humerus just above the elbow; this produced the dislocation without fracture.

Three weeks after the accident he came to Dr. Taylor, who had a skiagraph taken which revealed the true condition of affairs. Owing to some unavoidable delay it was nearly four weeks after the accident before the attempt could be made at reduction. He was given ether and after a great deal of physical effort and limbering up and breaking up the adhesions of the elbow, reduction was accomplished. The second skiagraph showed very well the bones in their proper relation.

AN ETHER INHALER FOR USE IN OPERATIONS REQUIRING THE PRONE POSITION.

Dr. Thomas C. Stellwagon (by invitation) presented this apparatus. It was devised to obviate the difficulty experienced in administering ether to patients when prone, especially when the Edebohl technic is employed. In addition, with the ordinary inhaler a very large amount of ether is required. He at first used a rubber bulb to force ether into the old inhaler but this proved unsatisfactory. The present modification has been in use in the Jefferson Hospital during the past six months and has met with general approval. With it considerably less ether is required. The addition consists of a lateral extension, near the lower end of the instrument, which is placed over the mouth of the patient. The hood-shaped mouthpiece is reversible to allow application when the person is on either side. But one hand is required to hold this inhaler to a patient's face. A question regarding the device that is not yet entirely settled is whether the patient gets sufficient air with the ether. Possibly a valve above the mouthpiece is needed to permit the egress of expired air.

STATED MEETING, HELD MARCH 5, 1906.

The President, John B. Roberts, M.D., in the Chair.

CLINICAL EXPERIENCES WITH MECKEL'S DIVERTICULUM AND OTHER VESTIGES OF THE OMPHALOMESENTERIC DUCT.

BY JOHN B. ROBERTS, M,D.,
OF PHILADELPHIA.

My observation of the congenital anomalies mentioned in the title of this paper is limited to the following instances:

Case I. *A Meckel's diverticulum on the mesenteric side of the ileum.*—I reported in 1896[1] a case of diverticulum, arising from the ileum a few inches above its entrance into the cæcum, seen while assisting Dr. L. W. Steinbach in an abdominal operation. This diverticulum was an inch and a-half long, with a base about half an inch wide, and tapered to a rounded end like the finger of a glove. It was connected with the gut at its mesenteric border and was attached to the mesentery or developed upon it. It was not the seat of any inflammatory action and its point was directed upward,—that is, away from the cæcal end of the ileum. It had nothing to do with the condition for which operation was done, which was obstruction due to old inflammatory adhesions about the colon near the cæcum.

Case II. *Fatal strangulation of the intestine by cord consisting of obliterated omphalomesenteric vessels.*—About ten years ago I saw a middle-aged man, with Dr. H. A. Stout, of Wenonah, N. J., dying with great distention of the abdomen from intestinal obstruction of five days duration. We prepared for immediate operation, but the man died just after he was placed upon the operating-table.

The autopsy showed a loop of bowel encircled by a thin

[1] Annals of Surgery, XXIII, 1896, p. 612.

cord of fibrous tissue, looking like the white string used for tying up parcels. This cord was about thirteen centimetres long, and extended from the front wall of the abdominal cavity to the mesentery above the point of strangulation of the bowel. From another part of the bowel hung a pedunculated mass, four and a-half centimetres long. The cord ran through an opening in this appendage, as through a pulley. The appendage arose from the intestine opposite the mesentery, but had no lumen. The specimen was exhibited to the Philadelphia Pathological Society on October 28, 1897. Dr. David Riesman [2] considered the cord to be the obliterated vitelline, or omphalomesenteric, vessels.

CASE III. *Strangulation of the ileum by a Meckel's diverticulum (a remnant of the omphalomesenteric duct), relieved by operation.*—A boy, four and a-half years old, was brought to me by Dr. H. J. Butte on January 8, 1906, with a history of unrelievable intestinal obstruction. He had complained of pain in the abdomen for four days previously, which he attributed to a kick by another small boy. Vomiting had occurred promptly and was accompanied by absolute constipation. There had been no previous abdominal crises in the history of the case. At the time of admission the temperature, pulse and respiration of the boy were practically normal.

After two or three hours' observation, an incision was made near the middle line of the abdomen, extending from an inch above the umbilicus to a point two inches above the pubes. The intestines were markedly distended and congested. About three feet from the ileocæcal valve a slender diverticulum of the ileum was found. Its diameter was less than that of the normal vermiform appendix. Its end was a mere fibrous cord attached to the abdominal wall near the umbilicus. The structure was distended at its middle into a sac similar to that which is sometimes seen in the appendix when it is inflamed. Between this sac and the ileum there was a patent tube lined with mucous membrane. There was evidence of inflammation of these structures. The ileum a short distance from the point of origin of the diverticulum was tightly strangulated by the passage of the diverticulum and its fibrous continuation across it. A deep groove was thus made in the portion of the bowel opposite the mesentery, similar to

[2] Meckel's Diverticulum and the Omphalomesenteric Duct, University Medical Magazine, June, 1898.

that often seen in cases of tightly-strangulated hernia at the femoral or inguinal ring.

