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THE UNIVERSITY OF MINNESOTA

GRADUATE SCHOOL

Report

of

Committee on Thesis

The undersigned, acting as a Committee of the Graduate School, have read the accompanying thesis submitted by Verne Carlton Hunt for the degree of Master of Science in Surgery. They approve it as a thesis meeting the requirements of the Graduate School of the University of Minnesota, and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science in Surgery.

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THE UNIVERSITY OF MINNESOTA

GRADUATE SCHOOL

Report

of

Committee on Examination

This is to certify that we the undersigned, as a committee of the Graduate School, have given Verne Carlton Hunt final oral examination for the degree of Master of Science in Surgery. We recommend that the degree of Master of Science in Surgery be conferred upon the candidate.

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June 1 1918

THESIS

TORSION OF APPENDICES EPIPLOICAE

Verne Carlton Hunt

Submitted May 15, 1918, to the Faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the Degree of Master of Science in Surgery.

Introduction

The appendices epiploicae appear along the whole of the large intestine except the rectum, where they terminate quite abruptly. They consist of little processes or pouches of peritoneum; no other part of the intestinal wall enters into their formation, the space or sacculation being filled with a variable amount of fat, usually considerable in obese persons. Their shape and size is variable, usually dependent on their fat content. They are often more or less flattened but may be quite cylindrical. When flat they are usually lobulated. Their size is variable along the course of the large bowel and in different persons, the smallest occurring along each side of the mesentery of the appendix vermiformis. The development is moderate on the ascending and descending colon, and the greatest size is usually on the transverse colon and sigmoid flexure. Their length varies from 0.5 to 5 cm. but they have been reported 15 cm. in length (Linkenheld). As a rule but one artery and one vein enter the base of the appendix epiploica. The appendices epiploicae occur quite evenly in two rows, their line of origin usually being quite close to the anterior and posterior inferior longitudinal muscle bands.

Harrigan quotes Robinson in saying that the physiologic function of appendices epiploicae is not protective and defensive like the great omentum, as they are simple in structure and present no evidence of specialized function. It is Robinson's belief that these appendices epiploicae are concerned with the movement of fluids in the large intestine; however, no definite evidence of their true function has been brought to light.

The pathologic changes incident to the appendices epiploicae are usually those attending mechanical interference with the blood supply either by torsion or direct pressure, torsion being perhaps the only cause within the

abdomen, that is, not limited to the abdominal cavity. A considerable number of cases have been reported in which torsion of an appendix epiploica has occurred in a hernial sac, this being the most common site for mechanical interference by direct pressure and strangulation without torsion; however, torsion occurs here also. In either event the interference with the circulation may be suddenly complete or gradually progressive. Fat necrosis is the chief degenerative change, there frequently being considerable inflammatory reaction, particularly in those cases of hernia as is manifested by the adhesions which frequently close off the neck of the sac, and the presence of serum (Serve, Kendirdjy and Sejournet, and Schweinburg -cases-). Subperitoneal hemorrhagic effusions occur (Lorenz, Zoeppritz, Mohr, Schweinburg, and Linkenheld - cases -) and at times only small ecchymotic areas with dark discoloration of the appendix epiploica have been seen. In the abdominal cavity these same changes take place, with torsion, and several appendices epiploicae may adhere over the one in which torsion has occurred, in a way suggesting protection. The affected appendix epiploica then becomes encysted, and fat necrosis and saponification taks place until the cyst contains but an oily, straw-colored fluid, as was seen in Case A43849.

Since all cases of torsion of an appendix epiploica present acute pathologic processes, characterized by subperitoneal hemorrhagic effusion, fat necrosis, gangrene, etc., infection of the appendix epiploica by direct microbic invasion from the lumen of the bowel because of interrupted continuity, as is seen in diverticulitis of the colon, seems a very probable etiologic factor. Many authors have noted the frequeht presence of diverticula in relation to the appendices epiploicae. Telling says: "Bland Sutton has stated and illustrated by diagrams that this fat is directly continuous with the subserous fat, and if there is any tendency to the formation of diverticula, it will be readily seen that the soft fatty tissue of the appendices epiploicae form points of lowered resistance." McGrath states that the relationship between diverticula and appendices epiploicae

seems to be due to the fact that these fatty masses are situated either directly on or close to the points where the larger vessels enter the intestinal wall. Greaves reports a case in which there was an acute inflammatory process in two appendices epiploicae of the pelvic colon. They were nodular, black in color, and each one contained a fecal concretion, but no communication with the lumen of the bowel could be found. However, while torsion of these appendices epiploicae had not occurred, the inflammatory process was undoubtedly due to microbic invasion by way of a diverticulum. Erdman found, in most of his cases of acute diverticulitis of the colon, involvement of one or more appendices epiploicae which were usually very hard and injected or hemorrhagic and becoming gangrenous.

In some of the cases of diverticulitis of the colon with tumor formation seen in the Mayo Clinic the appendices epiploicae have been found involved in the inflammatory process in a way suggesting protection to perforation of the diverticulae. Virchow's case in which colon bacilli were cultivated from the center of a foreign body found in the peritoneal cavity, as the sole cause of a peritonitis, adds evidence to the infection theory. Diverticulitis was not found in any of the cases of torsion of appendices epiploicae reported in the literature, nor was it demonstrated in our cases yet it seems that infection may prove to be the etiologic factor in the production of torsion and of inflammation in appendices epiploicae.

