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APPENDICITIS

BY

Sir CECIL WAKELEY, K.B.E., C.B., D.Sc., P.R.C.S., F.R.S.Ed.

Senior Surgeon and Director of Surgical Studies, King's College Hospital; Surgeon to the Royal Masonic Hospital and Belgrave Hospital for Children; Consultant Surgeon to the Royal Navy

AND

PETER CHILDS, M.A., D.M., M.Ch., F.R.C.S.

Surgeon, South Devon and East Cornwall Hospital, Plymouth; late Surgical First Assistant, King's College Hospital

[WITH SPECIAL PLATE]

Appendicectomy is one of the commonest surgical operations performed, especially as an emergency. The Registrar-General's figures show that "in the period 1935-8 the number of deaths from appendicitis remained very constant, successive annual totals being 3,178, 3,053, 3,039, and 3,027. In the next three years a rapid fall occurred, to 2,733 in 1939, 2,465 in 1940, and 1,970 in 1941, but this was followed by a stationary period with 2,038, 1,976, and 1,965 deaths. In 1945 a further fall began, bringing the number to 1,774 in that year." The report continues, "These two changes were contemporaneous with the introduction on a considerable scale of sulphonamides and penicillin respectively. Non-civilian deaths included in the above totals in years 1939-45 were 11, 87, 97, 111, 90, 84, 71" (Registrar-General for England and Wales, 1949).

Development

The stages in development of the appendix are shown in Fig. A.

At the fifth week of foetal life the caecum appears as a small outgrowth of the wall of the primitive midgut, which is not yet differentiated into small and large intestines. This outgrowth is the same diameter throughout, equal to that of the intestine. But about the eleventh week it increases in length. Even at this early stage the process differentiates into a basal fifth and a distal four-fifths, which grow differently. The basal portion grows equally with the large bowel, whereas the distal portion grows greatly in length but little in diameter. Thus at the end of foetal life the caecum is conical in shape, with its wide base joining the ascending colon and the narrow end tapering gradually into the vermiform appendix. Such a caecum is termed infantile, and persists for some time after birth. In 3% of cases such a type of caecum is found throughout life.

At the sixth or seventh month of foetal life the terminal part of the ileum adheres to the medial wall of the caecum for some distance. In addition, two folds of peritoneum—one anteriorly, one posteriorly—pass between the two parts. In such a way is future

FIG. A.—Early development of the appendix, showing its tendency to become retrocaecal.

growth of the caecum regulated. As the caecum begins to expand the medial part of the wall cannot enlarge as much as the rest. The lateral part grows much more rapidly, and eventually forms the apex and most of the body of the caecum, while the original apex with the vermiform appendix is pushed into one or other of the sites mentioned below.

The level of the caecum varies at different periods of foetal life. At the eleventh or twelfth week it lies immediately beneath the liver and to the left of the median plane. Gradually it travels to the right across the descending part of the duodenum, and lies on the right side, and downward, to reach its adult position at birth or some time later. Descent may be imperfect, giving a high caecum, or excessive, in which case the caecum lies in the pelvis (Cunningham, 1931).

Anatomy

The general anatomy is well known and requires no discussion (Fig. B). But the site in which the appendix

FIG. B.—The anatomy of the terminal ileum, caecum, and appendix as seen from behind.

finally settles is of importance, as the symptoms, signs, and complications of appendicitis are in some degree related to the site of the appendix.

Wakeley and Gladstone (1928) analysed 5,000 cases taken from the operating theatre, post-mortem room, and dissecting-room. Their findings are shown in Table I

TABLE I.—Position of Appendix in 5,000 Cases (Wakeley and Gladstone)

	No. of Cases
Anterior or pre-ileal	47 (0.94%)
Splenic or post-ileal	25 (0.5%)
Pelvic, on psoas muscle, near or hanging over brim of pelvis ..	1,606 (32.11%)
Subcaecal, beneath the caput caeci	101 (2.02%)
Post-caecal and retrocolic	3,219 (64.38%)
Ectopic	2 (0.04%)

In a consecutive series of 430 operations for appendicectomy performed at King's College Hospital during 1947 and 1948 the position of the appendix was noted in 171; the results are given in Table II.

