

ACUTE DIVERTICULITIS OF THE CECUM*

REPORT OF THREE CASES DIAGNOSED PRE-OPERATIVELY
AS ACUTE APPENDICITIS

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OUT-POUCHINGS OF THE COLON of various sizes, shapes, positions, and types occur very frequently throughout the population at large. The exact number can be only estimated because of the obviously large number which are never diagnosed. This is largely due to the fact that they cause no symptoms to necessitate the individual either being subjected to roentgenologic examination with a barium enema, or to gastro-intestinal studies as a result of abdominal complaints. Those found at autopsy represent a very small percentage of the total population. A few are found as incidental findings at operation. In routine autopsies, Mayo²⁵ reports from 5 to 7 per cent of all the colons examined revealed diverticula some place throughout their entirety. Epstein⁸ quotes Sprigg and Marker to show that out of 1,000 routine roentgen-ray examinations of the colon, 100 diverticula were found. The location of each showed about 58 in the pelvic colon, 46 in the descending colon, 16 in the transverse colon, 10 in the ascending colon, 7 in the cecum, 5 in the appendix, and 3 in the rectum. Anderson¹ reports a 5.7 per cent occurrence of the diverticulosis of the colon noted in routine roentgenologic examinations, and 6.9 per cent occurrence of diverticulosis in routine autopsies.

Diverticulosis is the term used to denote those silent out-pouchings of the colon with small necks and lined by mucosa, in which there is no evidence of inflammation or symptoms referable thereto. When these blind sacs become inflamed, either because of obstruction or other causes, the diagnosis of diverticulitis must be made. Bennett and Jones⁴ estimate that in only 12 to 15 per cent of the cases of diverticulosis, does inflammation occur to justify the diagnosis of diverticulitis. Ochsner and Barger¹⁹ found that in 2 per cent of 151 cases of uncomplicated diverticulosis of the colon, the diverticula were present in the right half of the colon, and that about 14 per cent of all diverticula become inflamed, and 15 per cent of these inflamed diverticula were subjected to surgery. From this it is seen that acute diverticulitis of the cecum meriting surgical intervention is not a rare condition. Various authors have reported and reviewed cases appearing in the literature since the first case was reported by Patier in 1912. In 1944, Noon and Schenk²⁷ reported 48 cases and added three of their own. These cases were taken from the American and British literature and represented the highest number of cases noted to that date until Anderson's¹ recent, most comprehensive review, in which 91 cases of acute diverticulitis of the cecum were reported from the literature. To

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these he added nine cases. These nine cases of acute diverticulitis of the cecum were among some 700 cases of surgical diverticula of the colon at the Mayo Clinic.

The three cases of acute diverticulitis of the cecum herein presented were seen on the surgical service of this Veterans Administration Hospital within a 12 months' period; all three were diagnosed preoperatively as acute appendicitis; all were subjected to surgery. An acutely inflamed true diverticulum was found in each, and in two cases rupture of the diverticulum with abscess formation was encountered. These cases will bring the total of those reported to over 100, and will help to disprove the previously held belief that this is a rare surgical entity, and should impress the surgeon that it is one which must be kept constantly in mind when the diagnosis of right-sided abdominal pathology is made preoperatively. It also must be considered when the pathologic condition of the appendix found at operation is not sufficient to explain the signs and symptoms leading to preoperative diagnosis of appendicitis.

In a patient presenting signs and symptoms characteristic of appendicitis, in whom an appendectomy has previously been performed, the diagnosis of acute diverticulitis of the cecum must be considered as a very real possibility.

The average age incidence of this disease is given by different authors to be approximately 40 years. In our cases, all the patients were males due to the character of the hospital in which the cases were seen. Their ages were 25, 35 and 30, respectively. It has been noted in the past that there has been a preponderance of males reported with this condition. However, Anderson¹ finds about an equal number of each sex with this disease.

