denuded area with skin flaps taken from the side of the penis. The operation was followed by primary union. The perineal tube was removed, the sinus closed, and the patient was discharged from the hospital April 2 as cured.

On April 25 the patient returned to my office with a recurrence in the right skin flap at the junction of the glans penis. The patient was placed in the hospital, and the ulcer excised by an elliptical incision, including a portion of the corona of the glans penis; the edges were brought together with a few stitches, followed by primary union. At the same time it was noticed that the corresponding left skin flap was becoming indurated, with a tendency to break down along the edges. So rapid was the destruction of the skin and deeper structures that any further operative procedure was abandoned.

An attempt was now made to control the phagedæna with the Paquelin cautery, but without any result. We then tried an application of formalin, 20 per cent. solution, which seemed to check for a short period the rapid progress of the disease. New areas then became involved; there was already much of the penis destroyed, as shown by the plate (Fig. 1), and we decided to amputate the penis at the penoscrotal junction. After his return to the hospital, it was noticed that one superficial inguinal gland on the right side was enlarged about the size of a hazel-nut; this gland showed a tendency to break down.

On September 6 the amputation of the penis was performed, and at the same time the broken-down gland of the right groin was removed; both wounds recovered primarily. There has been no recurrence of the disease to the stump of penis, but a marked recurrence in the right groin, destroying skin and superficial tissue about three and a half inches long and two inches wide. On November 6 the ulcerated area was thoroughly curetted, the diseased areas of the skin cut away, and the entire surface of the ulcer wiped out with pure nitric acid. The wound granulated, and the patient was discharged from the hospital on November 30 as cured.

Pathologic Report by Dr. Coplin.—The first material for examination in this case consisted of "A," Inoculations on vari-

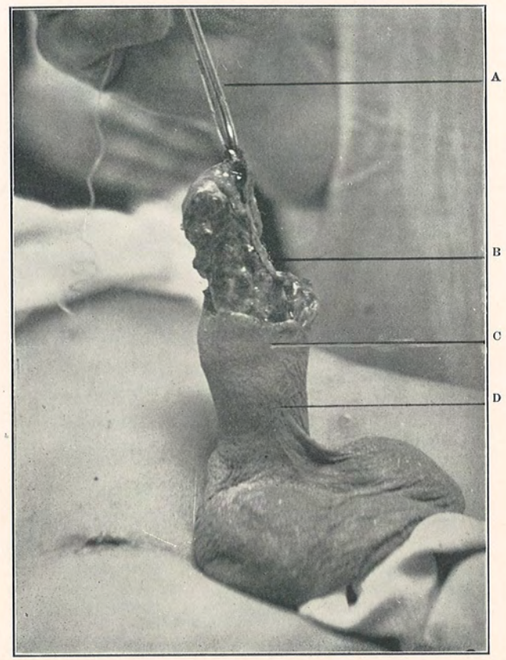


Fig. 1.—Phagedæna of the Penis. Photograph before operation. (Case reported by Dr. Loux and Dr. Coplin.) A, Hæmostat by which organ is extended. B, Fibrous septum marking superior margin of corpus spongiosum. Just below the leader from B is seen the necrosing end of the spongy body. C, The undermining extended down to about this line; at points, *e.g.*, around the urethra, the subcutaneous necrosis extended somewhat deeper. From C to D is the zone of induration. The amputation line was about the point marked by the leader from D.

ous media; "B," Material for spreads; "C," Fragment of tissue; all from penis.

The following is a summary of the result of the examination made by Dr. R. C. Rosenberger:

"A." Inoculations were made from the material upon glucose agar, bouillon, and liquid blood serum. Incubated for forty-eight hours, a growth was demonstrable in the glucose and urine agar. After incubation for this period, cultures were made and placed in an anaërobic condition. These cultures may be dismissed at this point, as they yielded no information not obtained by the aërobic method.

Upon urine agar there developed small, pinhead-sized colonies, yellowish in color, granular in appearance, and more or less discrete.

Spreads made from these growths and stained by the ordinary methods contain cocci .9 micron in diameter, occurring in pairs, grouped and ungrouped. Some of the pairs consist of cocci with flattened sides in apposition. They retain the dye when treated by Gram's method.

In glucose agar the growth follows the stab, and is also seen upon the surface; it is of a golden yellow color.

Spreads made and stained by ordinary methods show the same organisms described above as found in urine agar, and possessing the same morphologic and tinctorial properties.

The tubes of bouillon and serum showed a growth in seventy-two hours. Each medium was clouded, and a delicate, easily broken-up pellicle formed upon the surface.