Torsion intra-abdominally of an appendix epiploica may suddenly deprive it of its circulation, and with no protection from the omentum or neighboring appendices epiploicae, necrosis of the narrow pedicle occurs so rapidly that it drops off and remains in the peritoneal cavity as a free body, encysted by its peritoneal coat. Such fatty bodies have been found in 4 cadavers (Littre, and in 7 instances at operation, (Schede, Neri, Riedel, 4 and Case A210428). Laveran, Cruveilhier, and Virchow)[1]./ Of those found in the cadavers, one contained a stone and in two the foreign bodies were fibro-cartilaginous. The case of Virchow showed an atrophied appendix epiploica as a possible source of the

foreign body. The foreign bodies found at operation retained their fatty composition in all cases except one (Schede) in which calcification of the body had occurred. These foreign bodies varied in size from the size of a pea to a hen's egg. Colon bacilli were isolated from one of the bodies (Riedel's fourth case) as the source of a fatal peritonitis. In four of these cases operation was done for acute or subacute conditions and nothing else was found to explain the symptoms.

DISCUSSION OF CASES REPORTED IN THE LITERATURE

The literature contains records of forty-two cases which have accumulated under the combined titles of "torsion and inflammation of appendices epiploicae". It seems advisable to divide these cases into their true classifications, rather than into one large group, according to the pathologic condition presented.

Nineteen were cases of true torsion of an appendix epiploica, intra-abdominal in 9 cases and within a hernial sac in 10. One case of intra-abdominal torsion was a finding at necropsy, the remainder were seen at operation and each presented an acute process. The intra-abdominal cases possessed symptoms of acute surgical comditions in which the diagnosis of acute appendicitis was made in three instances, intestinal obstruction in two, gallstones in one, ovarian disease in one, and appendicitis and gallbladder disease in one. There were no pathologic findings to explain the acutd symptoms, except the torsion of the appendices epiploicae.

The ten pdients with hernias in whom torsion of an appendix epiploica had occurred all had acute symptoms on which the diagnosis of strangulation or incarceration of the hernial contents was made. In twelve cases of hernia in which the symptoms were acute there were from one to three strangulated or incarcerated appendices epiploicae, showing the inflammatory reaction and fat necrosis attending mechanical interference with blood supply without torsion of the pediclee.

The literature contains accounts of eleven cases of foreign body in the peritoneal cavity which are assumed to have been the results of torsion of appendicee epiploicae, and while evidence in its support is presented in but one case (Virchow) in which there was found an atrophied appendix epiploicae the possible source of the foreign body, that assumption is probably correct. However, in the absence of facts establishing these cases as true torsion of appendices epiploicae it seems they should not be classified in that group.

One case (Patel) from the report is a true case of diverticulitis for which the diagnosis is easily mistaken.

Excluding the last 12 cases, the literature contains but 30 cases in which there has been mechanical interference with the blood supply of an appendix epiploica and in 19 of these it was by torsion. The symptoms in each of these 30 cases were of sufficient severity to require urgent surgical interference.

Several theories regarding the cause of intra-abdominal torsion of appendices epiploicae have been advanced. Morestin states that for torsion to occur it is necessary that these fatty appendages should be abnormally long and large. Ebner quotes Payr's theory of the difference of length of artery and vein, the vein being the longer by reason of its winding course. In congestion, particularly in stasis with engorgement of the veins, this difference of length may furnish the tendency to the twisting of the pedicle.

Zoeppritz's patient had an adhesion to the omentum, which on moving in the abdomen suddenly, due to a sudden turn of the patient, may have been responsible for the torsion of the appendix epiploica. Zoeppritz quotes Küstner, Mickwitz, and Carlo as regards external causes, such as peristalsis and variations in the filling of the abdominal organs, contraction of the abdominal muscles and the effect of abdominal pressure, being sufficient to cause torsion of intraperitoneal bodies.

Torsion of an intrahernial appendix epiploica is explained by Ebner in a certain case by its twisting on its exit into the hernial ring at the moment of

coughing, similar to the spiral twisting of a cloth used in cleaning a lamp chimney; the tip of the appendix epiploica follows along the wall of the sac, and its base or pedicle remains more or less fixed. In some instances the appendices epiploicae are carried into the hernial sac with omentum and torsion is produced (Ebner).

DISCUSSION OF CASES FROM THE MAYO CLINIC

To the cases reported in the literature I desire to add 11 cases which have been under observation in the Mayo Clinic in the past ten years. Seven of these cases are true torsion of the appendix epiploica, 1 is of doubtful torsion, acting as a band producing intestinal obstruction, 2 are of incarceration in a left inguinal hernia, and 1 is of a foreign body in the peritoneal cavity with unproved origin from an appendix epiploica. Four of the cases of torsion presented acute symptoms, for which operation was done, and in the remaining 3 cases, the torsion was probably symptomless as it was found in the course of abdominal operations for other pathologic conditions. The cases in which there was incarceration in a hernial sac presented symptoms of incarceration of the hernial contents. The foreign body was found in the course of an operation for postoperative hernia, and the appendix epiploica, producing the obstruction of the sigmoid, manifested symptoms of chronic intestinal obstruction.