TABLE II.—Position of Appendix in 171 Cases at King's College Hospital

	No. of Cases
Anterior or pre-ileal	7 (4.1%)
Splenic or post-ileal	13 (7.6%)
Pelvic, on psoas muscle, near or hanging over brim of pelvis ..	42 (24.5%)
Paracolic	7 (4.1%)
Post-caecal and retrocolic	101 (59.1%)
Ectopic—in umbilical hernia	1 (0.6%)

It is not only the site which is important surgically. In the case of the post-caecal and retrocolic appendices the relation of the appendix to the peritoneal reflection is important, for on this depends, to some extent, the likelihood of dissemination of infection into the general peritoneal cavity. Figs. C, D, and E show some of the possible relations.

FIG. C.—Attachment of the retrocaecal appendix to the posterior abdominal wall in the right iliac fossa.

FIG. D.—The retrocaecal appendix attached to the posterior wall of the caecum

FIG. E.—The retrocaecal appendix lying free in the retrocaecal fossa.

Material.—During the 31 months, February, 1947, to August 31, 1949, 217 appendicectomies were performed by one of us. There were no deaths. It has been thought worth while to review the pathology of the appendix as illustrated in this series and to discuss the treatment of appendicitis.

SIR CECIL WAKELEY AND P. CHILDS: APPENDICITIS

FIG. 1.—Case 40. Mucosa intact; no abnormality in the outer coats apart from vascular dilatation in the subserosa. ($\times 25$.)

FIG. 2.—Case 206. Intense congestion of vessels of the subserosa. Muscle coat oedematous and mucosa intact. ($\times 25$.)

FIG. 3.—Case 17. Showing the earliest changes of an acute inflammatory reaction in subserosa and muscle coats. ($\times 25$.)

FIG. 4.—Complete destruction of the mucosa; all outer coats are heavily infiltrated with polymorphonuclear cells. ($\times 25$.)

FIG. 5.—Section of the distal part of the appendix shows complete replacement of lumen and mucosa by fibro-adipose tissue. ($\times 25$.)

A. J. N. WARRACK: TUBEROUS SCLEROSIS

FIG. 1.—Sclerotic area immediately below surface of cortex. Phosphotungstic acid; haematoxylin. ($\times 300$.)

FIG. 2.—Tumour of left kidney, showing adenocarcinomatous type of growth. H. and E. ($\times 300$.)

FIG. 3.—One of the tumours in the right kidney, showing vascular fibrous tissue. H. and E. ($\times 300$.)

Pathology in "Acute" Appendicitis

Table III sets out the pathology found in 168 appendicectomies performed as emergencies.

TABLE III

	No. of Cases
Acute suppurative appendicitis:	
Uncomplicated	61
Non-perforated, with early general peritonitis	2
Non-perforated, with abscess	2
Perforated, with general peritonitis	6
Perforated, with abscess	2
Associated with faecaliths	4
Associated with "kinking" of appendix and localized peritonitis	1
Associated with faecalith, perforation, abscess, and local peritonitis	3
Acute gangrenous appendicitis	3
With early general peritonitis	2
With faecalith and established general peritonitis	3
With abscess	1
Late general peritonitis due to acute suppurative appendicitis	2
Appendix abscess drained	4
Acute suppurative appendicitis with evidence of past inflammation	9
Vascular dilatation in the outer layers of the appendix	1
Chronic appendicitis	10
Normal appendices	15
Containing faecaliths	16
Adherent	4
Removed from children under the age of 13	10
Containing worms	1
Misdiagnoses (pyelitis, lymphoid hyperplasia of terminal ileum, pneumonia)	3
Unknown pathology	1

The earliest case operated on was that of a medical student aged 28 (Case 40). He gave a history of only 2½–3 hours, but the signs and symptoms were typical of appendicitis and he had vomited much. The pathologist's report on his appendix is interesting (Plate, Fig. 1): "An appendix 9 cm. in length. Its mesentery is very fatty. The serosal surface is congested, but the lumen is patent throughout, and the mucosa is normal. Section shows an intact mucosa and no abnormality in the outer coats apart from vascular dilatation in the subserosa. There is no inflammatory infiltration."

The exact significance of this vascular dilatation is difficult to determine. It may, in view of the shortness of the history, represent the earliest stage of inflammation. It is impossible to be dogmatic about this, but it is worth noting that in the "acute" series five cases, and in the "elective" series two cases, in which the pathologist reported macroscopically and microscopically no evidence of inflammatory change, it was noted at operation that there was abnormally marked injection of the serosal vessels of the appendix.