The cause of diverticulosis and subsequent diverticulitis is not definitely established, but Greensfelder and Hiller¹⁵ suggest that any one, or several, of the following mechanisms may be important as a causative agent: (1) eversion of the cecal wall between two constricting bands, (2) traction by abdominal adhesion (usually postoperatively), (3) eversion of a weak spot in the cecal wall, caused by migration of a purse string suture into the lumen of the intestine (postoperatively), (4) eversion of the weakened area in the cecal wall, resulting from the rupture into the cecum of an abscess of the appendiceal stump, (5) weakening of the wall of the bowel at the site of entrance of blood vessels into the muscularis, (6) increased intraluminal pressure in the cecum, either due to constipation or increased intraabdominal pressure, (7) inherent weakness of the wall of the bowel due to age, congenital weakness, obesity or atrophy of the fat along the vessels which penetrate the wall, (8) traction on appendiceal epiploicae, mesentery or omentum, with or without adhesions, (9) traumatic diverticula following previous operative procedure, especially appendectomy (this type is classified as "Secondary Diverticula"), (10) retention in residual form of the appendix which appears in embryologic life but normally disappears before the true appendix develops, (11) cathartics, etc.

The preoperative diagnosis is, in the great majority of the cases, acute appendicitis and operation is carried out for alleviation of that condition. The following preoperative diagnoses have been made: Acute appendicitis, gan-

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grenous appendicitis, perforating appendicitis, appendiceal abscess, subacute appendicitis, chronic appendicitis, uterine fibroid (degenerated), salpingitis, carcinoma of the cecum, diverticulitis of the right colon, obturator hernia, stump appendicitis, abscess of undetermined origin and benign ulcer of the cecum.

In approximately one-third of the reported cases, histories of previous attacks of right lower quadrant pain were elicited. The most usual complaint of patients is pain in the right lower quadrant, either localized or generalized. Pain may be of a cramping or dull aching type and it was present in various patients for periods of a few hours to several days. The general observation has been made by several observers that in acute diverticulitis of the cecum, the pain is less severe and more prolonged, and shows a more chronic course in contradistinction to acute appendicitis where the pain is more acute, and of shorter duration. However, this is purely an impressionistic finding. Other symptoms noted with more or less frequency are: Tenderness in the right lower quadrant, mass in right side of the abdomen, rebound tenderness, psoas tenderness and tenderness over the entire abdomen.

The differential diagnosis, preoperatively, is not easy because of the many diseases which this condition resembles. When a diagnosis of an acute surgical condition in the abdomen is made, roentgen-rays are of little value and are contraindicated. The laboratory work has proven to be of very little help in differential diagnosis, as the same picture is noted here as is noted in acute appendicitis. A leukocytosis may or may not be present. Usually there are no urinary findings which are of any help. Also, if roentgen-ray examination of the colon were made, it would be ineffective in demonstrating diverticula which are plugged by feces, fecaliths, or pus, causing visualization to be impossible. Thus, it is seen that a differential diagnosis of acute diverticulitis of the cecum as against acute appendicitis cannot be made, but it is a condition which should constantly be kept in mind by the diagnostician and operating surgeon.

Diverticula may be divided into two groups. True diverticula are those in which all normal layers of the intestine, including the mucosa, submucosa, muscularis, and serosa are present over the entire diverticula, the false or acquired type are those in which the muscularis is absent, the other layers being present. It is believed that false diverticula represent out-pouchings through weak points in the muscularis of the bowel. The true diverticula are probably congenital. All three of the cases here reported were true diverticula, as shown by the presence of all layers on microscopic pathological examinations. Diverticula in the cecum, when present, are usually not associated with the presence of diverticula throughout the remaining portion of the large bowel. The majority of those cases reported are the true type and are solitary. Two of the cases here reported are true solitary diverticula; the third is a true type but multiple.

CASE REPORTS

Case 1: A 25-year-old white male entered the hospital on June 13, 1946, with a history of abdominal cramps of 48 hours' duration, most marked in the right lower

quadrant and slight nausea over the same period of time. There was no vomiting, diarrhea or increase in temperature noted by the patient. On examination, generalized abdominal tenderness was noted, which was localized and most marked in the right lower quadrant. Slight rigidity and slight rebound tenderness were noted in the right side of the lower abdomen. Rectal examination revealed no mass, but some tenderness in the right lower quadrant was present. The leukocyte count showed 13,200 cell per cubic mm. of blood with 62 polymorphonuclear leukocytes. The examination of the urine revealed no abnormal findings. His admission temperature was 99.5°F. A preoperative diagnosis of