It may be seen from the histories of cases from the literature and those included in our series that intra-abdominal torsion produces symptoms, acute in various degrees, simulating those of galletone colic, acute appendicitis, intestinal obstruction, etc., the pain not necessarily occurring directly over the seat of the lesion, for, while the sigmoid has been the portion of the bowel most frequently affected, the pain has in many instances been in the right abdomen. In the combined series of cases (40) in which mechanical interference with the blood supply to the appendix epiploica had occurred, the origin of the appendix was in the sigmoid in 28 instances, in the cecum in 6, in the transverse colon

in 1, and not stated in 5. Left inguinal hernias are more apt to contain epiploic tags because of the close proximity of the sigmoid, with its long mesentery, to the internal ring of a left hernia. In the 24 cases of torsion or strangulation of the appendix epiploica in a hernial sac, it was found in a left inguinal hernia in 17 instances, in a right inguinal hernia in 5 and in a left femoral hernia in 2.

The amount of torsion of the appendices epiploica has varied from one turn through 180° (Zoeppritz) to ten half turns (Adler). It has been stated (Briggs) that torsion of appendices epiploicae usually occurs in persons more or less obese, during middle life or later. In 24 of the 26 cases of torsion, in which the age was given, the youngest patient was 20 years and the oldest 72, an average age of 45 years; 5 each in the third and fourth decades, 4 in each of the fifth, sixth, and seventh, and 2 in the eighth decade.

Intra-abdominal torsion occurred 11 times in the male and 5 times in the female. Within a hernial sac it occurred 6 times in the male and 4 times in the female, the males comprising 65+ per cent of the entire series of torsion.

ABSTRACTS OF REPORTS OF CASES IN THE LITERATURE

Appendices epiploicae as foreign bodies

Case 1. In 1703 Littre, during the dissection of a cadaver, found in the abdomen a free hard oval body, one inch long. In its center was a round white stone, the size of a pea.

Case 2. In Virchow's case the patient died of peritonitis. A hard calcified foreign body was found in the abdominal cavity, the possible source being an atrophied appendix epiploica of the vermiform appendix.

Case 3. In 1894, Schede reported a patient who had symptoms of ileus, and at operation a free body, hard and the size of an egg, was removed from the pelvis and found to be a calcified appendix epiploica.

Case 4. In 1894, Cruveilhier, at necropsy after death of unknown cause, found a large foreign body with white, smooth surface very hard and perfectly free

in the abdomen.

Case 5. In 1895 Laveran at necropsy found a mass of twelve fibro-cartilaginous bodies in the abdomen.

Case 6. In 1904 Neri found at operation several foreign bodies composed of fat within a connective tissue envelop.

Case 7. In one of Riedel's group of cases reported in 1905, the patient had attacks of pain simulating gallstone colic and a diagnosis of adhesions about the gallbladder was made. At operation two foreign bodies, almost as large as a cherry, were removed. The pains recurred, and three years later the patient committed suicide. The necropsy revealed two more foreign bodies free in the peritoneal cavity.

Case 8 (Riedel). The patient was a male, 25 years of age, who, four years previously had been operated on for an appendical abscess, with removal of the distal end of a gangrenous appendix. He had three indefinite attacks of pain with abscess formation in the umbilical region. Operation disclosed two small, yellow, round foreign bodies.

Case 9 (Riedel). The patient was a male, 32 years of age, whose symptoms were those of gallstone colic with jaundice. At operation the gallbladder contained no stones. The omentum was adherent to the liver and the transverse colon and two foreign bodies were slightly adherent to it. They were round and calcareous. A number of appendices epiploicae were hanging by a mere thread from the transverse colon.

Case 10 (Riedel). The patient, a female, 41 years of age, had been sick for eight days and presented the symptoms of peritonitis. At operation there were marked signs of peritonitis. A crescent-shaped appendix epiploica, attached to the descending colon, with a flat, grey foreign body lying free between it and the abdominal wall, seemed to be the sole cause of the peritonitis. The appendix epiploica was not twisted. Colon bacilli were found in the foreign body which was composed of fat. The patient died on the third day after operation, and

necropsy did not disclose any other cause for the peritonitis.

Case 11 (Riedel). The patient had been vomiting for fourteen days, the vomitus at last becoming fecal. A diagnosis of intestinal obstruction was made. At operation a foreign body the size of a bean lay free in the peritoneal cavity. The parent appendix epiploica seemed to spring from the cecum and was adherent to a coil of small intestine in such a way as to act as a constricting band, the small intestine being greatly distended. The foreign body was composed of fat and Riedel considered it a part of the appendix epiploica from which it had become separated by torsion.

Intra-abdominal torsion of appendices epiploica

Case 12. In a case of Tomellini, of a man dead of cardiac paralysis, necropsy revealed that the appendices epiploicae of the transverse colon and sigmoid were straighter than usual. A flattened appendix epiploica was found the same color as the others, and bound to the mass by a thin pedicle. This pedicle had undergone a true torsion around its long axis.