Spreads were made and stained by ordinary methods. Upon microscopic examination two organisms were seen,—a bacillus and a coccus. The bacillus was slender, 1 micron to 3 microns in length, and .4 micron in thickness, and occurred in groups, short filaments, and ungrouped. It decolorized when treated by Gram's method.

The coccus measured .9 micron in diameter, occurring in small groups and presenting the morphologic and tinctorial characters of the staphylococci of suppuration. Plates were made, and after isolation of the organisms the bacillus was inoculated into milk, gelatin, and upon potato and other test media. Upon these different media the bacillus yielded the reactions common to organisms of the colon group,—generating a small quantity of

gas, turning blue litmus red, growing with a brownish color upon potato, etc. The coccus is evidently the *Micrococcus pyogenes aureus.*

Inoculations from fresh material were also made subcutaneously into the ears of a rabbit. In seventy-two hours there was noticed swelling and redness around the site of inoculation, followed by pus formation.

Inoculations made upon plain and glycerin agar from the pus showed in forty-eight hours a pure culture of the *Micrococcus pyogenes aureus.*

Spreads made from the pus and stained by ordinary methods for bacteria contain a few polynuclear leucocytes, granular detritus, and shreds of fibrin. A few micrococci are seen, .9 micron in diameter, occurring principally ungrouped and retaining the stain when treated by Gram's method. No bacilli were demonstrable.

In six days the inflammation in the inoculated ear subsided, and since that time the animal has remained apparently healthy.

"B." Spreads made and stained by ordinary methods show numerous polymorphonuclear leucocytes and a few lymphocytes. Numerous cocci are seen, some of which are .9 micron in diameter, occurring in small groups, but mostly ungrouped. A few are found within the cells; they retain the dye when treated by Gram's method. An occasional bacillus is seen which measures 3 microns to 4 microns in length, with rounded ends and occurring extracellular. The cocci resemble the micrococci of suppuration. The bacillus was not obtained in culture, but from its morphology resembles the *Bacillus subtilis,* probably a contaminating organism, and having no bearing upon the suppurative process.

"C." The specimen consists of a small, irregular wedge-shaped mass of tissue, .7 centimetre in its greatest, .5 centimetre in its shortest diameter, and .3 centimetre in thickness. It is of a pinkish color and the surfaces are irregular and rough.

Specimen was fixed in a saturated alcoholic solution of bichloride of mercury, and embedded in paraffin; sections were cut and stained by the usual laboratory methods.

*Histologic Examinations.*—One surface of the section is nearly covered by stratified squamous epithelial cells. In the middle portion of the surface the epithelial cells have entirely disappeared, or rather been converted into a mass of necrotic and



richly granular *débris.* Beneath the necrotic surface a moderate degree of tissue reaction is present. The cells found here are for the most part polynuclear leucocytes, although lymphoid and spindle-shaped cells are also present in abundance. A few mast-cells are also noticeable in the sections stained with toluidin blue. Beneath the surface the mass is made up mostly of a delicate, connective-tissue reticulum. Throughout this latter tissue abundant new and newly-forming capillaries are present; some of these contain a few erythrocytes, others a few leucocytes, and still others are comparatively empty. At points a large number of polymorphonuclear leucocytes and wavy spindle-shaped cells are seen, together with a few mast-cells.

The lower surface of the mass shows a few areas of necrotic tissue, throughout which are scattered a few polymorphonuclear leucocytes.

A number of sections were stained with Löffler's methylene blue and by Gram's method.

In the preparation stained with Löffler's methylene blue a large number of bacilli and cocci are seen. Most of the bacilli are thin, 1.5 microns in length, and occur in groups and in short filaments. Where a few are seen in a field a tendency to polar staining can be recognized. This latter feature is not seen in all the bacilli. The bacilli are situated generally between the cells, though some can be seen within the cells. They do not stain by Gram's method. A second organism is a large bacillus, 3 microns to 4 microns in length, with rounded ends, occurring mostly individually.

The cocci mentioned are .9 micron in diameter, and occur principally in pairs, with their flat sides in apposition. They retain the dye when treated by Gram's method and are intra- and extra-cellular. A few other cocci are seen that are slightly smaller than those just mentioned, but possess the same peculiarities as to situation and staining reaction.

All the bacteria mentioned above are scattered through the specimen. They are most abundant deep in the tissue, although some (bacilli and cocci) are found in the most superficial layers of the necrotic epithelial cells. The small bacillus referred to resembles very closely the bacillus of Ducrey, both morphologically and tinctorially. Every peculiarity of the bacillus, however, is not present, but the size, situation, and staining properties sug-

gest this probability very strongly. The cocci are undoubtedly the ordinary micrococci of suppuration.

