APPENDICITIS *

By JORGE DEL TORO

The subject matter of this paper, together with the cases described in it, refers to appendicitis only. Appendectomies performed during the course of other abdominal operations are not included as material for study.

Records have been compiled concerning age, sex, pathology, diagnosis, treatment, and a special reference to mortality. Three hundred and eighty consecutive cases of operations for appendicitis comprise this analysis. Of these, 230, or 60.10/19 per cent have been acute; 16, or 4.4/19 per cent, subacute; 134, or 35.5/19 per cent, chronic cases.

Sex: One hundred and fifty-five cases have been males; 225, females.

Age: There are 37 cases (old emergency cases) where age is not stated in the records, so we have 343 to work on.

Age	Number	Per cent
1–10	31	9.03
11–20	115	33.52
21–30	105	30.61
31–40	50	14.57
41–50	25	7.28
51–60	11	3.02
61 and over	6	1.74

The youngest case was 2½ years old, the oldest, 70. An appendectomy was performed on a male child 2 years and a few months old for a gangrenous appendix due to ileo-cecal intussusception, but it is not recorded here. The child lived.

If the incidence by age is studied in the acute cases only, we find the following:

Age	Number	Per cent
1–10	31	14.83
11–20	71	33.97
21–30	52	24.87
31–40	28	13.39
41–50	14	6.68
51–60	7	3.35
61 and over	6	2.82

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Anatomy: The *appendix vermiformis* assumes varied acrobatic contortions, many of which favor fecal stasis, or obstruct circulation; its anatomy is also dependent on the changes of anatomy of the cecum. The retrocecal or retrocolic position which, in normal anatomy, represents a minor proportion, in cases of disease assumes a large one. In our series 34.48 percent of the cases are recorded as retrocecal, internal or external, some of them being retromessenteric, or behind the messentery of the ileum. This percentage, however, is not quite accurate, as many of the records do not state the position. The pelvic position appears in 7.36 percent of instances. These pelvic appendixes may form inflammatory adhesions to the iliac vessels, and in healed cases without operation produce painful swelling of the limb by pressure on the vein.

Pathology: It is hard to draw a sharp line of classification, for many factors such as different micro-organisms, age, anatomic positions of the appendix, etc., as well as the time at which the case is operated upon, have a decided influence upon the pathology found.

As a general rule, appendicitis is classified into (1) the catarrhal or localized; (2) the diffuse or spreading, with its gangrenous and ulcerative forms, and (3) the chronic varieties.

From the year 1925 on, a number of the cases are classified as follicular. I have not been able to find from where I originally got the term, but it applies to those acute cases in which the infection is so aggressive, that, taking the appendix by assault, it marches through it to the lymph nodes of the messo-appendix without leaving much damage done to the organ. The lymphoid tissue of the appendix is more abundant during adolescence, and it is at this period that the follicular form is most frequent.

William Boyd in his *Surgical Pathology* states ". . . the submucosa continues with the subperitoneal tissues at the messo-appendix by the *hiatus muscularis* for the passage of blood vesels and lymphatics . . . more especially, in cases of streptococcus infection, the inflammation may extend rapidly from the submucosa to the peritoneal coat, and set up a general spreading peritonitis, even when the appendix does not appear to be very acutely inflamed. In these cases the symp-

toms of peritonitis mask those of the local appendicular lesion. . .''

Of this special form there are several instances in our records; one, Case 350, makes a good illustration:

Case 350: Female, aged 5. Several days attack. Symptoms and signs of generalized peritonitis; abdomen harder and more sensitive about region of the appendix. Blood count: total 33,200; polynuclears, 90 per cent. On operation we found a generalized sero-purulent peritonitis and plastic peritonitis about the cecum and terminal ileum. Meso-appendix lymph nodes swollen. Appendix acutely inflamed, but no edema, and not perforated.

The specimen was examined by Dr. Koppisch of the School of Tropical Medicine, San Juan, who gave the following report:

No. 6604: C.M.L. Female, aged 5; white. Appendix. *Gross:* An appendix measuring 4 cm. in length and 1.3 cm. in circumference. It has been previously opened to expose the lumen. The peritoneal coat is slightly roughened and dull. The mucosa is pale and perhaps slightly thickened. *Microscopic:* The peritoneum is covered by a broad layer of fibrin enmeshed in which are red blood cells, polys and large mononuclear cells. As occasional small area of infiltration with round cells is seen in the muscle layer. The lymphoid tissues are prominent and the germinal centers are active. The interglandular stroma of the mucosa is loose and edematous and contains moderate numbers of eosinophiles. There are areas of round cell infiltration in the sub-mucosa. Diagnosis: Acute peri-appendicitis.

