

Chapter I

THE ETIOLOGY OF APPENDICITIS

The etiology of appendicitis has engaged much attention, but this has been mainly speculative or prejudiced. In this chapter I shall deal with the subject from the viewpoint of a clinician, which must necessarily be narrow and circumscribed. To enlarge this limited view a study of the literature has been undertaken in an endeavour to analyse and make use of those studies which have the hallmark of careful and responsible work. From this analysis have been gathered, what I consider to be the only hypotheses and theories worthy of consideration. There is no doubt that the problem is still unsolved and should still provide a valuable field for investigation.

The most complete survey of the subject as yet made is that of Rendle Short.¹ It is a statistical study, which may be summarized as proving the increased frequency of the disease which took place towards the end of the last century, and as giving the evidence for the belief that neither increased eating of meat or other form of food accounts for this fact; Rendle Short suggests that the cause is rather to be found in the relatively less quantity of cellulose eaten on account of the wider use of imported foods.

My own statistical enquiries follow, in part, the lines initiated by Rendle Short but, whilst aiming at supporting his evidence of increased frequency, I went a stage further in an endeavour to find out whether the disease had also increased in severity. These statistics are in great part the result of working in the Records Department of Guy's Hospital, and for the facilities so readily given I take this opportunity of thanking the authorities of the Hospital.

¹ *Brit. Journ. Surg.* 1920–21, vol. VIII, p. 171.

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A study of the records was carried out for three decennial intervals, the years 1875, 1885 and 1895. As Rendle Short found, it was necessary to read through every individual report. This is essential for the years 1875 and 1885, for in these years a diagnosis of appendicitis was unknown, save in a few surgical cases in the latter year. By 1895 the nomenclature was well recognized, but the same care was necessary lest any error might arise in the indexing or heading of the reports. The records are so complete and so well controlled by supervision of the Registrars that there is little doubt they may be looked upon as accurate. The only error is one of interpretation on my part, but every endeavour has been made to reduce this to a minimum.

In the year 1875 there are records of nine cases of appendicitis. The objection has been raised that hospital statistics are untrustworthy since it is unlikely that mild cases would be admitted. Against such objection may be set the fact that of these nine cases five were of the catarrhal type. I shall not waste time in dwelling upon clinical pictures or any details beyond dividing the cases into what may be called mild and severe. It is necessary to say a few words in explanation of this classification. Mild cases include those where there was no evidence of *B. coli* infection of the peritoneal cavity. It includes the simple catarrhs and the cases of plastic peritonitis which respond to medical treatment. The severe types are those in which the peritoneal cavity was infected with the *B. coli* and abscess formation or general peritonitis supervened.

I think that most surgeons will agree that this is a sound, if rough, generalization for the purpose of classification. I realize the possible errors which may be introduced in any endeavour to compare the earlier statistics with those for 1932 which follow. The main fallacy is that a plastic peritonitis may be associated with gangrene, especially with gangrene of the mucous membrane alone. It may even be associated with

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perforation, but such perforation being shut in by adhesions to neighbouring bowel, omentum or posterior abdominal wall, does not lead to abscess formation. Every surgeon must have had the unhappy experience of separating an appendix from adhesions where there was no evidence of *B. coli* infection of any part of the peritoneal cavity, only to find that there is a perforation of the appendix, which as long as it was shut in by such adhesions was harmless and may well have remained so. Hence, when including appendicitis complicated by plastic peritonitis among mild types of disease, I realize that this is open to criticism. At the same time an examination of a large number of appendices justifies the statement that cases of simple plastic peritonitis with gangrenous changes in the appendix are uncommon, the percentage quite small, and the large majority are cases where the gangrene, if present, has not reached the outer coats of the appendix. Any such criticism does not affect the clinical picture. Of the seven mild cases seen at Guy's in 1875, five were simple catarrhs without evidence of peritoneal involvement, two were cases with plastic peritonitis, demonstrable as a tumour in the right iliac fossa. All these cases made uninterrupted recoveries. Two were severe cases. One of these was a child aged 5. She was removed from hospital against advice and the Registrar makes a note that she would probably die. This pessimistic conclusion seems scarcely justified as the disease appears to have been localized. The removal from hospital, and therefore from continuity of treatment and appropriate surgical intervention, may, however, have warranted so gloomy a prophecy. The other was a case of general peritonitis, in which a "perforated ulcer" was found post-mortem.