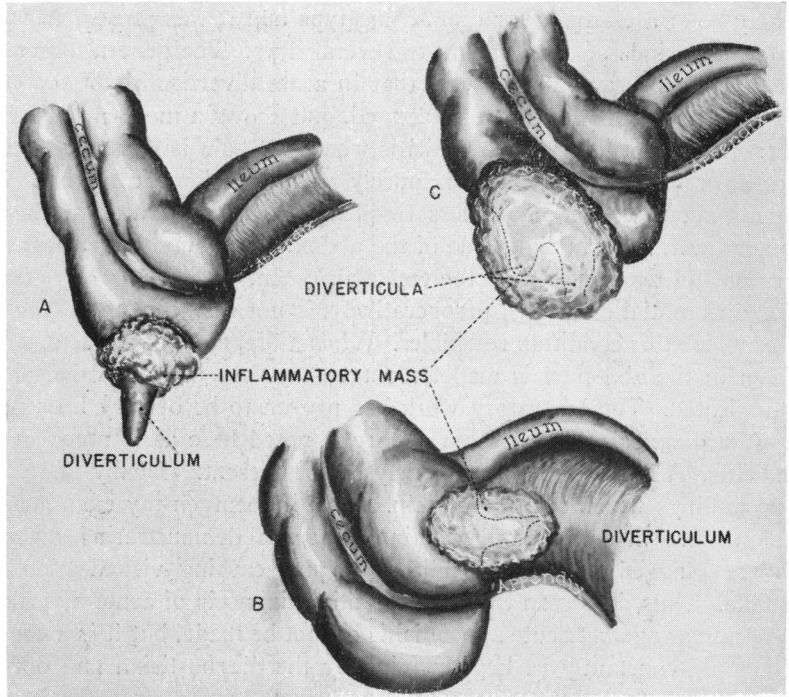


FIG. 1.—A. illustrates the location and appearance of the lesion in Case 1—an inflammatory mass at the base of the diverticulum without perforation. B. shows the perforated diverticulum within an inflammatory mass—involving the meso-appendix encountered in Case 2. C. double diverticula within a walled-off abscess as seen in Case 3. One of the diverticula is perforated at its tip.

acute appendicitis was made. At operation, which was performed by Dr. D. J. Abramson, the appendix was found to be in a normal position and not inflamed. There was a mass, measuring 3 by 4 centimeters in the redundant portion of the cecum. This mass was located opposite the ileo-cecal valve on the anterior lateral aspect of the cecum, near the free tenia of the colon (Fig. 1A). On careful investigation, this mass was found to have in its center a markedly inflamed diverticulum of the cecum containing a fecalith and a considerable amount of fibrinous exudate at its base. The diverticulum, which was not perforated, was amputated at its base and the defect in the colon closed with purse-string type inverting cat gut suture in the serosa and this was reinforced by interrupted sutures. The appendix, which was not abnormal, was also removed. The abdomen was closed without drainage and without chemotherapeutic agents in the peritoneal cavity. The convalescence was uneventful and the patient was discharged from the hospital 8 days later. The

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pathological examination showed a marked inflammatory process throughout the wall of a true diverticulum which contained mucosa, muscularis and serosa. The appendix showed no pathologic changes. Follow-up barium enema studies of the colon revealed no further diverticula.

Case 2: A 35-year-old white male admitted to the hospital February 13, 1947, with the complaint of abdominal pain, aching in character, which has been present in a mild degree intermittently for several years. The day before admission, the pain became much worse and was confined predominantly to the right lower quadrant. He noted no radiation of the pain. There was no vomiting or nausea. He had a history of normal bowel

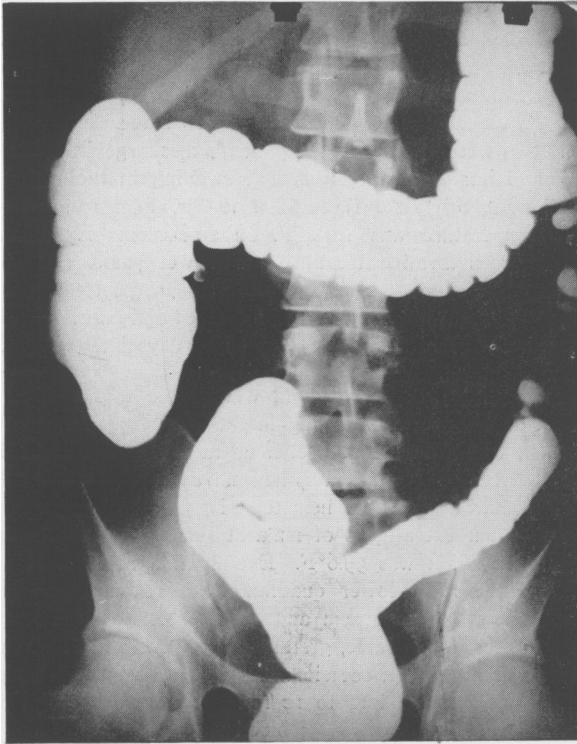


FIG. 2.—X-ray examination of colon with barium enema showing one additional small diverticulum on the medial aspect of the ascending colon near the hepatic flexure.