Among the chronic varieties the obliterating type is perhaps the most interesting, as the symptoms produced are so much out of proportion to the pathological changes found in the appendix. Undoubtedly, this form must be produced after repeated attacks for a long period of time. We cite as an apt illustration:

Case 375: Male, aged 39. For years a sufferer from intestinal troubles. The appendix not visualized by the X-rays. On operation, a small appendix found pointing toward the pelvis and with old fibro-adhesions.

The report of the pathological examination by Dr. Hans Smetana on the above case is as follows:

No. 6523: Male, aged 39; white. *Appendix vermiformis. Gross:* The specimen consists of an appendix measuring 3.3 cm. in length and 4 mm. in diameter. The sub-peritoneal blood vessels are slightly injected. On cross section the lumen is found to be obliterated. *Microscopic:* The lumen of the appendix is replaced by fibrous tissue and fat tissue. The musculature appears hypertrophied. The surface shows remnants of fibrous adhesions. Diagnosis: chronic appendicitis with obliteration of lumen.

Diagnosis: As a general rule, the acute cases do not offer many difficulties in diagnosis, as most cases are typical. A few may be misleading, and give rise to excusable doubts. One has to be alert for the very acute gangrenous and obstructive types. In these, the local symptoms are very severe, the pains more acute than usual, and the leucocytosis and polyneucleosis are rapid in rising. These cases have to be dealt with as emergency cases, and must be operated upon at any hour of the day or night if one wants to forestall a rupture.

Case 361: Female, aged 61. A mortality case upon which the operation was performed two and half days after the onset of the attack, and in which the generalized peritonitis was already so severe that the patient could not survive.

Case 157: Male, aged 39. Very fat. Acute gangrenous appendicitis. Operated on during the first 14 hours of attack. Perforation. Cured.

The recurring cases should be followed closely and be examined during some of the attacks.

It is in the chronic cases that the diagnosis is more difficult. The X-rays are largely used in these circumstances and, like all other mechanical diagnostic devices, are a good help if not depended upon to the detriment of a sound clinical diagnosis and the proper physical examination. A chronic appendix can, in many instances, be diagnosed at the first visit, but as a rule the patient has to be seen several times before one can be certain that the symptoms are due to the appendix.

Gynecological case: Female, aged 47. Pending operation for recurrent appendicitis. On a severe attack of pain we took it for granted that it was appendicitis—an acute attack on the existing chronic condition. On operation, a chronic obliterating appendix was found that did not account for the acute pain. Searching for the cause, a gangrenous cystic ovary, and hydrosalpinx due to twisting were found.

In contrast to the obliterating type there is the very wide, funnel-shaped type which may be distended by gases and undoubtedly must be the cause of the short-duration colics felt by these cases. We had occasion to hear one of these appendixes expel its gaseous contents with such an alarming noise that everyone in the operating room stood at attention, wondering what had happened (Case 139).

Adhesions and anatomical positions play an important rôle in the chronic cases, as well as the shape of the cecum

and ascending colon, and the relative anatomical situation of the cecum. A dilated or mobile cecum can be diagnosed by palpation—it forms a distended mass that can be distinguished from the rest of the intestines and has a higher percussion note. By massage its gases can be made to pass up the ascending colon. However, care and thought are very necessary to preclude erroneous judgement.

Case 275: Male, aged 59. Operated upon for duodenal ulcer under other supervision two months before, with report that the appendix had not been excised because it was healthy. Very severe symptoms and signs of abdominal infection. The localization was in the epigastric and umbilical regions. Everything pointed to some disaster about the duodenum. On operation there was found an acute ruptured appendix situated behind the messentery of the ileum just in front of the peritoneal covering of the transverse portion of the duodenum. Cured.

Two cases of acute infection of Meckel's diverticuli were impossible to differentiate from acute appendicitis.

A ruptured ovarian abscess lying high up was impossible to diagnose even after digital vaginal examination. In females, a digital vaginal examination should always be made.

Leucocytosis: The leucocytic count is of great help, if not so much for a differential diagnosis, at least as a guide to the index of infection in the diagnosed cases.