In 1885 there were 13 cases, of which nine were mild and four severe. One of the latter died. Of the mild cases five were simple catarrhs, four had plastic peritonitis. Of the severe cases three had abscesses, one of which burst naturally

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into the bowel and was evacuated completely, two were opened. These three cases recovered. The fatal case was one of general peritonitis.

In 1895 there were 57 cases of acute appendicitis admitted. Thirty-five were of a mild type, 20 of a severe type. Five of the latter died, four with general peritonitis and one with an abscess. Two cases cannot be classified: one was probably a mild type and in the other details are wanting.

These years are strictly comparable. They show that the increased incidence of the disease set in between 1885 and 1895, and Rendle Short's figures shorten the interval to the five years 1890 to 1895. That they are a true record I feel convinced for the reasons set out in Rendle Short's paper. His figures cover the years 1880 to 1918.

Owing to the cordial co-operation of my surgical colleagues a complete record of every case of acute appendicitis admitted to Addenbrooke's Hospital during the year 1932 was made possible. I personally examined the appendix after removal and marked the details of the pathological picture present, about which I shall speak later. For the present the total number and the subdivision into mild and severe are sufficient. Cases where the gangrene is limited to the mucous membrane have been included as mild cases. Every case of obstructive appendicitis has been placed under the heading severe. This last classification is justified, because whilst some cases of obstructive appendicitis may be removed before infection with *B. coli* has passed to the peritoneal cavity, such a calamity will almost certainly follow in every case of acute obstructive appendicitis which is left untouched. The formation of a mucocele of the appendix is such a rarity that it cannot affect this grave prognosis.

In the year 1932 there were 150 cases of acute appendicitis admitted to Addenbrooke's Hospital. Of these 69 were mild cases under the above definition, but in eight of these there

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was gangrene, usually very pronounced, of the mucous membrane only. It is possible that this gangrene in some cases might have gone further and led to severe infection of the peritoneal cavity. My impression, however, after examining many hundreds of pathological specimens is that such gangrene remains localized, and the destructive changes resulting can often be recognized in cases where a history of a previous attack is forthcoming. I have felt justified in including all these cases under the heading of mild, as I feel it is fairer to the statistics. Their inclusion weighs against any impression, present in the mind when these statistics were undertaken, that not only is the incidence of the disease increased but also the severity. There were 81 cases of severe disease, which included 55 where gangrene had reached to the outermost coat of the appendix, 19 cases of obstructive appendicitis, and one case of abscess where no serious lesion of the appendix was discernible. The table shows at a glance the points I have endeavoured to make from these statistics.

Year	No. of In-patients admitted to hospital	Total No. of cases of Appendicitis	No. of cases per 1000	No. of mild cases	No. of severe cases	Percentage of severe cases
*1875	5285	9	1.7	7	2	22.2
*1885	4571	13	2.83	9	4	38.4
*1895	6239	57	9.1	35	20	36
†1895	2910	15	5	—	(2 unplaced)	—
†1905	3762	64	17	—	—	—
†1915	3481	75	21.5	—	—	—
†1918	4021	113	28	—	—	—
‡1932	4469	150	33.3	69	81	54
‡1934	5550	172	31	—	—	—

In the last column is placed the percentage of serious or severe cases for each year analysed.

* Guy's Hospital. † Rendle Short's statistics (Bristol Royal Infirmary).
 ‡ Addenbrooke's Hospital.