Whatever may be the significance of vascular dilatation, 7 of the 61 cases of acute suppurative appendicitis indicated clearly that the infection of the appendix did not begin in the lumen. In none of these appendices was the lumen in any way obstructed, nor was there evidence of involvement of the mucosa. Typical reports from pathologists are as follows:

Case 206.—A boy aged 12½ (Fig. 2). "Section shows intense congestion of the vessels of the subserosa, which is heavily infiltrated by polymorphs and covered in a few areas by fibrinopurulent exudate. The muscle coat is oedematous, and is infiltrated by moderate numbers of polymorphs. The mucosa, which is intact, is least involved by this acute suppurative process, which appears to have started in the outer layers."

Case 17.—A boy aged 15 (Fig. 3). "Section showed the earliest changes of an acute inflammatory reaction in the subserosa and muscle coats."

The shortest history in these seven cases was 12 hours, the longest four days. All patients were between 8 and 22 years of age. None complained of nausea, and there was slight vomiting in only two cases.

Two pathological reports among the remaining 54 cases of uncomplicated acute suppurative appendicitis were as follows:

Case 89.—A man aged 29, 18 hours' history. "The proximal third of a 9-cm. appendix is covered with fibrinous exudate. The lumen is patent throughout and there appears to be some diffuse superficial ulceration of the mucosa. Section shows acute suppurative appendicitis with extensive mucosal ulceration and oedema, and polymorphonuclear infiltration of all the coats of the organ."

Case 71.—A man aged 41, 12 hours' history. "The lumen of an 11-cm. appendix is patent throughout. The proximal 2 cm. shows congestion and ulceration of the mucosa. Elsewhere the mucosa is intact, but the organ is dilated. Section through the proximal part shows early ulceration of the mucosa and diffuse and focal polymorph infiltration of the outer coats."

In none of these cases was there evidence of a causative obstructive lesion. But Case 71 does illustrate how inflammatory swelling of mucosa in the proximal part may cause obstruction secondarily.

The length of history in these 54 cases lay between 8 and 48 hours. The age incidence was as follows:

0–10 years	8 cases	41–50 years	4 cases
11–20 "	21 "	51–60 "	1 case
21–30 "	15 "	61–70 "	1 "
31–40 "	4 "		

Where the disease had progressed beyond the stage illustrated by these 54 cases we found complications.

Acute suppurative appendicitis was found with early general peritonitis in four cases, in which a seropurulent fluid was disseminated throughout the general peritoneal cavity; the bowel was injected along its whole length. A typical pathological report was as follows (Fig. 4): "The distal half is covered with inflammatory exudate, and shows mucosal ulceration. Section shows complete destruction of the mucosa, and all the outer coats are heavily infiltrated with polymorphonuclear cells."

The history in all four cases ranged from 24 hours to 3 days. All the appendices were lying free in the peritoneal cavity, one being anterior and pre-ileal and three being subcaecal.

The acute suppurative appendix can, without perforation, give rise to an abscess. This was found in Case 23, that of a girl aged 4½ with a 48-hour history, in whom a small abscess was walled off by omentum round an unperforated appendix. And in Case 47, a woman aged 39, with an eight-day history, an abscess was found round an appendix which the pathologist described as follows: "The distal third of an appendix 7 cm. long is surrounded by a ragged mass of haemorrhagic tissue. The lumen is patent and there is no obvious ulceration of the mucosa. Section through the distal part shows it surrounded by a mass of haemorrhagic granulation tissue which is heavily infiltrated by polymorphs. The inflammation extends through the muscle coats into the submucosa, but the mucosa is intact."

In six cases perforation of acute suppurative appendices occurred, and general peritonitis ensued, with free pus in the peritoneal cavity. In Case 85, a man aged 37 with a five-day history of pain in the right iliac fossa, the pathologist's report was: "The specimen consists of an appendix 5 cm. long. The mucosa is extensively ulcerated, and perforation has occurred in the middle third of the organ, where its wall is completely necrotic."

The length of history in these cases ranged from 36 hours to 5 days. A feature worthy of note was looseness of and frequency of motions in four of the six cases. This symptom was associated with both pelvic and retrocaecal appendices. The ages of the patients were 7, 11, 15, 36, 37, and 50 years.