The cord-like end of the diverticulum was detached from the belly wall, and the diverticle itself was ligated near its ileac attachment and removed. The groove made in the gut, thus relieved from pressure of the tense band, was so dark that I feared that perforation from sloughing would occur. I therefore turned in the suspicious portion by a series of Lembert's sutures. The mesenteric glands were very large, and the veins in the mesentery greatly distended and black, as though actual thrombosis had occurrd. There were a few flakes of lymph on the surface of the bowels, but no distinct peritoneal inflammation existed. An attempt was made to bury the stump of the diverticulum after its mucous membrane had been sterilized with a drop of undiluted carbolic acid. If my recollection is correct, I finally abandoned the endeavor to bury it, because of the tension made on the wall of the gut by the sutures, which had to be placed so near those used to turn in the constricted area. When I made the abdominal incision, which was near the middle line, I had to avoid on the inside of the belly-wall a white fibrous cord, which was probably the remains of the right hypogastric artery or the urachus.

For a good many days the patient's condition was rather critical, with high temperature and a weak, intermittent pulse. A movement of the bowels was obtained on the day after operation. Some days afterward the stools became exceedingly offensive and suggested the possibility of there having occurred some sloughing at the point of former strangulation. The convalescence, however, continued satisfactorily, and at the end of a little over three weeks he was discharged from further surgical observation.

CASE IV. *A Meckel's diverticulum found at autopsy.*—Within the last week, I have obtained a specimen, from a patient, whom I treated at the Polyclinic Hospital for traumatic rupture of the bladder and fracture of the pelvis. He died a month after injury from hæmorrhage occuring from duodenal ulcer.

At the autopsy, made by Dr. John M. Swan, a diverticulum was discovered, about four inches long. At its origin it is about the size of the ileum. It resembles in shape the finger of a glove. It was situated about two feet from the ileocæcal valve. The

man's death was in no way dependent upon the existence of the anomaly.

CASE V. *A possible instance of persistent, though modified omphalomesenteric structures.*—In 1895 I exhibited to the Section on General Surgery of the College of Physicians of Philadelphia [3] a pedunculated myxoma of the abdominal cavity. While operating on a very large umbilical hernia in a woman, I found among the intestines in the sac a translucent tumor as large as a pea. It had a long thread-like translucent pedicle descending into the abdomen. The growth was not attached to the hernial sac or its contents. The slender stalk was pulled out of the opening in the belly-wall till a foot or more was in my hands. Its lower attachment was not revealed. The tumor and a part of its footstalk were excised.

Dr. W. M. L. Coplin examined the specimen and pronounced it a myxoma. It was covered by epithelium, most of the cells of which were flattened, though some were more rounded in contour. The pedicle contained a single artery and vein, but no nerve-fibre was evident.

I have thought that perhaps these structures might have been the remains of the omphalomesenteric vessels, which had become free at the umbilical end and by modification had been transformed into the pedunculated tumor.

The surgical lesions liable to result from congenital persistence of the omphalomesenteric duct, in whole or in part, should be borne in mind by operating surgeons. This tubular structure, leading from the primitive intestine to the vitelline, or yolk sac, is usually obliterated in the second month of embryonic life. It may, however, remain patulous in the fœtus and cause a congenital intestinal fistule at the navel in the child after birth. This condition is similar in origin to the urinary fistule at the navel, due to an unobliterated urachus.

In other cases the umbilical portion alone may fail to undergo embryonic obliteration and leave a pouch at, and inside of, the navel lined with mucous membrane. Occasionally, and perhaps more frequently the intestinal end remains open and gives rise to a Meckel's diverticulum of the intestine.

[3] ANNALS OF SURGERY, XXIII, 1896, p. 295.

In still other cases the two ends of the duct may undergo the normal disappearance, and leave an unobliterated tube, or cyst, in the middle region; or the entire duct may disappear, leaving, however, a simple fibrous cord, representing the omphalomesenteric blood-vessels.

Various degrees of involution modify these conditions, and quite an array of surgical lesions needing operative treatment result therefrom.

Many cases of strangulation of the bowel, supposed to be due to old inflammatory adhesions are doubtless due to vestiges of the omphalomesenteric duct resembling inflammatory bands. Fistula at the navel, supposed to be caused by a sloughing umbilical hernia, is sometimes a persistent duct. The diagnosis is not very difficult, if the possibility of the rarer condition be remembered.

A diverticulum may become the seat of ulceration and perforation, like the vermiform appendix, from pyogenic or typhoid infection. It may be the cause of intussusception, and may be the whole, or a part, of the content of a hernial sac.