The proportion between the total count and the polymorphonuclears is of interest. Sonder advanced the hypothesis that the percentage of polynuclears is the index of infection and the total leucocytosis the index of body resistance. With this as a basis you may construct as many problems as you want. Two perpendicular lines are made; the left one going up by steps of one thousand each, beginning with seven thousand and representing the totals; the right one going up by steps of one percent paralleling each one thousand, and beginning by seventy-two percent. If a line is drawn connecting the given totals with the given percent, one gets the balance or proportion of resistance and infection. I have recorded the cases by marking: plus (poor resistance) for an upward direction of the line, and minus (good resistance), for a downward direction. I have found this proportion to be true in almost every instance.

This hypothesis, together with the Schilling filamented polynuclear count, and the Arneth's blood picture, is proof of

the efforts being expended in trying to solve this interesting problem.

Treatment: There is only one standard treatment for appendicitis: appendectomy. Where it can not be done, the only thing to do is to help nature.

At present, due to a more daring surgery and to more prompt diagnosis, few appendiceal abscesses are treated by drainage only. In almost every instance the appendix is excised, no matter in what condition it may be found.

A small stump of appendix left after a destructive supuration may give rise to subsequent attacks.

Case 131: Male, aged 34. A few weeks after having had an abscess drained in another hospital, he had to be operated on for a second abscess and have his appendix removed.

Case 155: Male, aged 63. Acute appendiceal abscess twenty years before. Surgical findings: acute infection of appendix stump with edema of the cecum and localized peritonitis. Adhesions, 4+. Acute nephritis in convalescence. Cured.

There is not much to be gained by the so-called "expectant treatment" in the acute cases. The patient generally has to go through a term of medical treatment, and a second term of surgical treatment.

In the mild acute, and in the chronic cases, where for some reason it is desired to postpone an operation, the expectant treatment may be necessary.

In deciding on surgical treatment, the clinical picture should be given first consideration, but in a case where the clinical symptoms are mild, but with the blood picture giving a decided index of infection, one should not hesitate to operate.

Drainage: Of the acute cases, 110, or 47.82 per cent were drained.

I have never seen much reason for debating the question of drainage, nor for the belief that the mortality is higher in drained cases. A case that is drained is a severe one. Drainage must be used judiciously. Although one can not expect to cure a generalized peritonitis by one or by multiple drains, a good deal may be done by these means in preventing the spread of infection. It is a gratifying fact that in all these acute cases there is no instance of post-operative spread of infection.

Multiple drains are best in the severe cases. Several soft rubber cigarette drains should be properly placed so that they can be withdrawn afterwards, one by one, leaving the remainder loose enough not to plug the wound. There is no danger of the wound opening, as the rectus muscle closes in as soon as released from the pressure on the drain.

It is only experience that will teach when a case should be drained, or not drained: free abscesses, perforated appendixes, localized or general peritonitis, are the most suitable cases. When the infection has gone beyond the limits of the appendix and there is edema of the cecum, or adenitis of the messentery, drainage can not be expected to accomplish much, and the resolution of the edema and the cure of the already established infection has to be left to the resistance of the patient. Cases, even of the gangrenous or obstructive types, if operated upon in good time, can be safely left without a drain. There are some of these cases in which draining would have probably done more harm than good.

Care must be exercised in operating on the chronic cases. As pointed out before, all pains should be taken to be sure of the diagnosis. Patients with generalized enteroptosis, with chronic, established colibacilosis, and neurotic individuals, do not receive much help from appendectomy, even when the appendix is really at fault. When a mobile, dilated pelvic or hammock cecum exists, improvement will follow cecoplication. Instances of the most intractable right-sided constipation have been greatly helped by making the cecum smaller.

Complications: Three cases of heart and lung complication are recorded as fatalities. There is one instance of hepatitis, and one of cholecystitis. Renal infection of a more or less severe degree is not infrequent, especially in children. Abortion usually follows in the first ten days after operating upon a case while pregnant. There are very few cases of pneumonia, but one unusual complication in the following case:

Case 265: Male, aged 26. Acute, ruptured, retro-ileal appendicitis. Drained. On the 15th day after operation developed phlebitis of the left iliac vein.

Mortality: There are 11 death in this series, all of them in the acute case. This makes a mortality of 2.83 per cent for all cases, and 7.782 per cent for the acute cases.

According age, the mortality is as follows:

Age	Number of deaths	Per cent
11–20	6	54. 54
31–40	1	9. 09
41–50	2	18. 18
61 and over	2	18. 18

There was no mortality in the groups of 1 to 10, 21 to 30, or 51 to 60 years.