*Diagnosis.*—"A." Inoculations upon glucose and urine agar. Pure culture of the *Staphyloccocus pyogenes aureus.* Inoculations in bouillon and liquid serum, a bacillus probably of the colon group and the *Staphylococcus pyogenes aureus.*

"B." The spreads contain cocci possessing the usual mor-

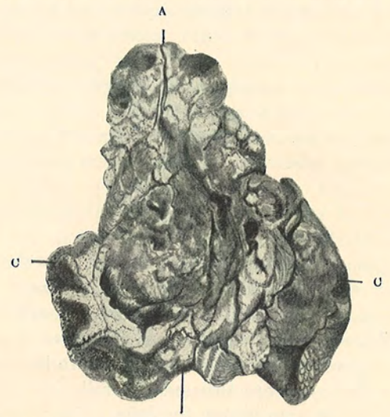


FIG. 2.—Penis after amputation; inferior surface. Natural size. (Case reported by Dr. Loux and Dr. Coplin.) A, Fissured ulcer marking area of urethra beneath the glans. B, Urethra at point of amputation; laid open. C C, Undermined skin incised on inferior surface and turned back (dorsalwards) in order to indicate the extent of the undermining. Just below the leaders from C C the intense induration is indicated.

phology and tinctorial reactions of the micrococci of suppuration.

"C." The tissue shows a widely destructive inflammation, the necrosis being of the liquefaction type. Bacteria are present in abundance; one of the organisms present cannot be differentiated from the bacillus described by Ducrey; it is not our intention, however, to insist upon the identity of the germ found with the microbe described by that observer. The histology of the tissue excludes malignant disease. At the time of this examination tuberculosis was not suspected, even after most careful search for the bacillus as well as close study of the histology of tissue submitted.



Result of the examination of the amputated penis. The specimen delivered to the laboratory consists of an irregular cylindric mass of tissue measuring 8 centimetres in length. (Fig. 2.) One end of the cylinder is surrounded by skin, which at the extreme end is normal in appearance. This end measures 3.5 centimetres in diameter, and evidently corresponds to the line of amputation. The corpora cavernosa are somewhat retracted below the surface and appear slightly denser than normal, the right being somewhat more resistant than the left. The spongy body—corpus spongiosum—is inconspicuous, but the urethra can readily be identified in its centre. The subcutaneous tissue and the tunica albuginea present nothing noteworthy. Upon laying the urethra open, it is found that its length does not exceed 0.5 centimetre. Its mucous membrane at the line of incision is apparently normal, but at the external opening is ragged and ulcerated and undermined to within 0.3 centimetre of the line of incision. The width of the band of attached skin varies; at its widest point it is 4.5 centimetres, and at its narrowest point a little less than 2 centimetres. As already stated, the skin is normal along the line of incision. The free margin of the skin is ulcerated, ragged, undermined, and presents areas of superficial necrosis which extend from 5 to 20 millimetres from the free margin of the ulcer upward and backward upon the otherwise normal skin. The free margin of this ulcerated portion is slightly indurated, the amount of induration varying in different areas. At all points the margin is undermined, and in the neighborhood of the urethra the undermining at one point extends 2.5 centimetres. The urethra for a distance of about 4.5 centimetres has been entirely destroyed, and with it practically all of the spongy body. The glans has been for the most part destroyed. The remaining portion of the glans measures 3 centimetres by 2 centimetres. The superior surface of the glans (all the remaining portion) is covered by a wrinkled mucosa, the margin of which forms the ragged, indurated, and necrotic edge of the ulcer. There is but little undermining of the mucosa. The surface of the ulceration is beset with minute granules and covered by a grayish pellicle which can be removed with very little manipulation. The ulcerated portion is somewhat indurated, the degree

of induration varies in different parts, but is usually more marked near the margins of the ulcer.

Small masses were cut from different areas, fixed, dehydrated, and embedded in paraffin.

Sections cut from the region of the glans show the specimen to be covered by stratified squamous epithelial cells. Beneath the epithelium is a quantity of loose connective tissue and a few bundles of non-striated muscle.

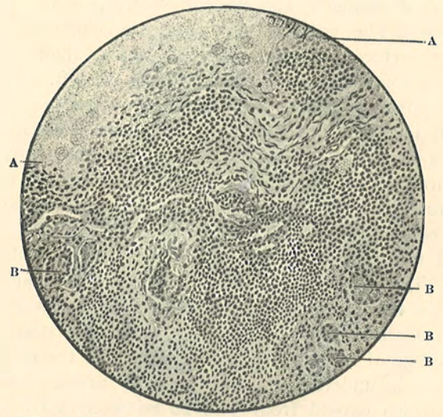


FIG. 3.—Section of floor of ulcer, case of chronic phagedæna. (Reported by Dr. Loux and Dr. Coplin.) A, A, The area between these two points is superficial and composed of the tissue undergoing liquefaction necrosis. Aside from the contained granules, a few granular and necrotic cells showing fragmentation and karyolysis are also present. B, B, B, B, Giant cells; other giant cells are also seen at several points in the field. Lymphoid cells are abundant throughout the field, and just above the centre and to the right are a number of fibroblasts. No area of caseation is present in this field.