In two cases of acute suppurative appendicitis, one retro-ileal with a 36-hour history, the other subcaecal with a 56-hour history, perforation of the appendix occurred with localization and formation of an abscess. Adjacent loops of small bowel formed the abscess wall.

Abscess formation is a complication of acute suppurative appendicitis, but abscess formation may itself be complicated by general peritonitis. In Case 1, that of a woman aged 62, a diagnosis of general peritonitis was made pre-operatively. At operation this was found to be due to spread from an abscess cavity lying behind the caecum; while in Case 5, that of a girl aged 17½ with an eight-day history of abdominal pain, general peritonitis was found to be due to spread from an abscess which had formed round a pelvic appendix.

Four acute suppurative appendices were complicated by the presence of faecaliths. The histories ranged from 24 to 48 hours. Vomiting was a marked feature in two cases, where the faecalith was clearly obstructing the lumen. Colic was pronounced in the third case. In the fourth case neither colic, nausea, nor vomiting was complained of.

In Case 132, that of a man aged 32 with a four-day history, the patient complained of copious vomiting and much colic, and an acute suppurative appendicitis, with a kink obstructing the lumen, and local peritonitis of the adjacent bowel were found. The appendix was lying retrocaecally.

Acute gangrenous appendicitis was found in three cases—two girls aged 17 and 14 years, and a boy aged 6. The histories ranged from 24 to 48 hours, and the appendix was in one case retro-ileal, in one pelvic, and in one retro-caecal. There was a localized peritonitis round the appendix in all three cases; in two of the cases faecaliths were obstructing the lumen. In Case 131, that of a boy aged 6 with a 24-hour history, the pathologist reported: "The lumen of a 7.5-cm. appendix is obstructed 2.5 cm. from the tip by a hard pellet of laminated faecal material. Beyond this point the wall is gangrenous, the serosa is covered by fibrinous exudate, and the lumen is filled with pus." In all these cases persistent vomiting was a marked feature.

In two cases acute gangrenous appendicitis led to early general peritonitis, with foul-smelling seropurulent fluid free in the peritoneal cavity, in 36–60 hours. In Case 60 the pathologist reported: "The appendix, 6 cm. in length, shows the typical naked-eye appearances of late acute suppurative appendicitis. Section shows almost complete destruction of all the coats of the organ." In one of these cases the appendix was retrocaecal, in the other pelvic. In one vomiting was a marked feature.

Two cases of acute gangrenous appendicitis in association with a faecalith perforated and gave rise to well-established general peritonitis, after 48 hours in one case and five days in another. In both cases vomiting was a marked feature. One appendix was pelvic, the other retro-caecal. In Case 111, that of a man aged 32 who gave a history of three days' abdominal pain but who had not vomited at all, the pathologist reported: "The mucosa of the proximal half of the appendix is dark and ulcerated. The wall is thickened and the serosa covered by exudate. Beyond this the lumen is obstructed by a faecalith, and beyond this faecalith the wall is thin, completely necrotic, but not yet perforated.

In Case 40, that of a man aged 72 with a five-day history, a gangrenous retrocaecal retroperitoneal appendix was found surrounded by an abscess.

In four cases of appendix abscess which were drained only, the appendix was removed at a later date. In Case 204, that of a woman aged 49, the pathologist's report on the appendix removed one year later was: "The wall of the appendix is thickened, and the lumen of the terminal ¼ in. (1.9 cm.) is obliterated. No section was made."

In Case 55, that of a man aged 46, the pathologist reported six months after the abscess was drained (Fig. 5): "The middle part of an appendix 4 cm. long is replaced by a thin fibrous cord, and the distal part of the lumen is obliterated. Section of the distal part shows complete replacement of the lumen and mucosa by fibro-adipose tissue."

Perhaps the most intriguing finding is in Case 29, that of a boy aged 3 years who had an appendix abscess drained, and four months later had his retrocaecal appendix removed. The pathologist reported: "The specimen consists of an appendix 4 cm. in length. There is some patchy congestion of the serosa. The lumen is patent throughout. The mucosa and muscle coats show no naked-eye abnormality. Section shows an intact mucosa with no evidence of past or recent inflammatory change in the submucosa or subserosa."