movement on the day previous to admission. He felt some burning on urination but no other prominent genito-urinary symptoms. His temperature on admission was 98.6°F. Examination revealed marked tenderness in the right lower quadrant, slight rigidity, moderate rebound tenderness with a positive psoas tenderness noted in the right lower quadrant. Laboratory findings on admission revealed a white blood cell count of 11,250 per cubic mm of blood, with 69 polymorphonuclear cells. The urine examination was negative. A preoperative diagnosis of acute appendicitis was made. The operation, which was performed under spinal anesthesia, was carried out through a McBurney type incision. There was no free fluid present. Upon mobilization of the cecum, the appendix was noted to be greatly elongated but not markedly inflamed. At a point about one-half inch distal to the appendix on the medial aspect of the cecum, there was large firm inflammatory mass the size of a hen's egg involving the meso-appendix (Fig. 1B). This mass

was carefully dissected from the cecum along its serosal covering and a gangrenous diverticulum was noted. This gangrenous mass was tightly adherent to the cecum and was made up of inflammatory tissue covered tightly by meso-appendix and in its center was the perforated tip of the diverticulum. The entire mass was excised at the base of the diverticulum. The defect in the cecum was closed with interrupted catgut sutures and reinforced with #60 cotton sutures. There was no spillage into the peritoneal cavity and no evidence of generalized peritonitis. The appendix was removed routinely. The abdomen was closed without drainage and without the institution of chemotherapy. The patient's convalescence was not remarkable and he was discharged from the hospital 15 days postoperatively. Roentgen-ray study of the gastro-intestinal tract and a barium enema examination of the colon postoperatively revealed no evidence of diverticula throughout the rest of the colon. Pathologic examination revealed a small sac-like structure which contained many blood vessels, eosinophils, polymorphonuclear and lymphocytic infiltration throughout the walls; layers of muscularis, mucosa and serosa were noted and a diagnosis of gangrenous diverticulum was made.

Approximately two weeks following the patient's discharge from the hospital, he was readmitted with complaints of fever, chills and swelling in the right lower quadrant. Physical examination at this time revealed a tender, firm mass beneath the recent McBurney scar. Temperature was 101.4°F. on admission. Examination was otherwise negative. After conservative treatment with wet packs and chemotherapy for a few days, the mass was opened surgically under sodium pentothal anesthesia and was found to be a subcutaneous hematoma. This was drained and no evidence of inflammation, exudate or pus was noted. Patient was discharged 20 days later, completely well.

Case 3: The patient was a 30-year-old white male who entered the hospital on May 20, 1947, with a history of awakening in the morning with soreness in the right lower quadrant which continued without relief up until the time of examination. There had been no nausea or vomiting. His bowels had moved normally the day before. He had had no history of similar attacks; no hematemesis, jaundice or other G.I. complaints. He had a history of recurrent attacks of malaria since his discharge from the service. His temperature on admission was 99.6°F. Examination revealed moderate tenderness on deep palpation in the right lower quadrant with rebound tenderness referred to McBurney's point. There was no spasm and no palpable mass. Urine examination, on admission, showed an occasional coarse, granular cast; otherwise it was negative. Subsequent urine examination showed an occasional hyalin cast, another coarse granular casts, from 5 to 6 white blood cells, and 10 to 12 red blood cells per high power field. His serology was negative. Examination of his blood showed a white blood count of 12,400 cells per cubic mm. of blood with 75 polymorphonuclear cells. A diagnosis of acute appendicitis was made. The operation was carried out under spinal anesthesia through a transverse incision in the right lower quadrant. There was no free fluid present in the peritoneal cavity. A firm mass, the size of a hen's egg, was found bound down in the right gutter on the lateral aspect of the cecum (Fig. 1C). Inspection revealed the appendix to be lying free and not involved in the mass and not inflamed. The cecum was mobilized with difficulty, and the cecum and mass exteriorized. The mass was dissected from the cecum and in its center was found a ruptured diverticulum with abscess formation. The appendix was somewhat inflamed. The diverticulum was on the posterior lateral aspect of the cecum, approximately 1½ inches lateral to the base of the appendix. It had a broad base and its tip was divided to form two separated diverticula, one of which was inflamed and the other of which was perforated and involved in the before-mentioned mass. The wide base of the two diverticula was clamped, the mass excised, and the defect in the cecum closed with an inverting type of catgut suture reinforced by #40 interrupted cotton sutures. The appendix was removed in the routine manner. Inspection of the remaining exposed portion of the colon revealed no further diverticula. The abdomen was closed without drainage and no chemotherapy instituted. The pathologic examination