Sections taken from the dorsum of the penis (Fig. 3) show it to be covered by stratified squamous epithelium upon one surface. Beneath this epithelial layer is a large quantity of rather dense connective tissue and non-striated muscle. Here and there can be seen accumulations of small round cells, polymorphonuclear leucocytes, a few epithelioid cells, and giant cells,—distinctly suggestive of tubercles.

They are for the most part discrete, but in one or two areas



a beginning coalescence of two tubercle-like agminations can be detected. Beginning caseation is also noticeable in other areas.

Sections taken from the region of the urethra show the mass to consist almost wholly of granulation tissue. The lining epithelium of the urethra is in some parts destroyed and encroached upon by the granulation tissue. No well marked tubercles are seen in these sections, but a few giant cells are scattered throughout. The sections were also stained for bacteria, and especially for the tubercle bacillus.

Upon examination of sections stained with Löffler's methylene blue, in the blood-vessels, intracellular and scattered irregularly through the tissue, numberless bacilli were demonstrable.

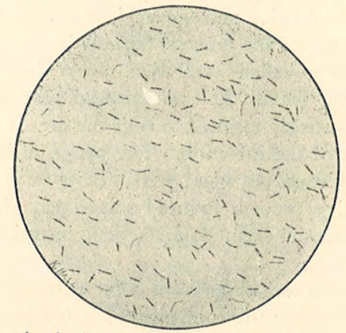

FIG. 4.—Bacillus of soft chancre (Ducrey). The irregular staining of the organism and variations in morphology are well shown. From section stained with methylene blue. Zeiss 2 mm. homo. im., projection eyepiece No. 2.

They average 1.5 microns in length, possess rounded ends, and exhibit polar staining. They do not retain the dye when treated by Gram's method. (These bacilli are similar to the organisms met with in sections from the same case made some time before, and which were then thought to be the bacilli of Ducrey.) A few cocci were also seen. No tubercle bacilli nor any other acid resisting bacilli were demonstrable.

The tissue removed from the groin was not examined; it was ordered sent to the laboratory, but was not delivered in a condition permitting examination.

*Diagnosis and Remarks.*—The process is clearly not a simple one. The profound tissue alterations are evidently the

result of a violent infection, mixed in character, and rapidly extending; a careful histologic study fails to show satisfactory evidence that the tissues are making any efficient effort to limit the spread of the bacteria. Not only do the bacterial findings clearly show the existence of a mixed infection, but the histology discloses the presence of two forms of necrosis occurring separately and only together in the sense that one may be consecutive to the other, a view not supported by a study of the sections. The liquefaction necrosis is evident superficially, restricted to the skin and outer layer of granulation tissue, while the caseation is present at or near the areas of giant cell agmination and not evident elsewhere. Our inability to demonstrate the tubercle bacillus in its usual form, or in some of its so-called involution types, does not exclude tuberculosis, but leaves the one essential link missing; personally, I am strongly inclined to urge the presence of tuberculosis as a part of the infection. The pyogenic infection is of course demonstrated, but space precludes its further discussion. The suppurative process induced experimentally seemed to differ in no essential from staphylococcic infections frequently seen.

Probably the most important point to be settled, if settled it can be, is whether the fundamental lesion in this case was chancroidal; should we accept the bacillus of Ducrey as the cause of soft chancre, then the bacteriologic findings are to be weighed against the clinical aspects of the case. If the clinicians decide that the lesion is not chancroid, then the bacteriologic finding is of still greater import, as I think we have demonstrated the presence of an organism that at least cannot be differentiated from the bacillus in question if it be another germ.

The bacillus of Ducrey[1] (Fig. 4) is given by Cornil and Ranvier[2] as the cause of chancroid. After the appearance of the papers by Krefting[3] and Unna,[4] I sectioned a number of soft chancres and studied the pus from others. I was greatly impressed with the constancy of the organism, although occasionally I examined lesions, clinically thought to be typical instances of chancroid, in which the organism



could not be found. Since that time, Peterson,[5] Nicolle,[6] Istamanoff and Akspiantz,[7] Leuglet,[8] F. Bezançon, V. Griffon, and Le Sovrd,[9] and others have done much to establish the specificity of the organism described by Ducrey. Nicolle maintains the value of finding the organism as a test differentiation from the initial lesion of syphilis.