Case 13 (Riedel). This patient was a man 40 years of age, who, three days before admission, complained of severe abdominal pain, vomiting, etc., and presented the picture of intestinal obstruction. At operation there was free fluid in the abdomen, the jejunum was greatly dilated, the ileum less so. Arising from the left wall of the cecum, an appendix epiploica stretched across the ileum and was adherent by its twisted middle portion to the mesentery of a coil of small intestine. The ileum was greatly contracted by the appendix epiploica, acting as an obstructing band, and was relieved by the removal of the appendage. Enterostomy was done to relieve the obstruction. The patient died on the following day and necropsy disclosed peritonitis.

Case 14. Briggs, in 1908 reported the case of a male 35 years of age, without a history of previous abdominal complaint. He had had a sudden attack of right lower abdominal pain, which gradually subsided but increased later in the

day. The pulse and temperature were normal. A tumor was palpable over the tender region of the appendix. On the fifth day with the patient's temperature 100 F. operation was performed. Presenting in the incision was a tumor 1½ inches long and 1 inch wide, having the appearance of a hematoma with a peritoneal envelop. It was adherent to the cecum by a narrow twisted pedicle. The appendix vermiformis though normal, was removed. The tumor was an appendix epiploica with a twisted pedicle.

Case 15. Zoeppritz reported a case in 1909 in which the patient was a male, 20 years of age. For three weeks he had burning pains in the right epigastrium extending toward the midline. Before examination he had acute epigastric pain and there was tenderness at McBurney's point. The diagnosis lay between acute appendicitis and acute cholecystitis. The appendix vermiformis appeared in the incision and did not seem to be the cause of the acute symptoms. Upon lengthening the incision a brownish, bluish-red mass the size of a plum appeared in the wound, from the center of which extended a slightly thickened band of omentum. The removed tumor was an appendix epiploica of the beginning of the transverse colon twisted 180°. When the omentum was loosened there was no tendency to untwist.

Case 16. In Ebner's case reported in 1909 the patient was a male, 65 years of age, who had had a right inguinal hernia for fifteen years and a left inguinal hernia for a shorter length of time. Seven days before examination, after lifting a heavy load, he felt severe pain in the right side of the abdomen. The hernia could be reduced, but three days later there was much hypogastric distension and tenderness, with moderate increase in temperature for two days. Retention of feces and flatus with vomiting occurred, a diagnosis of intestinal paralysis was made and immediate operation performed. There was a small amount of clear, bloody fluid in the abdominal cavity and a pedunculated fat tag 15 cm. long, arising from the sigmoid and extending from the left inguinal region over to the right side by a thin pedicle, was twisted through 180 degrees. This proved

to be an appendix epiploica. As a result of the torsion, congestion and extravasation of blood had occurred in the fat tag. After operation the symptoms of intestinal paralysis were progressive and the patient died on the seventh day. The author explains the intestinal paralysis as being due to the coagulation processes in the mesenteric vessels following torsion of the appendix epiploica.

Case 17. Pochhammer, in 1910, reported a case of a patient, a male 34 years of age who had during the past eighteen years, repeated attacks of pain in the right lower abdomen which had been diagnosed as appendicitis. He had a similar attack just before admission to the hospital, with no nausea or vomiting. From the history and examination the diagnosis of appendicitis was made and operation performed. In the pelvis was found a hard, fatty tumor the size of a hen's egg, bluish-black in color and its central portion was infiltrated with blood. It was evidently an appendix epiploica which had become enlarged from fatty infiltration and the pedicle had become twisted. The vermiform appendix was shrunken and showed no evidence of inflammation, but was removed.

Case 18. Morestin reported a case in 1912 in which the patient was a female 30 years of age, who ten days before examination experienced sudden severe left abdominal pain with nausea, and moderate temperature for twenty-four hours. Four days after the onset a tender mass the size of a large egg, separate from the uterus, could be felt in the left side of the pelvis. A diagnosis of left tubo-ovarian disease was made and operation performed at which time atrophy of the uterus and its appendages was found. A mass in the left side of the pelvis in the middle of a few blood clots and recent adhesions, purplish in color with some attachment to the uterus and broad ligament, had its origin in the sigmoid by a narrow pedicle, twisted upon itself, and proved to be an appendix epiploica. The patient's convalescence was uneventful.

Case 19. Kimpton reported a case in 1915 of a patient, an obese male, 42 years of age, who had had acute pain in the right lower quadrant of the abdomen, with nausea. He had had one or two previous similar attacks. The lower right

quadrant of the abdomen was rigid and tender; the pulse and temperature were normal. A diagnosis of acute appendicitis was made, and at operation a black appendage of fat presented in the region of the appendix vermiformis which was a twisted appendix epiploica. It was removed and, although the vermiform appendix was normal, appendectomy was done. Further abdominal exploration was negative. The twisted appendix epiploica was hemorrhagic and necrotic. The convalescence was uneventful.

Case 20. Harrigan, in 1917, reported a patient, a male, 29 years of age, who two days before examination had sudden severe pain in the right lower quadrant of the abdomen, with no radiation, which became progressively worse in spite of the use of opiates. Physical examination was negative except for a slight rigidity and tenderness over McBurney's point. The temprature was 100 F., pulse 98, and respiration 24. A diagnosis of acute appendicitis was made and immediate operation performed. The vermiform appendix was not inflamed and general exploration of the abdomen was negative except in the sigmoid where an appendix epiploica presented evidence of acute inflammation, the pedicle being twisted. The appendix epiploica was removed by ligation of its pedicle and the vermiform appendix removed, with the patient's complete recovery.