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showed the specimen to be a true diverticulum containing all layers of small intestine with necrosis of the epithelium and diffuse invasion of the wall by leukocytes in the muscularis. Convalescence was uneventful and the patient was discharged approximately 17 days postoperatively. At this time a gastro-intestinal roentgenographic study was made, as well as a barium enema examination which revealed a small diverticulum on the medial aspect of the ascending colon, just below the hepatic flexure (Fig. 2). There was no other evidence of diverticula or pathology.

COMMENT

It is seen from these cases that acute diverticulitis of the cecum closely resembles an acute appendicitis in all respects and behaves very similarly in the abdomen. Abscess is usually formed at the site of perforation and very rarely causes generalized peritonitis. The omentum frequently acts to localize the exudated material and holds it in check to form abscesses similar to those noted in two of these cases. The abscesses often lie adjacent to the mesentery or between its leaves. These thick-walled abscesses are closely associated with the cecum and often become tumefied and associated with large mesenteric lymph nodes to the extent that differential diagnosis of malignant tumors of the cecum is very difficult, if not impossible, even at operation. This is a very important fact because, as is well known, carcinoma of the cecum is much more common than diverticulitis of the cecum. Consequently, unless the accurate diagnosis is made by the operating surgeon, the improper operative procedure may be carried out and a radical resection of the cecum and ascending colon done in the belief that the lesion at hand is a carcinoma, whereas in reality it may be an inflamed diverticulum and a simple resection of the local lesion is all that is necessary. On the other hand, since diagnosis of carcinoma of the cecum is a much more formidable one and the sequelae carry such a high mortality, error in the opposite direction should also be guarded against. Most patients subjected to surgery for diverticulitis of the cecum recover. The mortality rate is given as 6 per cent.

At operation the usual finding is a single diverticulum with a narrow neck in the outer portion of the cecum. It may have become congested by concretions or fecalith and obstructed and the neck traps pus in the blind sac. Since the muscularis is often absent or very deficient there is no pressure to force the fecalith or blocking concretion out of the neck and thus obstruction and strangulation result. This set of circumstances differs from the normal functioning appendix which is able, in numerous cases, to empty itself. Due to this bottle neck formation and stasis and an increased absorption of water in the right colon, fecaliths are more liable to form and give rise to acute inflammatory reaction here. Jonas¹⁶ found fecalith present in 68.4 per cent of his cases. A fecalith was present in only one of the cases reported in our series of three.

Local sequelae following acute diverticulitis of the cecum may be: (1) Perforation with localized or generalized peritonitis, (2) gangrene of the diverticulum, (3) abscess formation, usually involving the right portion of the cecum, peritoneum in the right lower quadrant, and omentum, (4) multiple adhesions in the area of the diverticula, (5) entero-intestinal fistula, or

entero-vesicle fistula, or entero-colic fistula, or others, (6) retrocecal abscess, (7) extra-peritoneal abscess.

There may be a diverticulitis with intestinal obstruction or there may be diverticulitis associated with a carcinoma of the cecum, so both should be kept in mind at the time of operation. Upon palpation of a mass in the cecum at the time of operation, an examining finger may be placed in the opposite wall of the cecum and the surgeon may feel a defect or hole in the mass at the site of the base of the diverticulum, and this may give some aid in differentiating it from a carcinoma.

The other diseases which must be considered and differentiated from acute cecal diverticulitis are: Acute appendicitis, carcinoma of the cecum, actinomycosis of the cecum and right side of the bowel, and intussusception.