If the writers quoted, and others that could be mentioned, are correct in their view, then the case is one of chancroid running an unusually lengthy course and with an unusual destruction of tissue. Although, as already stated, we have failed to demonstrate the tubercle bacillus, I cannot ignore the histologic picture quite faithfully portrayed in some of the sections. Admitting the doubtful points, this lesion would be regarded as a manifestation of (1) staphylococcic infection, (2) infection by the colon bacillus, (3) infection by the streptobacillus of Ducrey, and (4) tuberculosis, the morbid processes not necessarily occurring in the order given.

[NOTE.—Since the foregoing report was submitted there have been no recurrences at points of previous operations. About the middle of February, 1902, the left epididymis became tender and slightly enlarged, and rapidly increased in size. On March 4, Dr. Loux removed the left testicle with the cord as far as the left external ring; although the examination is not as yet completed, it is sufficiently advanced fully to establish the diagnosis, and proves the testicular enlargement to be due to an acute, rather disseminated tuberculosis involving both the globus major and globus minor.

In the light of the added information, the conclusion previously reached, that the condition was primarily either chancroidal or septic, the probabilities favoring the former, and that upon the initial infection was engrafted tuberculosis, seems to be thoroughly established.]

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[1] Monatsheft für praktische Dermatologie, ix, 1899.
[2] Manuel d'Histologie, 1901, Tome i, p. 676.
[3] Archiv für Dermatologie, 1892, p. 41.
[4] Monatsheft für praktische Dermatologie, xiv, 1892.
[5] Centralblatt für Bakt., xiii, 1893.
[6] Thèse de Paris, 1893.
[7] Société Méd. du Cancase, 1897.
[8] Société de Dermatol., 1898.
[9] La Presse Médicale, December 12, 1900.

## TETANUS AFTER VACCINATION.

Dr. Richard Harte showed a boy that had been under his care at the Episcopal Hospital, a case of tetanus. He works in a hat factory, and is in the habit of handling skins, particularly of the rodent variety. Five days after vaccination the arm was slightly reddened; nine days after vaccination the wound was all right, except red and slightly ulcerated. When he was admitted to the hospital, October 25, his jaw was distinctly stiff. He complained for a day or two of a feeling of discomfort in the back. On admission he had a distinct trismus and tetanic convulsions. They were, from then on, very marked. He would be thrown into a state of convulsions by touching his leg or arm. There was opisthotonos, sometimes very marked; his body thoroughly arched, resting on head and heels, and sometimes at night he would have convulsions, where there was distinct pleurothotonos.

For treatment after admission, fifty cubic centimetres of antitoxin serum were injected, and, in addition, he was given chloral, morphine, and bromide freely. The convulsions were not apparently controlled in any way by the serum, but by full doses of chloral, ten grains every two hours for a while, until he came under the influence of it, the convulsions were controlled. When the effects of the chloral passed away, the convulsions would return.

The first day the antitoxin was given in doses of fifty cubic centimetres. Then it was cut down and continued cut down for many days, until he took ten cubic centimetres. The trismus he had was very marked, but at no time was there any difficulty in nourishment. He did not complain very much of pain, and at no time did his temperature go above 102° F.; usually it was about 100°. For a long time the reporter did not think the boy would get well; but when he fought things out for ten days, then it looked as if he were destined to recover, and from that time on his recovery was very marked from day to day. There is nothing in the wound; just the remains of the old vaccination mark. There is nothing there to interest you.

Dr. De Forest Willard remarked that the doubt expressed by Dr. Harte in the efficacy of the serum was shared by the majority of surgeons. He used the chloral and bromide. In a



case that the speaker had succeeded in curing, he kept the boy for twenty-eight days under chloral, bromide, and morphine, absolutely saturated, and the disease did not yield until after twenty-eight days. (*Transactions of the Philadelphia College of Physicians*, xvii, 27.)

Dr. Shoemaker said that there was one peculiarity in this case which distinguishes it from postvaccinal cases recently reported, viz., the shortness of the period of incubation. The others have run from the nineteenth to the twenty-fifth day generally, as was developed in a report and discussion regarding several cases at the Philadelphia County Medical Society. These reports made it very probable that there was postvaccinal infection.

Dr. Taylor stated that he had only treated one case of tetanus with antitoxin, that of a boy of eight years, who first developed tetanus seven days after the receipt of injury, which was a punctured wound of the foot. In addition to antitoxin, he was given large doses of chloral and bromide, so that he was kept deeply narcotized. Whenever the chloral and bromide were diminished in amount, his convulsions recurred. This condition persisted for a long time, but he finally recovered.