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DR. JOHN H. GIBBON referred to three cases in which he had met with a Meckel's diverticulum. In one case a diagnosis of general peritonitis was made and at the operation a gangrenous Meckel's diverticulum constricting the small intestine was found. This case was reported in the *American Journal of the Medical Sciences.* The other two diverticula were met with in operating for other conditions. Our idea as to the frequency of Meckel's diverticulum has changed greatly since the abdomen has been more frequently opened. No doubt this malformation was in the past frequently the cause of peritonitis.

DR. WILLIAM J. TAYLOR mentioned two cases of Meckel's

diverticulum, one of which he had reported to the Academy, the other to the Johns Hopkins Medical Society. The latter occurred in a child who was supposed to have had three attacks of appendicitis, the symptoms resembling those of a brother who had a few months previous been operated upon for that condition. When the abdomen was opened a globular mass protruded and examination revealed a large diverticulum which was twisted on itself three times, the entire mass being gangrenous. It was cut away at the base and the gut united, the result of the operation being very satisfactory. In the case reported at the Academy, the diverticulum was a long fibrous band that completely encircled the gut and passed through the mesentery. By gradual contraction it had narrowed the intestine. This patient also made a good recovery.

COXA VALGA.

Dr. James K. Young reported the case of a boy, eight years of age, who was brought to him for examination January 27, 1906, by Dr. M. A. Roberts. The patient had a fall about five years before, after which his mother noticed that he walked "crooked." The deformity has been increasing of late. When he falls down he has difficulty in getting up again.

The boy stood on his left leg with right knee thrown forward and inward, and spine curved, with the convexity to the right, and with the left shoulder depressed. In walking he limped on the right leg and the over-development of the quadratus muscles is noted. In standing the crease of the buttocks is inclined to the left, and the abdomen is pendulous and prominent. In the lying position there is slight lordosis and the pelvis is tilted upward on the right side. The right leg is apparently longer than the left, although the bony measurements are the same. In the right hip flexion is abnormal, the thigh is carried outward in adduction during flexion, and adduction is then limited. The adductor tendon is smaller. In the left hip all the movements are normal, and adduction is normal. The right limb is adducted upon the pelvis. Flexion of both knees shows the femur of the right limb to be a little longer than that of the left, and the lordosis is not entirely lost until both thighs are flexed upon the abdomen. The spine is flexible in every direction, and there is no osteitis present. There is an increased

development of the quadratus lumborum muscle and also in the latissimus. There is pain upon motion in the groin above the insertion of the adductor muscles, and this point is also sensitive to pressure.

Skiagram shows the angle of neck and femur on right side to be decreased to about 100°, the normal angle in the adult being about 130°, but varying in individuals, the variation being in an inverse ratio to the stature and to the development of the pelvic bones.

On February 8, 1906, Dr. Young divided the adductors from their pelvic attachment, encased the leg in plaster, and adducted the limb for two weeks. The patient will wear an elevation on the left foot, with the expectation that the weight falling at a different angle upon the neck will correct the angle of deformity.

This has occurred in a similar case of coxa valga in a child who was 2½ years old in March, 1904, when he was brought for treatment. The biceps tendon in this case was divided and by the use of a high shoe upon the other foot the angle changed.

SABRE BLADE DEFORMITY.

Dr. James K. Young reported two cases of sabre blade deformity.

Case I.—A girl, eleven years of age, applied to the Polyclinic Hospital December 1, 1904. She was a tall, healthy-looking girl. When she was one year old she fell out of bed and was unconscious for a time. When two years old the mother noticed that she dragged the leg. She wore braces for a year. Has not worn them since. Five weeks previous to date of applying at hospital she stepped suddenly down from a flight of steps at school and the leg gave way under her. On her way home she fell again. The leg was very painful and she reached home with difficulty. Was unable to walk from that time until coming to the hospital. Examination of the leg at this time showed a bending of the tibia, and the end of the lower fragment of the broken fibula could be felt under the skin. Skiagraph showed fracture of lower tibia and fibula, and of upper third of tibia, with a small amount of callus. Ends of fibula not approximated. Forward bending of tibia. Tibia also showed areas of softening.

December 10, the ends of the fibula were excised and an

attempt made to unite them with silver wire, but the bone was too soft and too much diseased to hold the wire. About ¾ of an inch of bone was removed and the periosteum sutured together. The bone was brought into a straight line. Nothing was done to the tibia. A subsequent skiagraph showed growth of bone within the periosteal sheath, and union of the fibula had occurred. Examination at this time (1906) shows the fracture still ununited.

Case II.—A boy, fifteen years of age, applied to the Polyclinic Hospital July 16, 1904. In the early part of 1903 while walking he fractured the tibia above the malleoli. Leg was not set at time of injury. Tibia was deformed for eight years.

When he applied at the hospital his ankle was fixed with the foot at right angle to the leg. There was considerable pain in the leg, increased upon standing and walking. Skiagraph showed typical sabre-blade deformity. He was fitted with brace, and after four weeks reported that he had much less pain.