There were nine cases in which acute suppurative appendicitis was found in appendices showing evidence of previous pathological change. In Case 195, that of a woman aged 63 who had a long history of dyspepsia and a recent history of 48 hours' pain in the right iliac fossa, there was localized peritonitis, and free pus was found round an anterolateral paracolic appendix, the lumen of which was obliterated, while the tip was patent, the site of acute suppurative appendicitis, and perforated. She had not vomited. In contrast, in Case 129, that of a woman aged 43 with a 24-hour history, acute suppurative appendicitis was found in the proximal part of the appendix, the tip of which was not inflamed. She had vomited much, and had looseness and frequency of bowel motion. In two other cases the distal part of the appendix was obliterated by fibro-adipose tissue, while the proximal segment was the site of an acute suppurative process. In two others there was proximal obliteration of the lumen, with a distal acute suppurative process. In three cases there was thickening of the wall with subserosal and submucosal fibrosis. In at least one of these cases there was no previous history of abdominal pain.

In the 10 cases reported as chronic appendicitis by the pathologist, the lesions found were: submucosal fibrosis in six cases; subserosal fibrosis in five cases; and obliteration of the lumen, in part, in seven cases.

In Case 92, that of a woman aged 34 with a history of previous attacks and a recent history of 24 hours, the report was: "The middle quarter of an appendix 5 in. (12.7 cm.) long is almost obliterated, and reduced to a thin cord. There is slight dilatation beyond this, and it contains mucoid material. Section shows well-developed submucosal and subserosal fibrosis." Such an appendix might well have developed into a mucocele of the appendix.

Pathology in "Chronic" Appendicitis

Table IV shows the pathology of the appendix in those cases in which it was removed as an elective procedure (39 cases).

TABLE IV	
Acute suppurative appendicitis	4
Chronic appendicitis	9
Vascular dilatation of outer layers of the appendix	2
Normal appendix	12
Normal appendix containing faecaliths or inspissated faeces	7
Normal appendix associated with kink	1
Normal appendix associated with adhesions	4

There were four cases in which the appendix showed acute suppurative appendicitis.

Case 80.—A woman aged 41 had had attacks of pain in the right iliac fossa on and off for four years. Her first attack began with pain in the right iliac fossa, and later she felt sick and vomited several times. The second attack was two years later. It lasted for two days with pain which was not so severe as in the first attack. She felt some nausea but did not vomit. Her tongue felt "rough," her appetite was poor, and she felt constipated. Since then she has had frequent mild attacks of similar character at intervals of three to six months, and in the last attack she had some diarrhoea.

Examination on admission showed only one abnormal finding—namely, tenderness in the right iliac fossa. Operation showed the appendix to be adherent in the pelvis. The pathologist reported: "The lumen of the 6-cm.-long appendix is patent throughout. The mucosa and outer coats show no macroscopic abnormality. Section shows a very early stage of acute suppurative appendicitis with focal polymorphonuclear infiltration in places. The lumen contains purulent exudate, and there is oedema of the outer coats."

In the other three cases intermittent pain in the right side was the only prominent symptom, and tenderness in the right iliac fossa the only sign. In one case the barium meal and follow-through examination was negative, and in one the radiologist reported chronic appendicitis. In all three the pathologist reported acute suppurative appendicitis with ulceration of mucosa.

In the nine cases reported by the pathologist to be chronic appendicitis the lesions found were: obliteration of the lumen by fibro-adipose tissue, five times; submucosal fibrosis, five times; and subserosal fibrosis, three times.

In both the "acute" and the "chronic" series there were appendices which were normal macroscopically and on histological examination. The significance of such "lily white" appendices has been discussed elsewhere (Childs, 1949).

Mode of Infection

In this series of cases evidence is heavily in favour of infection by the blood stream. Those appendices showing early changes have changes in the outer layers. Inflammation and ulceration of the mucosa occur relatively later in the disease.

Mechanical obstruction of the lumen of the appendix does not seem to play any part in the initiation of acute appendicitis. When acute suppurative infection occurs in an appendix which shows evidence of previous inflammation it is as likely to be found proximal to an obliterated part of the lumen as it is to be found distal (See Cases 195 and 129 above). When the infection is distal to an obliteration of the lumen the mechanical obstruction produces a secondary effect. It causes a rise in tension in the distal part, and perforation may result therefrom. It is our impression that faecaliths play no part in the initiation of disease; but when the appendicular tissues around a faecalith become swollen and infiltrated the faecalith acts as an immovable object and causes pressure necrosis and perforation. It is significant, too, that faecaliths are so often found in association with acute gangrenous appendicitis.