This is one of the very few cases which he had seen recover where the symptoms developed soon after the receipt of the wound. Almost all cases of recovery reported after the use of antitoxin have been those of chronic tetanus.

Dr. Rodman reported a case of tetanus where the antitoxic serum was used subdurally, but the patient died on the fifth day, the time they usually die in cases of acute traumatic tetanus. Tetanus developed quickly after the injury. He agreed with Dr. Harte that chloral and morphine are the best remedies we have. It would seem from an analysis of a great many cases of tetanus that exactly the same experience that Dr. Harte has had has been met with by many surgeons, that is to say, that while chloroform and morphine will relieve the spasms of tetanus, the results are not so abiding as under chloral. It seems undoubtedly to be the agent that controls the spasm better than any other drug. From the time of Hippocrates it has been recognized that if a case occurs after fourteen days it is apt to get well; certainly more than 50 per cent. recover.

He called attention to the statistics of Professor Yandell, of Louisville, who analyzed 415 cases,—the largest number analyzed

by any authority. His statistics, taken in connection with those of the War of the Rebellion, show very clearly that if patients survive the fifth day after the onset of the disease, they are apt to recover. There is a marked falling off in the death-rate after the fifth day. This fact should lead surgeons to support the patient; feed them very judiciously, even under chloroform, with a stomach-tube; keep them in a quiet room; allay the spasms, and prevent irritation of any kind, either central or peripheral; by so doing, and keeping the patient alive until the fifth or sixth day, tide them over that period of greatest danger. He did not think that point had been sufficiently dwelt upon. If it was necessary, give chloroform, introduce a tube into the stomach, and feed systematically. He had seen cases recover under such treatment. There was no specific for tetanus. He thought the reports of Roux and others had been too optimistic.

Dr. John B. Roberts said that he had been very doubtful about these cases of tetanus being really caused by infection with the tetanus bacillus through the vaccination wound, because it is so common to have a wound of infection healed before the tetanic symptoms show themselves. A person vaccinated might readily attribute the disease to the vaccination, when infection had taken place through a small wound on the hand or foot which had been forgotten. He saw a case of this sort some years ago, where the child and his family declared that he had not been wounded. The symptoms were those of tetanus, and he soon was able to show a cicatrized wound on the hand, of which the boy and his family had not thought.

He mentioned a recent case of possible tetanus which he had treated with tetanus antitoxin. He used the remedy, because he feared the patient might be developing tetanus, and he was afraid to wait until the symptoms should become sufficiently pronounced to make the diagnosis sure. A woman, aged forty-one years, was admitted to the Methodist Hospital with a wound of the right hand caused by a circular saw The joint between the middle and proximate phalanges of the index-finger had been opened, and the extensor tendons of the index-, ring-, and little fingers had been cut by the saw. Tenosuture with fine silk was done, and a wet corrosive chloride of mercury dressing was applied. Five days after the accident slight pain was felt in the region of the masseter muscles, and there was perhaps a little stiffness when the woman



attempted to open her mouth widely. The abdomen, however, was not rigid, and the temperature was below 100° F., running quite close to the normal line. Her pulse was from 72 to 88 and the respirations varied from 20 to 40 per minute. On the next day, which was the sixth day after the accident, she showed a slight tendency to frowning in the skin of the forehead when she tried to open her mouth widely. This, however, she could do without much difficulty. There was a slight tendency to sweating, and the temperature in the evening reached 99.8° F. Although there was no abdominal rigidity, the symptoms already mentioned, with slight pain in the back of the neck as well as in the jaw, made him fear to wait longer. He therefore gave her an injection of twenty cubic centimetres into the subcutaneous tissues of the abdomen. Her temperature fell to normal the next day, and even went a little below normal. The pain and stiffness gradually subsided, and she was discharged on November 22. From the first suspicion of tetanus, he gave her ten grains of chloral three times a day.

Her case is perhaps worthy of mention, though the testimony as to the value of antitoxin serum is indefinite, since the diagnosis was not established. On the whole, he thought it was better to give the remedy early in suspicious cases, because, when the disease is actually established, treatment seems to be of very little value in the great majority of cases.

Dr. Harte said, in regard to the remarks that Dr. Roberts had made as to whether there was any other previous evidence of traumatism about his case, that he felt quite confident that there was not. Again, with regard to the boy's vocation. He was working in a factory, handling skins, handling the skins of rodents, a form brought from South America. That he was doing all the time. There was no protection to the wound; simply a granulation, a granulating sore on the arm; and, owing to the work he was doing, all the conditions were favorable for infection, which naturally made him think this was a case of true tetanus, due to infection, primarily through the sore, either from the primary vaccination, from the point itself, or from some material in the work he was handling.