Dr. DeForrest Willard said that five days previous he operated on a colored boy eight years old who had marked sabre-blade deformity. Several years previously the tibia had given away but not knowing that fracture had occurred the boy had continued walking and when seen by Dr. Willard the condition well illustrated the remarkable compensatory power of bones. The fibula had remained intact and had developed to three times its normal size; the tibia had atrophied and absorbed. The lesion was treated as an ununited fracture, the tibia being cut down upon and wired, while a wedge from the fibula was resected.

Dr. Henry R. Wharton said the interesting point in the cases of sabre-blade deformity reported was the occurrence of fracture. In his experience, fracture is a rare complication of the condition. In a number of cases upon which he had operated he found the bone dense and the compact portion increased in thickness. The treatment he finds most satisfactory in these cases is to make an incision in the soft parts from epiphysis to epiphysis and then lay open the bone to the medullary cavity throughout its entire length. This can be done with a circular saw propelled by a dental engine or with a Hey's saw. This method of operating shows the thickness of the bone as before

mentioned, the hard part being from one-eighth to one-fourth inch thick. Having thus exposed the marrow throughout its entire length, the external wound is closed without drainage. Generally there is relief of pain. Several cases have been relieved in this manner after a long treatment with potassium iodid had proved ineffective.

HEMIPLEGIA FOLLOWING OPERATION FOR APPENDICITIS.

Dr. H. R. Wharton reported the case of a boy, aged eight years, who was admitted to the Girard College Infirmary, in May, 1905, suffering from bromidrosis, with excoriation about the toes and feet. He was exceedingly nervous and became hysterical when the feet were dressed. One week after admission he complained of pain in his right iliac fossa; no rigidity, very slight tenderness on pressure. These abdominal symptoms passed away after the use of an enema. Two days later the abdomen became markedly distended, and there was pain and tenderness, with slight rigidity of the muscles over the right iliac fossa, but the pain was never severe at any time. The temperature at this time was 99° and the pulse 108. Six-hour leucocyte counts showed a gradually-increasing leucocytosis—13,000, 20,000, 22,000, 28,000.

The appendix was exposed by an incision through the outer edge of the right rectus, and was found to be much inflamed, and enlarged about three times its normal size. It was firmly adherent to the omentum, was gangrenous, and perforated at its distal end, and contained a good-sized concretion. An abscess, circumscribed by adherent bowel, extended into the pelvis. The appendix was removed, and the abscess drained with glass tube and gauze drains. The patient did well after the operation, there was free purulent discharge from the wound for a few days, and all drainage was removed from the wound at the end of the first week.

On the third day after the operation the patient, who had been previously bright, answering questions and talking freely, suddenly became quiet, and examination showed inability to protrude the tongue or to speak. There was ptosis of the right eye, facial paralysis on right side, complete paralysis of motion of the right leg and partial of the right arm, with diminished

sensation in both these members. Babinski reflex present in right foot, patella and ankle; clonus reflexes normal. The patient had no marked elevation of temperature, never being over 100 2-5° during the first week, and his abdominal condition was entirely satisfactory.

At the end of the third day, after the appearance of the hemiplegia, the patient began to improve, the voice returned and the sensation was normal in the limbs. Motion was regained first in the fingers and toes, and at the end of the sixth day he could use his hand fairly well, but made no attempt to do so unless his left arm was tied to his side. Improvement of the motion in the leg was slower, reflexes negative, except for a slight ankle clonus.

The nurse in charge of the case reported that when visited by members of his family he apparently redeveloped the paralysis of the arm and leg, and could not be induced to move either member.

The abdominal incision was healed after the twenty-third day, and from this time the patient was encouraged to use the limb in walking, and in a few days walked quite well. He developed typhoid fever during the early fall, and made a satisfactory recovery from this disease. In December, 1905, he was in good condition, with no evidence of impairment of function in the right arm or leg.

When Dr. Wharton saw the case a few hours after the development of the hemiplegia, he was inclined to attribute it to embolism, but the rapid disappearance of some of the symptoms, beginning in three days, and the previous nervous condition of the patient, the development of marked nervous symptoms on slight provocation before the operation, and the redevelopment of the symptoms of paralysis of the arm and leg when visited by members of his family, suggested the possibility of hysterical hemiplegia. Although many of the symptoms could be explained as hysterical manifestations, a careful study of the case rendered it difficult to explain all of them upon this hypothesis, notably, the presence of facial paralysis, ptosis, and the Babinski reflex, which all point to an organic lesion.

Dr. Wharton Sinkler saw the patient a few days after the development of the nervous symptoms, and sent the following report of his observations:

"The case was probably one of thrombosis of one of the vessels supplying the motor area, but there is reason for the belief that the patient was also suffering from hysteria. The reason for this opinion was that hysterical facial paralysis is so rare that it may be excluded. In addition to this the boy had ptosis of the same side and complete paralysis of motion in the right leg and partial in the right arm.