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This table suggests that the seriousness of the lesion in cases of appendicitis has increased. For the year 1932 the figures may be said to be accurate. For the other years the severity has had to be surmised from an analysis of the clinical records, and if some of the cases of plastic peritonitis were cases where a protective process has limited extension of disease from a perforated appendix to the peritoneal cavity, it might appear to negative any conclusion. The point is, however, that whether perforation took place or not the disease was strictly enclosed and limited, there was no evidence of abscess formation and no suggestion at any time of life being endangered. The error I believe to be small. Careful study of the cases would seem to justify the conclusion that the severity of the disease has increased as well as the incidence.

Further evidence, from different sources, may also be included here. Wilks¹ published an abstract of all cases admitted to Guy's Hospital between the beginning of April to the end of November 1853. He says: "Under the head of Caecitis are four cases which were all cured." He then continues: "We frequently have fatal instances of the disease, in which the vermiform process has given rise to a long train of formidable symptoms." Battle and Corner² state that 456 cases of acute abdominal disease were admitted to St Thomas's Hospital during the years 1900, 1901 and 1902. Of these 168, or 37 per cent., were acute appendicitis, that is, on the average, 56 cases a year.

Before leaving these statistics it is worth while considering whether there is any difference in treatment which may have led to increase in severity. About 1895 many cases of appendicitis were being transferred from the medical to the surgical side for operation. The well established and sound

¹ *Guy's Hospital Reports*, 2nd Series, vol. VIII, 1853, p. 431.

² *Surgery of the Appendix*. Constable, 1904.

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medical treatment, which is described in Habershon's¹ book on *Diseases of the Abdomen* (1862) and which was practised in the wards of every enlightened hospital, as any one reading reports of cases in the pre-surgical era will see, fell into disrepute. This treatment aimed at absolute rest to the parts with warm applications locally. The exhibition of opium, the limitation by mouth of anything but the simplest of fluids, and the avoidance of any purgatives was the treatment carried out. There is no doubt that this treatment, based on clinical and pathological observation, and above all on the recognition that rest to an inflamed part is essential, was logical and sound. The success attending it cannot be questioned. There has been a tendency to think that the mortality and complications in appendicitis in the pre-surgical era were high. This is not borne out by the case sheets. In 1875 out of nine cases one died and the Medical Registrar hazarded the opinion that that one case which left the hospital against advice would probably die. This was the child thought to have a localized abscess, whose case has already been commented on. In 1885 out of 13 cases one died with general peritonitis, the rest recovered. Not one in either year left with a fistulous opening, or, as far as we know from the reports on discharge, suffered from any complication endangering life or interfering with return to ordinary work. With the introduction of surgical treatment, however, the treatment with opium was abandoned on the grounds that it obscured symptoms. There is little doubt that with the abandonment of one fundamental of treatment the whole structure fell. The doctrine of absolute rest to the parts, by withholding any purgative, seems to have gone with it. A desire to get rid of waste products, an idea that they were injurious locally, or an absence of any sound

¹ Habershon and Hilton were at this time contemporaries on the Staff of Guy's Hospital and it may well be that the latter's *Rest and Pain* influenced the whole school.

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reasoning at all, led to a negative attitude as opposed to a positive assertion. Looking back it would have been wise if, at the time when the evil of masking symptoms with opium, with which most medical men will be in agreement, was postulated, the strongest emphasis had been laid on the evils of any form of purgation or large enemata. That for years this purgation treatment of abdominal pains has been a blight on the treatment of the disease no one can question. Tanner's paper¹ on the subject is very convincing. The evil of any form of purgation in abdominal pain cannot be emphasized too strongly. No one can say that the colic of one hour may not prove to be appendicitis in the next. A case under Pye-Smith in 1895 shows that stagnation of faeces in the bowel can exist without harm resulting. A man, aged 28 years, was admitted on March 14th with a plastic peritonitis secondary to appendicitis. He was treated medically with opium internally, appropriate diet and Lin. Belladonnae externally. From the date of admission until the 22nd there was no action of the bowels and yet in this time the tumour disappeared and the man recovered. This is not a unique case, for there is one similar in the same year. I am not personally advocating such an extreme example of *laissez-faire*, but only calling attention to the fact that in these cases absolute rest appeared to be of more service to the patient than a mere clearance of bowel contents.