## INTESTINAL AND FACIAL ANTHRAX.

Dr. De Forest Willard reported the case of a man, twenty-four years of age, a wool sorter, who was admitted to the Presbyterian Hospital, November 3, with a large sloughing ulcer in left cheek, one and one-half inches from angle of mouth, surrounding which ulcer marked œdema of tissue extended over the entire side of the face and across to right eyelid and forehead. The ulcer was dark with elevated and puffy edges, and a small circumferential area of dusky redness with circle of vesicles. The accompanying pain was only slightly burning and stinging in character. He had a history of burning and itching pains in a pimple which had appeared six days previously. This ulcerated on the second day, and the vesicles appeared almost simultaneously. Pulse 102; temperature 100° F.; respiration 20; his condition fairly good. The superficial cervical glands were enlarged.

The entire area of the carbunculous mass was dissected out, cutting deeply through the cheek down to the submucous layer, keeping outside of the vesicles. In the removed tissues anthrax bacilli were found abundantly, and cultures were readily obtained from the tissues, but not from the blood. The fresh wound was then cauterized with pure carbolic acid, thoroughly irrigated with bichloride 1 to 1000, and solution of potassium permanganate, and the whole left side of the face covered with a layer of mercurial ointment. On the following day the wound was irrigated with permanganate of potash, and pure carbolic acid again applied, followed by mercurial ointment. Quinine, fifteen grains, was given daily. Two days later the man began to suffer intense abdominal pain, which caused him to writhe in agony, and he had twenty-one stools in the twenty-four hours. Although his mouth and breath showed no symptoms of ptyalism, yet, in view of the possibility of mercurial absorption, the ointment was discontinued. Later progress of the case, however, showed that the mercury was in no wise responsible for this condition, but that it was undoubtedly a local intestinal infection similar to that upon the face. This inoculation could readily have occurred through careless handling of food with unwashed hands. The infection could gain entrance through even the slightest lesion of the mucous coat of the intestine. The abdomen became tense and swollen, with



marked evidences of enteritis and peritonitis, which symptoms persisted for two weeks. Vomiting was persistent, and the diarrhœa continued, though to a less degree. Pains were paroxysmal, but were controlled by morphine and paregoric. Fifteen grains each of salol and quinine were given daily, with moderate stimulation; also carbolic acid internally in small doses. His temperature rose to 104° F., and varied from this point to 102° for ten days. The abdominal symptoms did not abate. The tension of the abdomen was so great that the size of the spleen could not be determined. Milk was not borne at all, but raw and cooked eggs were retained. Enemas were of little service, as they were quickly rejected. On the fourth day streptococcus infection of the scrotum occurred with great œdema, which was relieved by free incision, irrigation, and drainage of about five ounces of pus. Antistreptococcic serum was then injected, twenty centimetres, upon six successive days. Either this or the evacuation of the pus from the scrotum lowered the temperature to 102° F., but the abdominal symptoms remained persistently. Vomiting of dark green fluid continued, and the diarrhœa persisted in spite of remedies. The œdema of the face slowly disappeared, and the condition of the facial wound improved decidedly. The scrotal wound was irrigated three times a day with permanganate of potash solution, and the facial wound washed and dressed with carbolic solution.

At the end of two weeks, the nausea, pain, vomiting, and diarrhœa still continued, with extreme distention and tenderness. The abdomen now showed through the tense walls evidence of an accumulation of pus in the left iliac fossa. The abdomen was opened three inches below, two and one-half inches to left of umbilicus, and three quarts of the most horribly offensive pus evacuated. The stench was so great that it pervaded the whole hospital. This pus contained streptococci, but no anthrax bacilli nor coli communis. The collection was only slightly walled off from the peritoneal cavity, and no opening was discovered, consequently it was impossible to decide positively whether this infection was a streptococcic one along the line of the cord from the infected scrotum, or whether there had been a small perforation of the bowel from the anthrax ulcer. The cavity was thoroughly washed and drained with hot salt solution. It remained very offensive for several days, but gradually contracted. There

has been no escape of fæces, and the discharge is now small and non-offensive. It is washed three times a day with peroxide of hydrogen and creoline. The facial wound has filled to the level of the skin, and the scrotal wound is closing. Fortunately, the patient has had no lung or throat infection.

The man is greatly reduced in flesh, but is eating and sleeping well; has had a septic parotitis, but bids fair to recover.

This man's recovery was undoubtedly due to the prompt excision of the carbuncle, the evacuation of the pus, the faithful care of the Resident Physicians, and the untiring attention of two nurses, who for weeks patiently endured the dangers in the case. By the use of rubber gloves, protective clothing, etc., they fortunately escaped infection, and no contagion occurred in the hospital. The man was strictly isolated, and all contaminated material burned.