"The Babinski reflex was present and ankle clonus was present to a slight extent on the right side. These phenomena indicated the existence of an organic change. The rapid recovery is explicable on the supposition that the collateral circulation was rapidly established. Rapid recovery in the hemiplegias of children, occurring after acute illnesses, is not unusual. That some of the symptoms alleged by the relatives of the boy were due to hysteria, there can be little doubt."

STRICTURE OF THE ŒSOPHAGUS.

Dr. H. R. Wharton presented a patient in whom gastrostomy, followed by retrograde dilatation, was performed more than five years ago for stricture of the œsophagus.

Robert B., seven years of age, was admitted to the Children's Hospital, October 13, 1900, suffering from difficulty in swallowing and regurgitation of food. He had four weeks previously swallowed a solution of lye, which he mistook for milk. At the time of admission he was emaciated, and seemed unable to swallow any food; even liquids were regurgitated, unless taken in very small quantities.

Upon examination with an œsophageal bougie, a stricture of the œsophagus was located, 9¼ inches from the line of the teeth, through which it was found impossible to pass even the smallest bougie. The patient was given nutritious enemata, and for a time improved slightly in weight under their use.

On December 17, as it was found impossible to pass any instrument through the stricture, and as he was losing rapidly in weight and was greatly emaciated, gastrostomy was done, and the patient was fed through the gastric fistula. He improved rapidly under regular feeding through the fistula, and ten days later he was anæsthetized and an attempt was made to pass an instrument through the mouth without success. A small flexible catheter was then passed through the fistula and into the

œsophagus, and after a number of attempts it was passed through the stricture and appeared in the pharynx. A stout silk ligature was attached to the extremity of the catheter, and it was withdrawn through the fistula. A small rubber drainage-tube was fastened to the end of the ligature, and it was well stretched and drawn through the stricture until its end appeared in the pharynx. The string attachment to the rubber tube was brought out of the mouth and secured to the cheek by a strip of plaster, and the lower end of the rubber tube was secured outside of the fistula by a safety-pin. At intervals of two or three days rubber tubes of increasing size were attached to the tube and drawn through the stricture and secured as described as above. At the end of three weeks the rubber tube was removed, and dilatation of the stricture was continued by passing bougies through the mouth. When the stricture had been dilated to about 26 French scale, he could swallow food quite well.

As he was able to take food well by the mouth, and the skin in the region of the fistula was excoriated, it was decided to operate for the closure of the gastric fistula. This was done by circumscribing the fistulous opening by an incision and dissecting it down to the abdominal muscles. The orifice of the fistula was incised at each end, and the mucous surfaces inverted and secured in this position by silk sutures; another layer of sutures next secured the aponeurotic structures over this, and the skin incision was finally closed with sutures.

There was a little leakage through the line of sutures for a few days, but this then ceased, and the wound healed firmly. The boy left the hospital in August in good condition, and at this time was able to swallow ordinary food without difficulty.

The patient was not seen again until November, 1905, when he was admitted to the Medical Ward suffering from fever, supposed to be typhoid. This proved not to be typhoid fever, and he was discharged in a few days. At this time he was able to take ordinary food without difficulty.

The procedure employed, gastrostomy, followed by retrograde dilatation of the stricture with rubber tubes, was most satisfactory in this case, and should be resorted to when dilatation of the stricture by bougies passed through the mouth is impossible. The modern operations of gastrostomy, which aim to produce a fistula without leakage, and do not give sufficient access to the stomach for the passing of bougies are not applicable in these cases.

TETANUS AFTER AMPUTATION FOR GUNSHOT WOUND OF FOREARM.

Dr. H. R. Wharton reported the case of a young man, aged eighteen years, who received a gunshot wound of the forearm at close range, with No. 6 shot, on October 27, 1905. The skin and subcutaneous tissue for a space of several inches, about three inches above the wrist, were torn away, but the bones were not injured. He was seen by Dr. Carpenter, who controlled the bleeding and sutured the tendons. On the third day after the accident gangrene of the hand developed, and he was sent to the Presbyterian Hospital. At this time the patient had a temperature of 103°, was delirious, and was septic.

The forearm was amputated three inches below the elbow, and immediately the patient's general condition improved. This improvement continued until December 4, when he complained of stiffness about jaws, which was followed by the rapid development of marked symptoms of tetanus. He was immediately given injections of tetanus antitoxin, and at the same time chloral hydrate and bromide of potassium in full doses. In spite of the treatment he became progressively worse, having from four to five convulsions in the twenty-four hours. At the end of a week he had taken fifteen injections of antitoxin, 30 c.c. each. At this time the injections of antitoxin were discontinued, and the chloral hydrate and bromide of potassium were continued. To control the convulsions the inhalation of nitrite of amyl, ether and chloroform were used. The latter drug was the only one which proved satisfactory. Morphia was also used freely to relieve pain and secure sleep. The patient was also given large quantities of liquid nourishment. For a week after discontinuing injections of antitoxin, the convulsions were frequent and severe, but in the third week diminished in frequency and disappeared entirely in the fourth week. The patient gradually improved in strength and was discharged on December 16, 1905.