Intrahernial torsion of appendices epiploicae

Case 21 (Riedel). The patient was a female, 20 years of age who had had a left reducible femoral hernia for ten years and an irreducible right femoral hernia for a few months. On the day before examination the patient had violent abdominal pain with tenderness of the left femoral hernia. At operation the next day a fatty structure 1 cm. by 5 mm. was found suspended from the wall of the sac by a thin pedicle of fibrin. The case seems to have been one of torsion.

Case 22 (Riedel). The patient was a female 56 years of age. For two years she had had a right inguinal and a left femoral hernia. Two days before admission to the hospital the patient suffered with severe pain in the left groin, and the femoral hernia was then an irreducible tumor. Immediate operation showed an appendix epiploica twisted once on its axis and adherent by its distal extremity in the hernial sac. Necrosis had already begun. The pedicle was ligated and the appendix epiploica removed with radical cure of the hernia and recovery.

Case 23. Serve, in 1906, reported the case of a male patient, who had had a left inguinal hernia for many years in which, two days before examination, he experienced a violent pain, following a severe muscular effort. The scrotum was swollen and at operation a few drops of fluid escaped from the hernial sac which revealed as the content, an appendix epiploica 10 cm. long, completely twisted on itself. This was removed and radical cure of the hernia was followed by recovery.

Case 24. Muscatello, in 1906, reported a case of a patient, a male, 38 years of age, who had experienced a sudden pain in the left inguinal region six months previously, the pain disappearing for a month. He had a left inguinal hernia extending into the scrotum which at operation contained omentum in the sac and an appendix epiploica adherent to the posterior border of the neck of the sac and twisted on itself. The torsion occurred 5 cm. from the insertion of the appendix epiploica on the colon. Removal of the appendix epiploica and radical cure of the hernia was followed by recovery.

Case 25. In 1907, Wolr reported a case of a patient, a male, 62 years of age, who had had for the past three to four years a reducible tumor of the left inguinal region, which ten days before examination became irreducible. On the diagnosis of strangulated hernia, operation was performed and in the hernial sac an appendix epiploica was found which presented hemorrhagic infiltration. The tips of two other appendices epiploicae presented in the sac, springing from the sigmoid and were in a state of torsion with gangrene imminent. They were

removed; the patient recovered.

Case 26. Lorenz reported a case in 1906, in which the patient, a female 33 years of age, had a right inguinal hernia, much abdominal pain, and symptoms of intestinal obstruction. Operation revealed in the hernial sac, among loops of intestine and inserted mesially to the neck of the sac, a narrow, tense, pseudo-ligament about 6 cm.long, and around which an appendix epiploica, arising from the colon, had become twisted and strangulated, torsion being through 360 degrees. The immediate visceral and parietal peritoneum was covered with fresh fibrin and the twisted appendix epiploica showed subperitoneal effusions of blood and gangrene of the pedicle at the point of strangulation. The band and appendix epiploica were resected with good recovery.

Case 27. Kruger reported, in 1907, the case of a patient, a male, 56 years of age, who had had an attack of pain in the right grain twenty years before which disappeared after a few weeks, to recur two years previous to admission to the hospital and again four days previously. The pain radiated from the urethra to the umbilicus. There was a firm mass in the right inguinal region, which, at operation, proved to be an appendix epiploica 4 cm. by 1.5 cm., and springing from the cecum by a short pedicle which had passed through the inguinal canal and become twisted in the hernial sac, giving rise to the inflammatory symptoms. The appendix epiploica was removed, with radical cure of the hernia.

Case 28. In 1908, Adler reported a case in which the patient, a robust woman, 72 years of age, had had a left reducible inguinal hernia for twenty years. The day before admission to the hospital the hernia became irreducible. An operation was done immediately and a cord-like mass lying in an edematous sac was found. The mass was of omental tissue which ended below in an enlargement the size of a chestnut. The cord was twisted on itself and contained ten half turns, the whole lying quite free in the hernial sac. On following the cord down, it was found to have its origin from the large intestine and proved to be an elongated twisted appendix epiploica. The hernia was repaired and there was

an uninterrupted recovery.

Case 29. In 1908, Linkenheld reported the case of a patient, a fleshy man 64 years of age, in whom eight days previously a painful, irreducible swelling had appeared in the right inguinal region. A diagnosis of strangulated omental hernia was made. At operation the hernial contents were found to consist of omentum and a twisted connective-tissue cord extending up into the abdominal cavity. This was ligated and the omentum removed with radical cure of the hernia. The patient died on the sixth day from gastric hemorrhage and necropsy showed multiple ulcers of the stomach; also 6 long, thick and fat appendices epiploicae of the sigmoid were found with the tied pedicle of the cord in the hernial sac.

Case 30. In 1910 Kendirdjy reported a case of a patient, a male 43 years of age, who had had a left inguinal hernia for twelve years. Two weeks before examination, severe pain in the hernia, and swelling were noted. Two days before examination symptoms of intestinal obstruction appeared and the skin overlying the hernia was inflamed and tender. When the hernial sac was opened, some yellow fluid escaped and a yellow fatty mass, presenting ecchymotic areas, formed its contents. This was attached to the sigmoid by a pedicle, in which torsion one and one-half times had occurred. The pedicle was ligated with radical cure of the hernia, and recovery.