A detailed analysis of the mortality cases gives us the following data:

Case 14: Female, aged 13. Very poor physical condition. Operated after generalized peritonitis had developed. Died three days after operation. Cause, late operation.

Case 33: Female, aged 18. Very frail constitution. Acute spreading appendicitis with abscess formation. Died 21 days after operation, of pneumonia and endocarditis. Cause, organic inability to withstand the infection.

Case 80: Male, aged 43. Very stout man. Shortness of breath. Probable myocardial insufficiency. Acute localized appendicitis. Died 10 days after operation from pneumonia and heart failure. Cause, sepsis and predisposition to lung and heart involvement.

Case 167: Female, aged 70. Chronic disease of the kidneys. Acute spreading appendicitis with localized peritonitis. Died on the 5th day after operation from uremia. Cause, sepsis and aggravation of preexisting disease; also, late operation.

Case 198: Female, aged 13. Generalized purulent peritonitis at time of operation. Died a few hours after. Cause, late operation.

Case 209: Male, aged 50. Suffering from acute bronchitis (after influenza) at time of attack. Gangrenous, ruptured appendix. Operation under local anesthesia. Died 5th day after operation from bronchopneumonia. Cause, sepsis and existing lung disease.

Case 210: Male, aged 34. Up and about during attack. Generalized plastic appendicitis, ruptured, with generalized peritonitis. Attack of six days duration. Cause: badly managed case and late operation.

Case 333: Male, aged 11. Sick for about 2 weeks; diagnosis, pneumonia. Acute, ruptured retrocolic appendicitis in process of localization of the abscess. Spreading secondary abscess between diaphragm and liver, around the hepatic flexure of the colon, and above and below the messocolon. Died 2 days after operation from the infection. Cause, late operation.

Case 344: Female, aged 17. White. Previously healthy. Gangrenous appendicitis, ruptured, with generalized peritonitis. Attack of six days duration. Preagonic at time of operation. Died 2 hours after operation. Cause, late operation.

Case 346: Male, aged 11. Previously healthy boy. Several days of attack. Acute, diffuse, retrocolic appendicitis with generalized fibropurulent peritonitis. Died 48 hours after operation from peritonitis. Cause, late operation.

Case 361: Female, aged 61. History of gall stones, colic. Very acute attack of gangrenous appendicitis. Ruptured with generalized purulent peritonitis. Two and half days of attack. Died two days after operation from peritonitis. Cause, late operation.

Of these 11 deaths, 7, or 63.63 per cent were due to delayed operation; one, or 9.09 per cent, to being too frail to withstand the infection, and to complications; and 3, or 27.27 per cent by poor health occasioned by preexisting or active disease of lungs or kidneys.

Infections of the *appendix vermiformis* are serious affairs, and have to be attended to as an emergency, and even when properly attended, weak organisms may succumb to their malignancy. Persons with previous disease of the heart, kidneys or lungs, run a grave risk should they develop appendicitis.

Technique: In the last 5 years the following technique has been practiced with a few variations when conditions have demanded:

Right para-rectal incision, saving the last intercostal nerves when possible.

Delivery of the appendix, and freeing of adhesions if present, before or after delivery.

The appendix is caught at its base with the points of a haemostad, and a double No. 1 plain catgut is passed through the messo-appendix between the base of the appendix and the cecum. The messo is then ligated at a convenient distance from the appendix—the messo-appendix divided between ligature and appendix.

The haemostad clamping the appendix is removed, and the appendix ligated where crushed, with the same ends of the ligature used in tying the messo-appendix. This is what I have called a double tie with one ligature.

The haemostad is reapplied a little farther away than before. With the knife-shaped blade of the cautery a hole is burnt just next to the ligature, and the lumen thoroughly destroyed; after this, the rest of the wall is divided with the same cautery. This is a more satisfactory technique than dividing first, and then destroying the stump.

The stump is then covered by a stitch of No. 1 plain gut passed through the messo-appendix, and through two or three convenient points in the wall of the cecum.

By this double tie with one ligature, no chance is left of a open space between the leaflets of the messo-appendix and the sub-peritoneal tissues for the spread of infection, as well as being a guarantee against possible post-operative haemorrhage from some untied vessel.

Heat is also the only dependable agent for quick sterilization of the stump. When the proper cautery is not available, the blade of a knife can be heated over the gas burner or alcohol lamp.