Dr. Wharton said that his experience in the treatment of tetanus by antitoxin had not been encouraging. The recovery in this case, he thought was due to the fact that they were able to support the patient until the disease had run its course, re-

lieving pain and securing sleep by the use of morphine, chloral and bromide, and to prevent death from spasm of the respiratory muscles by the use of chloroform during the convulsions.

INFECTIONS OF THE KNEE-JOINT.

Dr. Dudley P. Allen, of Cleveland, Ohio, read a paper entitled "A Study of Infections of the Knee-Joint, with Their Treatment."

In beginning the paper he explained that it was called a "study" because the subjects to be presented were still under consideration and definite conclusions had not been reached with reference to them. The paper was based upon material gathered at Lakeside Hospital during six or seven years, but work bearing upon the subject in hand had only been carried on during the last three or four years. The material under treatment showed that there were numerous cases of infection of the knee-joint in which the chief manifestations were swelling with effusion, pain and tenderness on pressure or motion. To such cases has commonly been applied the term of articular rheumatism. Many of the cases were admitted to the medical ward with this diagnosis. Some of the cases yielded quickly to treatment by the salicylates, the pain rapidly disappearing. Other cases were unaffected by such treatment, and a study of such cases was instituted. The paper, however, took up certain other classes of cases.

The first class of cases to be considered was those of infection of the knee-joint as a result of external wounds or trauma. In a number of cases of very severe infection an attempt had been made primarily to save the joint by drainage and irrigation. After it was evident that this had failed, a more radical method of procedure had been instituted. The knee-joint had been opened by a transverse incision across the front of the joint, separating the ligamentum patellæ, and by two incisions on either side, opening the joint to its upper extremity. After thoroughly clearing out the joint, the entire cavity was filled with iodoform gauze, with the joint in the flexed position. This secured absolutely perfect drainage. As it became evident that the acute infectious process was under control, the iodoform gauze was removed, a smaller amount returned, and the leg was gradually brought into the extended position. By this means the patient's

life was saved and the leg was preserved, although the knee-joint was perfectly stiff.

This method of procedure was recommended in cases of grave infection where it was evident that the patient's life, or at least his limb, was jeopardized by any more conservative treatment, the fact being pointed out of the seriousness of infections of the knee-joint. Several cases of unusual gravity were reported which had been treated by this method.

As opposed to this radical method of treatment, a case was reported of suppuration of the knee-joint, a pure culture of streptococcus being obtained. In this case the joint had been washed out with 1 to 40 carbolic acid, and then injected with an emulsion of iodoform in glycerine. This treatment had been repeated several times, and the patient recovered, with a joint which could be flexed to a right angle. The possibility was suggested that the further study of causes of infection of the joint might show that while some cases require the most radical treatment others might be treated in a more conservative manner.

Two cases were reported of infection of the knee-joint with pure cultures of pneumococcus. One of these cases had been treated as acute articular rheumatism, having been in the hands of a physician of large experience. Immediately upon admission to the hospital the joint was aspirated and thoroughly opened. The pus obtained gave a pure culture of pneumococcus. Incision failed to relieve the condition and the thigh was amputated, but the patient died. A careful post-mortem failed to disclose a diseased condition elsewhere.

Cases of this sort seem to emphasize the importance of early positive diagnosis.

Tubercular infection of the knee-joint was the next subject to be considered. The aid to be gained in such cases by means of X-ray photographs was pointed out and illustrated. It was also pointed out that in many cases early diagnosis by ordinary means was extremely difficult, due to the fact that the appearances were not always characteristic, and the X-ray photograph gave no assistance. Some cases were reported which had been seemingly very successfully treated by the injection of iodoform emulsion. It was pointed out, however, that statements with reference to cases of this kind must be very conservative, and could be convincing only after long observation, since the tend-

ency to recurrence of trouble in a knee after tubercular infection was well known. A strong probability was thought to exist of benefit from the injection of iodoform by thoroughly established results gained elsewhere. The writer pointed out a series of cases of tubercular disease of the vertebræ, with the accumulation of large amounts of pus. In these cases after aspiration and injection of iodoform emulsion, in some cases the process being repeated as high as ten times, a considerable number of permanent cures had been obtained. If such results could be obtained in tuberculous abscesses, having their origin in the spinal column, it seems strongly probable that beneficial results might follow a similar treatment of the knee-joint.