Intrahernial strangulation or incarceration of appendices epiploicae

Case 31. In 1906 Von Bruns reported the caseof a patient, a female, 55 years of age, who had had a left inguinal hernia for four years. It became suddenly painful, swollen and irreducible, the overlying skin becoming red and edematous. At operation a small amount of fluid escaped and revealed a gangrenous strangulated appendix epiploica which was removed, and good redovery occurred.

Case 32. Muscatello reported a case in 1906 of a patient a female 56 years of age, who was suddenly attached by violent femoro-inguinal pain on the

left side, radiating all over the abdomen and in which the diagnosis of strangulated femoral hernia was made. Operation under local anesthesia allowed the escape of clear yellow fluid and the exposure of two appendices epiploicae, measuring 2 and 1.5 cm. respectively, attached by narrow pedicles to the sigmoid. The appendices epiploicae were removed and the sac resected, with a radical cure of the hernia and recovery of the patient.

Case 33. In 1906 Schweinburg reported the case of a patient, a male 45 years of age, who had had a reducible left inguinal hernia for years. Six days before admission to the hospital the hernia became irreducible, and painful and tender. At operation the hernial sac contained odorless fluid and three appendices epiploicae which were thickened and hemorrhagic, and, on being drawn down, were found to have their origin from the sigmoid. They were removed with radical cure of the hernia and recovery.

Case 34. Verga reported a case in 1907 of a patient, a female 46 years of age, who developed a right inguinal hernia at 23 years of age and a left inguinal hernia at 26, both of which remained reducible until eight days before examination when the left hernia could not be reduced. There was some pain from it, radiating to the hypogastrium, but no nausea, vomiting or evidence of intestinal obstruction. In the left inguinal region there was a mass the size of an almond which was tender. On the diagnosis of an irreducible hernia, operation was performed Nov. 4, 1906 at which time two appendices epiploicae were found strangulated in the hernial sac, showing vascular engorgement and several hemorrhagic points. They originated from the sigmoid. They were ligated and cut off and the hernia repaired with good recovery.

Case 35. Vulliet reported a case in 1907 of a patient, a male 62 years of age, who had had a double inguinal hernia for 20 years. There was severe pain in the left inguinal region three days before admission to the hospital. At operation the left hernial sac contained two appendices epiploicae with thin pedicles extending to the sigmoid. Removal of the appendices epiploicae and

radical cure of the hernia was followed by recovery.

Case 36. In 1907 Smoler reported a case of a patient, a male, aged 37 years, who, on admission to the hospital, complained of nausea and weakness and who had noticed two days previously that a right inguinal hernia was no longer reducible. On examination, the patient was found in a state of moderate shock and an operation was done immediately. The hernial sac was thick and contained bluish-red discolored omentum with incipient necrosis due to torsion of 360 degrees of that part of the omentum. By the side of the omental mass, at the median side of the hernial aperture, a structure as thick as the finger and 2 cm. long, presented which proved to be an appendix epiploica of the sigmoid. The omentum and appendix epiploica were removed, with death of the patient on the fifth day.

Case 37. In 1908, Linkenheld reported the case of a female, 57 years of age, in whom there appeared eight days before examination a swelling in the right inguinal region which caused severe pain. The swelling was firm and tender. At operation strangulated in the neck of the hernial sac was a piece of fat, the size of a hazel nut. After freeing the adhesions, the fat tag could be withdrawn. It exhibited a distinct constriction and proved to be an appendix epiploica, probably of cecal origin.

Case 38 (Linkenheld). The patient a male, 71 years of age, had had a left inguinal hernia for a year, in which, two days before admission, pain, swelling and reddening of the skin occurred, with no symptoms of obstruction. The hernia was tender to pressure. At operation the contents of the hernial sac consisted of three appendices epiploicae, one the thickness of the finger, and the other two the thickness of a lead pencil. They were swollen, reddened and infiltrated with blood, being strangulated at their upper ends. Two days later the patient died from ruptured aneurysm as revealed at necropsy which also showed enlarged appendices epiploicae of the descending colon and sigmoid.

Case 39. Tisserand, in 1908, presented a report of a patient, a male, 36 years of age, who had had a left inguinal hernia all his life which the past

year, had at times been painful and irreducible. Sixteen hours before examination he had had a violent colic in the hernia with some nausea, but no vomiting. Immediate operation disclosed two appendices epiploicae in the hernial sac with some free fluid. One appendix epiploica was not strangulated but the other was swollen, ecchymotic and in the process of becoming gangrenous from strangulation. Its origin was probably from the cecum. These appendices epiploicae were removed, the hernia repaired and the patient had an uneventful convalescence.

Case 40. Truffi, in 1908, reported the case of a patient, a female, 45 years of age, who about a year previously, noticed a swelling in the left groin which appeared suddenly and remained for a week. Eight days before examination the swelling recurred. It was painful to pressure, the pain gradually subsided, but the swelling persisted. On admission to the clinic it was the size of a hen's egg and was not reducible. A diagnosis of irreducible hernia was made and at operation the sac was found to contain a small amount of dark red liquid and two club-shaped fat bodies, which were covered with numerous hemorrhagic points, and proved to be appendices epiploicae strangulated at the neck of the sac. They probably originated from the sigmoid. They were removed and the hernia repaired.