The microscopic pathology usually noted is gangrene of the mucosa with ulceration, inflammation of the muscularis with thickening and edema, with infiltration of blood vessels, and increase in the leukocytes in the subserosa, as well as fragmentation of the muscularis, and a generalized inflammatory picture. Perforation is much more likely if the muscularis of the bowel is absent in the diverticulum proper.

The treatment should be such that the minimal operative procedure is carried out to effectively eradicate the pathology present. The plan of treatment necessarily depends on the type and extent of the lesion, as follows: (1) Simple excision of the involved diverticulum with closure of the defect in the cecum (similar to the procedure carried out in routine appendectomy) can be done if too much of the bowel wall is not involved. In this respect, our experience is compatible with that of Gatewood¹² in that the tissue edges of the bowel were normal despite the gangrenous character of the diverticulum itself, and closure of the cecal defect could be carried out with ease by a purse string-type suture. However, if edema and thickening of the cecal wall in the area of the diverticulum is marked due to abscess formation and gangrene, as reported by Frehling,⁹ closure of the cecal defect is difficult and more extensive resection of the cecum may be necessary to get an effectual closure. (2) Simple closure of the defect after a perforation has occurred by invagination of the stump and suturing normal serosa to serosa at the base of the cecum is simple and often adequate. (3) Right colectomy will be necessary if too much of the cecum and ascending colon is involved in inflammatory and gangrenous mass and it is evident that any lesser procedure would jeopardize the patient's welfare, or would add to the spread of infection or increase morbidity or mortality. This should be used as the last resort. However, Jonas¹⁶ points out that very large inflamed diverticula lying close to the ileo-cecal valve or between the leaves of the mesentery, so as to jeopardize the cecal blood supply, require extensive resection, including the terminal ileum and ascending colon, with an anastomosis between the ileum and transverse colon. (4) Drainage of an abscess is the only practical procedure when present, or an inflammatory mass adherent to the terminal ileum, rest of cecum, and peritoneum to such an extent that attempt at resection would spread the infection and increase the

morbidity. (5) Exteriorization of the mass in a Mikulicz's type of procedure has been recommended when the cecal wall is gangrenous to such an extent that to return the cecum to the abdominal cavity would be unthinkable. At a later date, the ileo-colostomy would then have to be closed. An alternate procedure, recommended by Frehling,⁹ is to simply exteriorize the portion of the cecal wall which is gangrenous, form a cecostomy and allow the gangrenous portion of the cecum to slough; this results in a subsequent fistula, which may close itself or require minimal operative procedure at a later date. (6) Resection of the cecum may be necessary in cases where the cecum alone is involved and the terminal ileum and ascending colon appear to be in fairly good condition. If the blood supply to neither is jeopardized, the cecum itself may be resected and a side-to-end anastomosis be done between the terminal ileum and ascending colon just above the cecal region. (7) Schung²² advises conservative treatment with chemotherapy without resection if the clinical diagnosis can be made, on the rationale that the majority of the lesions would drain into the bowel and subside spontaneously. This is not recommended for a routine procedure.

CONCLUSION

Acute diverticulitis of the cecum is not as rare a disease as was previously believed, as evidenced by a total of now more than 100 cases in the literature. It must always be considered in patients exhibiting right lower quadrant pain and in whom a preoperative diagnosis of appendicitis is made. There is close resemblance to appendicitis in its pathology and action in the abdomen, which makes surgery the treatment of choice in this disease in all cases. Usually at operation for appendicitis, when a non-involved appendix is found, the possibility of cecal diverticulum, as well as a Meckel's diverticulum, must be considered. The operative procedures which have been recommended are given. The differential diagnosis, preoperatively, between acute appendicitis and diverticulitis of the cecum cannot be made. At operation, the differential diagnosis between the much more frequent carcinoma of the cecum, and diverticulitis of the cecum is very difficult to make. A careful evaluation must be made by the surgeon to avoid either a too radical resection for a minimal disease or a too limited resection in the case of a carcinoma, which merits the widest type of excision. Differentiation of this condition from a fibrosing type of tuberculosis of the cecum, from actinomycosis of the cecum and appendiceal abscess requires knowledge, experience and skill. Great care should be exercised in an attempt to carry out the correct procedure in each case. The condition may be present at any age in either sex, in fairly equal numbers, and if properly treated the mortality rate is low. The complications and sequelae are listed above. The one case reported here in which a hematoma of the abdominal wall resulted postoperatively is not a true sequela of the disease since there was no evidence of infection and it was obviously an error in hemostasis at time of operation.

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