Following the cases treated by injections of iodoform was a series of cases of tuberculosis of the knee-joint, in which the joint had been laid widely open. In one such case in which a positive diagnosis had seemed impossible, a movable body could be felt. On opening the joint this was found to be attached at one extremity to the synovial membrane surrounding the joint. There were other similar movable bodies of small size. These were removed and on microscopic examination they presented positive evidence of being tubercular. The writer insisted upon the value of early diagnosis thus gained by incision of the joint. Diagnosis by other means often proves unsatisfactory, since the material aspirated from tubercular joints often failed to give cultures of bacilli which could be discovered by microscopical examination, and the inoculation of animals also proved, in a certain number of cases, unsatisfactory as a means of diagnosis. While not prepared to take too radical a position, the writer had a growing inclination to the incision of questionable joints of this kind, since in a series of cases no evil results had been encountered, and the results obtained had seemed more rapid and more positive than those gained by other means.

In conjunction with the aid given in the diagnosis of tuberculosis by the use of the X-ray apparatus, the writer reported other cases of floating cartilage. In one of these a considerable amount of effusion was present in the joint, and a diagnosis was difficult. By the aid of the X-ray a floating cartilage was located and removed, and the fact established that it was not tubercular in character.

Another class of cases described were those of gonorrhœal

rheumatism. Although multiple joints may be involved, it was the writer's opinion that the joint which suffered most frequently, and probably most seriously, was the knee-joint. A careful study of the history of the cases, together with a thorough examination, usually gives at least a strong suspicion as to its nature. Such cases untreated often result in marked stiffening if not in ankylosis of the joint. This is sometimes associated with marked deformity. The writer had treated a number of cases of the kind by a thorough washing of the joint with carbolic acid. In some, in addition to this, an emulsion of iodoform had been used. The results obtained seemed much superior to those secured from less radical methods.

The last class of cases to be considered were those commonly classified as acute articular rheumatism, in which little if any benefit was found from the administration of salicylates. The close resemblance which these bore to others which are known to be due to a definite infection is such as to arouse a strong suspicion that they are also infectious. The results obtained in such cases are often long delayed and most unsatisfactory. Some cases of this kind had also been treated by washing and iodoform injection. Recently, in a series of cases, the joint had been opened by a long incision parallel to the patella, laying the joint open throughout its entire length. These cases had either been swabbed out with a 95 per cent. solution of carbolic acid, or carbolic acid had been poured directly into the joint. As soon as this had come in contact with every part of the joint, the joint was thoroughly washed with a 95 per cent. solution of alcohol, in order to limit the effect of the carbolic acid. On opening joints of this kind the synovial membrane had been found greatly thickened and reddened, and the intra-articular fringes in a similar condition, and also very greatly hypertrophied. Careful bacteriological and microscopic examinations had failed to disclose any organisms. The clinical appearances, however, were such as to lead one strongly to suspect their presence. In a small number of cases treated by this method, the results at the time of the report have been most encouraging, sufficiently so to warrant the further trial of the method.

After a consideration of the various sources of infection the writer's conclusion was that although it was perhaps too early to make a final statement with reference to the points under

consideration, enough experience had been gained to warrant the more radical treatment of infections of the knee-joint. The joint should no longer be considered a closed cavity which might be opened only with great danger to the patient. Under proper precautions it should be opened as quickly as any other closed cavity of the body, and its condition ascertained. By early interference much can be learned and many cases might receive prompt and efficient treatment with the hope of speedy and positive benefit, which otherwise would be left to conditions more chronic and much less hopeful.

Dr. DeForest Willard said that as regards prompt and radical treatment in infections of the knee there can be no question. If we can determine the diagnosis by means of the X-ray, by aspiration, and by bacteriological investigation, there is no reason for delaying operation. Early and thorough opening of the joint is most important. How open this shall be depends upon the character and virulence of the infection. In the most virulent cases the joint should be laid entirely open so that every portion may be cleansed and drained, thus avoiding amputation. Other less virulent cases need not be so thoroughly opened. A stiff knee is much better than an amputation through the thigh. Hence in infections radical measures are indicated. As to aspiration and injection of iodoform, Dr. Willard is not in accord with Dr. Allen, as the results after such procedure have not been satisfactory. Especially in the case of tuberculous joints has he been sadly disappointed by these injections. He now employs aspiration only as a diagnostic method or as a step preceding opening and drainage. In the case of gonococcal infections, the open treatment is the only one likely to yield good results, as such cases are liable to the rapid formation of adhesions unless the joint be opened and thoroughly cleansed. The majority terminate satisfactorily if the joint is opened; otherwise ankylosis is common even if early motion is made. This is particularly true of the knee-joint.

Tuberculin as a diagnostic agent has proven very unsatisfactory. As to the use of carbolic acid and alcohol in rheumatism, Dr. Willard is glad Dr. Allen has taken up the theory of infection in these cases. What is ordinarily called rheumatism is often an infection, a great number of cases being called rheumatism when they are not rheumatism at all. For instance gonorrhœal rheumatism ought never to be thus misnamed. Even cases of true rheumatism are instances of auto-infection, and the open treatment as detailed by Dr. Allen is along the right line.