Case 41 (Truffi). The patient a male, 75 years of age, had had a double inguinal hernia for 40 years; the left disappearing of its own accord and the right by operation two years previously. About two months before examination he had had severe pain in the left inguinal region with recurrence of the left inguinal hernia, which was irreducible with a sense of pressure and pain. Operation was advised. In the sac of the hernia were found two appendices epiploicae with strangulation of their pedicles in the neck of the sac. Convalescence was uneventful.

Case 42. In 1912 Patel reported the case of a patient, a male, 45 years of age, who had had a left inguinal hernia for twenty years. Eight days before admission to the hospital the hernia became irreducible and painful. The overlying skin was red and edematous, as was the scrotum. The symptoms continued and a

diagnosis of strangulated hernia was made. An incision of the hernial sac allowed the escape of a sero-purulent liquid. An appendix epiplèica was strangulated in the hernial sac. The tag was ligated and removed. The end of the pedicle had a lumen communicating with the lumen of the large intestine, which proved to be a diverticulum into the appendix epiploica.

CASES FROM THE MAYO CLINIC

True intra-abdominal torsion of appendices epiploicae

Case 43 (A8716). R. A. K., a male, 58 years of age was admitted to the Clinic April 10, 1908. The previous history was negative except for severe constipation for years. Two weeks previously pain was noticed on defecation; there was some mucus in the stool but no blood. The pain continued and was aggravated by enemas. There were no other subjective symptoms. A mass could be felt per rectum, and the diagnosis of a tumor of the sigmoid was made.

Operation was performed April 15, 1908, and an appendix epiploica with a twisted pedicle was found. The pedicle had its origin about five inches above the rectum, and the appendix epiploica had dropped to the bottom of the pouch of Douglas, forming a cystic and adherent mass the size of an orange. The appendix epiploica was removed with recovery of the patient.

Case 44 (A6851). A. Mc., a carpenter, 43 years of age, was admitted to the Clinic April 26, 1910. Less than a year previously he had had an appendectomy with negative exploration of the gallbladder. The history of the present complaint was pain in the right side of the abdomen opposite the umbilicus for four years, very severe at the onset, the patient being in bed four days at that time with diarrhea and vomiting. The symptoms recurred every two or three months. Appendectomy was performed less than a year previous to examination with recurrence of a similar attack two months later. During the past six months the attacks had been more frequent, the pain lasting from five to six hours and always accompanied by diarrhea. There was no disturbance of the bowels between

attacks, and no radiation of pain. At times there were spells of indigestion, but never any symptoms of organic disease of the stomach or duodenum. Seven days before admission the patient had had a severe attack of left lower abdominal pain accompanied by vomiting of four hours duration, and requiring morphine to control. The general physical examination, urinalysis, x-ray examination of the kidneys, ureter and bladder, and cystoscopic examination were all negative.

May 3, 1910, exploration was madeof the stomach, gallbladder and left ureter. These proved negative, but a twisted appendix epiploica of the sigmoid, with its circulation completely cut off, was found. There also were adhesions of the terminal four inches of ileum to the lateral abdominal wall; these were divided and the appendix epiploica removed. Within the next four months there were several recurrent attacks of pain; the further history of the case is not known.

Case 45 (A38941). Mrs. F. L., aged years, was admitted to the Clinic June 14, 1910. For seven years the patient had had attacks of moderate pain in the right lower abdomen, usually of only a few minutes duration, and never severe enough to keep her from her work, but at times they had been of the nature of a dull ache for a day at a time. During the two months preceding examination, there had been moderate digestive disturbance but never any acute attacks of pain. A diagnosis of chronic appendicitis and cholecystitis was made.

June 20, 1910 operation was performed and chronic adherent appendix, and an appendix epiploica, the size of a small pecan, with a twisted pedicle were found and removed. Exploration of the gallbladder and stomach was negative.

Case 46 (A69658). Mrs. J. J., aged 63 years, was admitted to the Clinic June 24, 1912. The patient had been perfectly well until three months previously, at which time she was confined to bed with burning pain and cramps in the left lower abdomen and much localized tenderness. This had been more or less constant, with the pain radiating around to the sacral region. Constipation, walking, and working aggravated the trouble. Physical examination disclosed tenderness in the left abdomen, moderate edema of the legs, due to large varicose

veins, and complete uterine prolapsus with rectocele and cystocele. X-ray of the kidneys, ureters and bladder was negative.

July 3, 1912, because of the complaint referred to the left lower abdomen, an abdominal operation was done. A calcareous appendix epiploica of the sigmoid, with a twisted pedicle was found. Other exploration of the abdomen was negative. The appendix epiploica was removed and a Kocher abdominal operation done for the prolapsus.

Case 47 (A162332). Mrs. J. B., 70 years of age was admitted to the Clinic June 10, 1916. Three years previously the patient began having occasional uterine bleeding for a few days at a time, which continued for a year. For two years the discharge had been scant, and six months watery in character. The uterus was enlarged. The menopause had occurred when she was 48 years of age.