Yet against all this we have to remember that in very many homes the treatment of an abdominal pain is the privilege of the domestic hierarchy, more especially where children are concerned. In so many cases it is only when failure to improve or an inclination to get worse follows on the domestic

¹ *Lancet*, 1927, vol. I, p. 970. The essence of this paper may be said to lie in the last sentence: "It is significant that only one-sixth of the 50 patients had had castor oil; this one-sixth included half those who developed an appendix abscess."

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treatment by purgation that skilled advice is called in. Treatment by purgation was probably as common in the past as it is at present. Thus in the year 1885 there is the history of the boy of 15, who had a violent attack of abdominal pain which proved ultimately to be appendicitis. This set in during the afternoon. He was given some gin and water and an ounce of Epsom salts at once. During the night he was given another ounce of Epsom salts. This failing in effect, some jalap was administered and in the middle of the next morning an ounce of castor oil, which made the boy sick. This is an extreme example of thoroughness with variety practised in the home circle. It is reasonable to believe that in the days of medical treatment of appendicitis purgative treatment at home occurred just as it so often does now; the mischief was aggravated and at its worst before the patient was seen by his medical adviser and sent into hospital. If treatment outside has already been such as to aggravate the disease to the severe type on admission, as Tanner has shown, the exhibition of opium after admission in the expectant era is unlikely to alter the type. In other words no change in methods of treatment accounts for any increase in severity, for the antecedent factors are alike in the two cases, and in both the mischief is done before hospital treatment can be carried out.

If, as is shown later, the stercolith is the factor making for the severe phase of disease, it suggests that stercolith formation has become more common.

From this statistical survey I now turn to the investigation of certain conditions which have been considered etiological factors in acute appendicitis. These are constipation, kinks and bends, vulnerability of the blood supply and thread-worms.

(A) **Constipation.** This can be completely eliminated. In the majority of cases of acute appendicitis the patient will

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give the history that his bowels are and have been perfectly regular. In fact I go so far as to say that the complete absence of any history of constipation favours the diagnosis of acute appendicitis in a doubtful case. Taking 40 consecutive cases of acute appendicitis, regularity of bowel action was found in 32 cases (80 per cent.), constipation in eight cases. The constipated patients are usually middle aged or elderly people. Constipation as a factor has often been attributed to stagnation of faeces in the appendix from back pressure in a loaded caecum. A loaded caecum is rare at operation. Examination in most cases gives the impression of emptiness.

Of the eight cases of constipation, in five the lumen of the appendix was empty, in two a small and insignificant quantity of mucous or muco-faeculent material was present, and one case was obstructive with a stercolith present.

That mere stagnation is not sufficient is shown in two cases of ring carcinoma of the ascending colon just above the caecum, where from chronic obstruction the caecum and neighbouring small bowel were dilated and hypertrophied. The appendix was also distended throughout but quite empty. Again I had the opportunity some years ago of seeing a post-mortem examination on a man who suffered from megacolon with a girth of 45 inches. The whole of the large intestine from caecum to the pelvi-rectal juncture was dilated and tortuous, as were also the ureters. The appendix was quite normal.

(B) Fixation of the Appendix by Adhesions, Bands, and in Fossae, and the Presence of Kinks in some part of its length. No attempt will be made to deal with anatomical details. The data given here are based on operative work supplemented by a much smaller experience at autopsies on all sorts of cases. In a majority of cases at operation the caecum, lower ileum and appendix can be brought out of the