Dr. William L. Rodman said that his experience accorded with that of Dr. Allen in regard to the injection of iodoform. From its use he obtains very good results. As with any other procedure, disappointment from its use will now and then be met, but he has depended upon it, particularly in lesions of the wrist-joint where erasion, excision, or other operative measures are not particularly desirable or satisfactory. In two cases of wrist-joint tuberculosis he secured absolute relief by injecting iodoform. It is a measure that should be repeated if necessary, failure being often due to the fact that it is not persisted in. Dr. Rodman strongly advocated an aggressive policy in the treatment of tuberculosis of joints. Surgeons in general have too long been afraid to do things in these cases. A tuberculous joint is difficult to infect and one may do almost as he pleases with such a lesion if he practices scrupulous antisepsis or asepsis. He has often opened such a joint and performed an atypical resection and thorough erasion without producing infection and without the operation resulting in ankylosis. In one case of knee-joint tuberculosis the entire inner condyle was removed and the joint drained for six weeks. Perfect use of the part resulted. The man is an enthusiastic sportsman and walks during his shooting expeditions, moving the joint as well as can any other person. In streptococcic infections, he believes that the plan detailed by Dr. Allen may be proper in the more virulent infections. It must be remembered that there are streptococcic infections and streptococcic infections, there being between them a marked difference in severity. Most radical treatment may be necessary in some cases, but in two instances of as virulent infection as appears possible Dr. Rodman had obtained good results from a middle course of treatment. One case was that of a plumber who ran a rusty nail into his knee-joint. He was treated by a physician for several days, during which a most violent infection developed. The patient insisted that the nail was not in the joint, though Dr. Rodman suspected its presence. When the joint was opened a pint of pus was evacuated and the headless rusty nail secured. Free drainage was instituted and, although a most extensive streptococcic infection spread from

the knee to the hip, inducing an intense erysipelatous condition with sloughing of large masses of tissue, a good result was finally obtained. The knee can now be bent past a right angle and the man can walk as well as he ever did. The second case was that of a boy who because of a suppurative osteomyelitis had one leg amputated above the knee. Suppuration of the opposite knee developed. The joint was irrigated daily for four weeks with sublimate solution, and the leg was saved with a movable joint. From these cases it will be seen that through-and-through drainage, with a tube, will accomplish much, and is to be preferred to more radical measures which make ankylosis a certainty. Dr. Rodman does not now operate on so-called rheumatic joints, though he may in the future.

Dr. Richard H. Harte said all surgeons recognized that in grave diseases, as typhoid fever, pneumonia, and like affections, there is apt to be infection of the joints. Where infection of the joints exists the best method of treatment is to open and drain. He has opened joints when they were involved by tuberculosis and by other infections, using iodoform emulsion; he believes in the efficacy of this agent. He also frequently leaves iodoform drains in for a long time. Dr. Harte endorses the very radical method advocated by Dr. Allen for the treatment of virulent streptococcic infections. This is the standard to which he believes surgeons are going to come, and adherence to it will result in saving limbs which formerly have been amputated. Regarding joint effusions, as in articular rheumatism, they at times follow trauma; synovitis then develops, followed by infection and finally rheumatoid arthritis. Dr. Harte was particularly interested in Dr. Allen's negative findings in cases of articular rheumatism. In conclusion, he stated his belief that the best working rule regarding joint infections is to operate on all doubtful cases. This may appear radical but it is better than to let the cases drag along for an indefinite period, until an extensive joint involvement has taken place. He sees *comparatively* little danger in thoroughly opening and draining the joint and removing the foci of infection.

Dr. Henry R. Wharton said his experience with iodoform injections had been similar to that of Dr. Willard; this agent was more freely used years ago than it is now. Regarding the wide-open treatment of streptococcic joint infections, he has

been content with free drainage consisting of multiple incisions and many drains. Functional results are satisfactory. In young children particularly he has seen recovery with good function. In cases of acute epiphysitis with pus, free drainage often leads to recovery with a useful joint; the older writers called attention to this result. Regarding gonorrhœal arthritis, he has treated a few cases by incision and many by aspiration. The latter procedure should be employed early and when repeated often leads to the restoration of good function of the joint. He has never used carbolic acid or iodoform injections for this affection.

Dr. James K. Young cited an instance of wide-open treatment of streptococcic infection of the knee-joint in a man of forty-five years. An incision had previously been made across the patellar tendon. He opened the joint freely, removed the patella and drained. The joint did not become ankylosed and the patient wears a brace. In his experience iodoform is of value in small joints, even the wrist and ankle; in the larger joints it does not give good results. He has abandoned its use in the hip and knee-joints, because in them it generally acts as a foreign body and has to be removed.