June 14, 1916 total abdominal hysterectomy with removal of both ovaries and tubes was done for carcinoma of the body of the uterus and multiple fibroids. Two appendices epiploicae with twisted pedicles, making a mass the size of the thumb were found and removed. These were reported to be hemorrhagic by the pathologist. There had been no history of a recent acute abdominal complaint.

Case 48 (A181741). P. B., a male, aged 37 years, was first seen January, 1917. One month previously the patient had had sudden, severe pain in the left lower abdomen with much localized tenderness which had partially subsided a few days before examination. The patient was a large man who had lost 20 pounds in weight since the onset of the complaint. The urinalysis, blood, and x-ray examination of the colon, were negative. A diagnosis was made of probable diverticulitis.

Operation was performed Jan. 5, 1917. A general exploration of the abdomen showed the small intestine and the gallbladder to be normal, the appendix small, short and normal, and the sigmoid markedly thickened with one epiploic tag about 1½ inches long and ¾ inch wide, twisted on its pedicle. Fat necrosis had occurred and the appendix epiploica had become adherent to surrounding epiploic

tags. The tags which were involved in the inflammatory mass and the one undergoing necrosis were removed and their stumps ligated. There was no evidence of diverticulitis.

Case 49 (A43849). Mrs. E. A. H., 51 years of age was admitted to the Clinic Nov. 7, 1917. The patient presented herself for examination becauseof a troublesome watery vaginal discharge, for which hysterectomy was advised. There were no symptoms of an acute abdominal process. She had passed the menopause at 36 years of age.

Nov. 12, 1917, total abdominal hysterectomy with removal of both ovaries and tubes, for chronic metritis of the precancerous type, was done. An appendix epiploica of the sigmoid appeared in the wound. It was a round body about 2 cm. in diameter and was twisted on its pedicle. It had become encysted and contained a clear, straw-colored fluid and sil. There was nothing in the patient's history to indicate that it had produced subjective symptoms.

Appendices epiploicae as foreign bodies

Case 50 (A210428). Mrs. C. B., aged 42 years, was examined Oct. 8, 1917. The patient who was very obese had had six operations for appendicitis, uterine prolapse, and postoperative hernia, the last one six years ago. For the past four years there had been more or less lower abdominal pain which she thought due to adhesions. She presented herself for the repair of the postoperative hernia.

Nov. 28, 1917 a large postoperative hernia was repaired. A tumor was found free in the pelvis, 4 by 3 by 3 cm. This proved to be a sac containing degenerated fat, probably an appendix epiploica which had become twisted from its attachment to the large bowel.

Incarceration of appendices epiploicae in hernial sacs

Case 51 (172141). G. G. B., a male, 63 years of age was examined Sept. 12, 1915. Nine months previously the patient had developed soreness in the left lower abdomen with the formation of a mass which had persisted and the

soreness had been aggravated by exertion. There were no other subjective symptoms. The patient was obese. On physical examination a small mass was palpable above the left internal inguinal ring and there was, separate from this, a left inguinal hernia. Urinalysis, blood, and x-ray examination of the colon were negative.

Sept. 18, 1916, abdominal exploration was done through a low left rectus incision. No disease other than the tumor mass was revealed. This apparently came and went as the sigmoid which was held tightly against the left internal inguinal ring, became blocked. A large incarcerated mass of omentum which was undergoing necrosis was found in the hernial sac, dissecting its way between the muscles and fascia. Adherent appendices epiploicae of the sigmoid were also contained in the hernial sac, which held the sigmoid in a fixed position. The omentum was divided and the sigmoid separated from its adhesions. The hernial sac and contents were removed and the internal ring closed with mattress sutures.

Case 52 (A186645). A male aged 51 years, was examined Feb. 24,1917. The patient had been perfectly well until one week previously when, after lifting a heavy load, he experienced pain in the left groin and a swelling formed which had remained painful and had caused some nausea. Physical examination was practically negative except for a firm irreducible mass 1½ inches by 1 inch in the region of the left external inguinal ring.

At operation March 13, 1917, an incarcerated appendix epiploica of the sigmoid was found in a left inguinal hernia. The appendix epiploica was excised and the hernia repaired.

Appendix epiploica producing intestinal obstruction

Case 53 (A49009). C. G. G., a male aged 57 years was examined Feb. 8, 1911. The patient's health was in fair condition until eight months previous to examination when he had had a sudden attack of pain in the left lower abdomen, with much distension followed by soreness for six or seven days. A month later he had a similar spell. Three months later he had a very severe attack with

symptoms of intestinal obstruction for seven days. He was in bed fourteen days, during which time there was much pain, tenderness and rigidity in the region of the umbilicus, with apparent obstruction in the left lower abdomen. Morphia and chloroform were used to control the pain. The last severe attack was eight weeks before, but the lower abdominal soreness persisted up to the time of examination. There was never any blood in the stool. The patient had lost about 30 pounds in weight; otherwise the general physical examination was negative. A diagnosis of chronic intestinal obstruction, with possible carcinoma of the sigmoid, was made.

Operation Feb. 13, 1911 revealed obstruction of the sigmoid by a band due to a long appendix epiploica which was adherent across the top of the sigmoid near its middle. Over this a loop of the sigmoid had dropped causing a rather tight obstruction. The band was divided and appendectomy done for acute appendicitis.

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