Those cases of acute suppurative appendicitis in which there is no perforation but a localized or generalized peritonitis or an abscess also point to blood-stream infection; for in these cases it is sometimes found that the mucosa of the appendix is not involved in the inflammation.

In none of our cases has there been any evidence to suggest spread of infection from within the lumen of the appendix.

Diagnosis

It is not our intention here to recapitulate the signs and symptoms of appendicitis. They are well known. But we do wish to emphasize one or two points. In a case of uncomplicated appendicitis there is no place for "expectant" treatment. The case is one of acute appendicitis requiring urgent operation, or it is a case of chronic appendicitis in which operation may be performed as an elective procedure. There are several features of the presentation of the case which may help in the making of a decision:

(a) Where symptoms which were intermittent have become constant or more frequent, or where there has been sudden and definite aggravation of the symptoms, operation should be regarded as urgent.

(b) Where fetor of the breath is appreciated, pungently but not constantly, just as one appreciates the scent of roses on a summer evening, operation must be considered urgent.

(c) Absence of pyrexia has no significance, but when slight pyrexia is associated with the signs and symptoms of appendicitis operation must be looked upon as urgent.

(d) Where vomiting and looseness of the bowel are prominent features of the history operation should be regarded as urgent.

(e) When pain is experienced in the left iliac fossa and maybe spreads upwards to the left costal margin, but is associated with tenderness in the right iliac fossa, the appendix will be found lying in the pelvis and extending across the midline. Operation should be considered urgent in such cases.

(f) In children, if it is thought that they may have appendicitis, operation is always urgent.

(g) The path of development of the appendix must be remembered. Where the caecum is undescended an appendicitis may give rise to pain and tenderness high up under the costal margin; or the caecum may have descended into the pelvis, and tenderness may be found only per rectum.

Treatment

1. *Chronic Appendicitis.*—Elective appendicectomy was performed through a muscle-split incision in the right iliac fossa. This incision was used in females as well as males whenever the diagnosis was assured. The wound was closed without drainage and the patient was allowed—nay, rather encouraged—to walk the next day, and if home circumstances were satisfactory the patient was sent home on the third or fourth post-operative day. A paramedian incision was used only rarely, when it was thought desirable to explore the abdomen.

2. *Acute Appendicitis.*—Urgent appendicectomy was performed through a muscle-split incision in the right iliac fossa. The muscle split incision can readily be converted, for greater ease of access in difficult cases, into a muscle cut as used by the Newcastle school and originally described by Rutherford Morison. The peritoneum was closed without drainage. The skin was also closed without drainage unless it was thought that it might have been contaminated. In the event of complications being found at operation, treatment was modified as follows:

(a) If there was an appreciable quantity of seropurulent fluid in the abdomen, with an early general peritonitis, the peritoneal cavity was cleared of this, so far as was possible, by sucker and gauze mops, particular attention being directed to the pelvis and the right paracolic gutter. The peritoneum was closed without drainage, but the wound was drained. The patient was treated post-operatively with continuous gastric suction, nothing by mouth, and intravenous saline and glucose-saline, until the gut moved again spontaneously.

(b) Where appreciable involvement of adjacent viscera by local peritonitis was found the appendix was removed, 10 g. of sulphathiazole and penicillin powder dusted over the affected area, the peritoneum closed without drainage, and the patient

treated post-operatively with continuous gastric suction, nothing by mouth, and intravenous saline and glucose-saline. Only in the more severe cases were systemic penicillin and sulphadiazine given.

(c) Where an abscess was found surrounding the appendix the appendix was removed whenever possible, the cavity cleared of sloughs (and faecaliths, if present), 10 g. of sulphathiazole and penicillin powder was dusted into the cavity, and the peritoneum was closed without drainage, but the wound was drained. The patient was given penicillin and sulphadiazine systemically, post-operatively. And if the abscess was not completely retrocaecal, post-operative suction and intravenous drip therapy was used.

3. Where the patient presented as a case of well-established late general peritonitis it was not possible to be certain pre-operatively that the appendix was the cause. Paramedian incision was used in these cases; a drainage-tube was placed in the pelvis and a stab drain into the right iliac fossa, and the wounds were closed. The patient was given systemic penicillin and sulphadiazine and treated with gastric suction and intravenous drip therapy. The appendix was removed through a muscle-cut incision in the right iliac fossa later.