This case, so far as he was able to learn, made the tenth reported in Philadelphia. Doubtless there have been others unrecorded, as there are many morocco factories and tanneries in the northeastern section of the city. Mutschler[1] (ANNALS OF SURGERY, October, 1901, p. 555) reports two cases under his care which were treated by circumferential injections of pure carbolic acid, and both recovered. They were situated so near to the eyelid that excision was not feasible. Of the ten cases, five died, and the fate of one is unknown. His own case of recovery is the only one of internal infection. The diagnosis was confirmed by discovery of the special bacillus in all these cases. All of them were workers upon hides or wool. Considering the immense number of hides that are imported from foreign countries, and the fact that it is very difficult for any government to prevent the cupidity of individuals from selling the hides and other portions of animals dying from anthrax, it is remarkable that more infections do not occur. The burning of every carcass entire would be the only effectual method of stamping out this disease.

DR. GIBBON said that he had a case of anthrax under his care at that time, and it was the second which he had seen in Philadelphia within two years. His first case resembled Dr. Willard's very closely: the lesion was upon the side of the neck, and the œdema extended down over the upper portion of the chest. The patient was engaged in loading vessels, and was accustomed to handling hides, and it was probably in this way that he became infected. The patient complained little of pain, and presented mild constitutional symptoms. The patient made a good recovery under local antiseptic treatment. Three days ago he saw the second case to which he referred. This was a colored man who drove a wagon for a morocco factory. He said he did not handle hides, but did clean up the yard about the factory, and in this way handled small pieces of hides. The lesion in this patient extends across the front of the neck, consisting of a thick, dark scab three-quarters of an inch wide and two inches long, around which is an œdematous area. There are no distinct vesicles, such as were seen in the first patient. This man presents, however, an enlarged gland above the lesion. The diseased area was excised and the base cauterized by Dr. Stewart. The patient suffers no pain and presents no constitutional symptoms, and is with difficulty kept from his work. In both of these cases the anthrax bacillus was found.

[1] See page 147 of present volume of Transactions.



DR. JOPSON said that anthrax was more prevalent in Philadelphia and vicinity than had been supposed. When Dr. Ghriskey and he reported a case in the Episcopal Hospital in 1899, they were only able to find three cases on record in the city in which a bacteriological diagnosis of anthrax had been made and confirmed. Since that time a considerable number of cases have been observed. Dr. Given observed one, Dr. Mutschler two, Dr. Gibbon has just described two, and Dr. Willard's case makes another one. And he ventured to say that if the attention of physicians was more often called to these cases, many cases previously regarded as erysipelas, cellulitis, or allied conditions would be found to be anthrax. Dr. Fussell had given him notes of four cases, treated by Dr. Kelly, of Manayunk, in which, though no bacteriological examination was made, all recovered under simple antiseptic treatment; yet, from the histories and location of the lesion, it is likely the majority of them were cases of anthrax. Many cases of this nature are overlooked, especially in the manufacturing districts of the city, such as Kensington and Manayunk.

## GANGRENOUS HERNIA.

DR. R. G. LE CONTE showed a fresh specimen of gangrenous ileum, illustrating a strangulation due to a band and a volvulus. The subject was a man, aged fifty-five years, who was admitted

to the Pennsylvania Hospital in a moribund condition. The following meagre history was obtained. He had had a reducible right inguinal hernia for twenty years. Two days before admission the rupture became irreducible, with increasingly severe pain in the lower abdomen. Obstruction was apparently complete from the onset of the symptoms, and in a short time vomiting began, and was continuous until he died. On admission to the hospital he was in collapse, pulse very rapid, small, and thready, facial expression pinched and anxious, respiration entirely costal. The abdomen was greatly distended, universally rigid and tender, with a semicircular area of dulness extending from the right short ribs to the anterior superior spine of the left ilium. The abdomen was opened in the median line, and this loop of gangrenous bowel immediately presented. It was about two feet in length and four inches in diameter, and filled with dark, bloody fluid of a cadaveric odor. It consisted of the lowest portion of the ileum, strangulated by a fibrous band two inches in length, running from the mesentery to the ilium. In addition, there was a half-twist from right to left in the strangulated bowel. The fibrous band was thick and strong and evidently of long duration. It is probable that the volvulus had occurred, and, as a result of the twist, the fibrous band had been drawn taut, with the production of immediate and complete strangulation. In the presence of so serious a lesion, and with death impending, it was deemed hopeless to attempt further surgical interference. The patient expired shortly after removal from the operating table.

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