4. Where the patient presented with an appendix abscess, a muscle-split incision in the right iliac fossa was used. The appendix was not removed unless it was readily accessible. If the appendix was not removed a drain was placed into the abscess cavity after it had been cleared of pus and sloughs (and faecaliths, if present). If the appendix was removed the cavity was dusted with penicillin and sulphathiazole powder, and the peritoneum closed without drainage, though the wound was drained.

Complications

In our series there were no deaths. Table V gives a list of the complications which developed post-operatively.

TABLE V.—Post-operative Complications

Respiratory	Slight	..	..	..	3
	Moderate	..	..	..	7
	Severe	..	..	..	1
Wound infection	Slight	..	..	..	6
	Severe	..	..	..	6
Persistent sinus	..	..	..	..	1*
Pelvic abscess	..	..	..	..	3†
Thrombophlebitis in calf	..	..	..	..	1
Penicillin urticaria	..	..	..	..	2
Irritation of skin due to penicillin	..	..	..	..	1
Prolapse of omentum along drainage-tube track	..	..	..	..	1

* Actually shown by lipiodol injection to be a fistula leading through the appendix into the caecum, following drainage in an eight-day case of general peritonitis. There was no faecal discharge.

† All cases of general peritonitis—1 developed on fifth day and discharged P.R. on tenth day; 1 developed on seventh day and discharged P.R. on eleventh day; 1 developed on 24th day and resolved by 36th day.

Mortality before the Advent of Sulphonamide and Penicillin Therapy

Bailey (1932) reported a mortality of less than 1% in those cases of acute appendicitis operated on within 12 hours of onset. If operation was delayed until 36 hours after onset the mortality rose to 11–18%. Peritonitis was the cause of death in more than 80% of fatal cases. Christopher and Jennings (1932) reported a mortality of approximately 5% in cases of acute appendicitis.

Holcomb (1932) reported 5 deaths in 153 (3.3%) cases of acute appendicitis. One death occurred in a case of acute suppurative appendicitis, three in cases with perforation and general peritonitis, and one in a case with gangrenous appendicitis and general peritonitis. Rayner (1933) had 17 deaths in 347 cases (4.9%); the proportion of "early" cases in the series (that is, within 24 hours of onset) was 25%. Garlock (1934) reported a mortality of 4.6% in 433 cases. Nuttall (1934) quotes McNeill Love:

operation on first day, 1.1% mortality; on second day, 2.8% mortality; on third day, 10.3% mortality.

Comment

In 1932 Shipley and Bailey were advising strongly against the use of drainage-tubes inside the peritoneal cavity. They increase the formation of adhesions and the liability to the production of post-operative obstruction. They need only be used, in our experience, in those cases in which the appendix is not removed.

Peritonitis was the commonest cause of death in days gone by. Provided the appendix is removed or the site of the appendix is drained, few patients need now die of peritonitis if systemic sulphonamide and penicillin therapy is used, the bowel is put completely at rest by the use of continuous gastric suction, and intravenous fluids are given to maintain the electrolyte balance until the bowel moves once again of its own accord.

Since McNeill Love (1933) advocated expectant treatment for cases of appendicitis with localized peritonitis, the following have been added to the surgeon's armamentarium: sulphonamides, penicillin, intravenous drip therapy, and gastric suction.

This new armamentarium has increased the safety of immediate operation in the presence of localized peritonitis. In the above series of cases, expectant treatment was practised only three times; in all three cases—two of abscess and one of appendix mass—the local signs indicated spread during the time the patient was watched, and operation was therefore performed.

Conclusions

Early diagnosis and early operation remain the most important factors in reducing mortality due to appendicitis.

If the diagnosis is appendicitis, and if it is clearly not chronic, operation is urgent. There is no place for expectant treatment.

Sulphonamide and penicillin should be used locally in the peritoneal cavity if there is an abscess or much local peritonitis, but the peritoneal cavity should never be drained if the appendix has been removed. Sulphonamide and penicillin should be given systemically whenever inflammation is widespread.

If there has been soiling of the general peritoneal cavity, or involvement of loops of small bowel in local peritonitis or in the wall of an abscess cavity, treat the patient with continuous gastric suction and intravenous drip therapy post-operatively until the bowel moves again of its own accord.

Always drain the wound if there is danger of contamination.

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