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NOTES ON APPENDICITIS.

By ALBERT CARLESS, M.S., F.R.C.S.

During the last few years so many cases of appendicitis have come under my notice that it seems desirable to add here a few remarks on the subject, gathering together some of the more important facts that have been forced on one's attention, and endeavouring to define one's position as to the vexed question of treatment.

Not long ago the very name of appendicitis was unknown in surgical text-books; typhlitis, perityphlitis, and peratyphlitis were described in works on medicine, but the true characters of the affection were but little studied. At the present time there seems no reasonable objection to the new terminology, since there is but little doubt that the appendix is primarily at fault in the great majority of these cases. One does not in the least question that true typhlitis exists, and that it may lead to a series of complications, included under the name perityphlitis, almost identical with those arising in appendicitis, but the number of these cases is comparatively small.

It is extremely difficult to gain any idea as to the frequency of this affection, but that it is extremely common cannot be called in question. Tofft, of Copenhagen, stated some years back that he had found evidences of its previous existence in 35 per cent. of all bodies that he examined after death. The conditions that lead to it are very

diverse, but it is evident that the old idea that assigned as its chief *cause* the presence of orange pips, grape stones, or other foreign bodies must be entirely discarded. It is only in a comparatively small proportion of cases that concretions are found; earlier writers stated that they were present in nearly 50 per cent., but this is much too high a calculation; Murphy and Treves both suggest about 30 per cent., but to my mind even this is too large a figure. These concretions are rounded ovoid bodies, rarely exceeding three quarters of an inch in diameter in their longest axis; they are usually laminated, showing that they have been old inhabitants of the appendix; they are formed of inspissated fæcal material, held together by mucus, and often with a considerable addition of phosphate of lime. Occasionally a small foreign substance such as a grape pip forms the nucleus. It must not be forgotten, however, that even if one grants the existence of a foreign body in the appendix, we have still to explain why it leads to an outbreak of inflammation when it has lain in this situation for so long. Possibly the final attack is due to its gradual increase in size, leading to pressure atrophy of the walls, or probably some other factor has to come into play.

I have been much impressed of late with the *rôle* that is attributed to injudicious movements, strains, twists, &c., and to my mind mechanical conditions play a much greater part in the ætiology of appendicitis than has hitherto been assigned to them. Fitz, who has investigated this subject statistically, assigns about 10 per cent. of the cases to this cause, and Treves, commenting on these figures, states that he thinks them too high. My own cases have been, I fear, too few to warrant any statistical statement; but certainly in a considerable proportion injury or some injudicious exercise had been present immediately before the attack, and might certainly have been an important accessory. Thus I saw last summer at Ramsgate, with Dr. Parker of Rickmansworth, an architect who had been in bad health for some time, in consequence of dyspepsia and general asthenia; he had enjoyed a heavy meal of new bread and apples, and then proceeded to take part in a display of agility, consisting in jumping over chairs, forms, &c., and

the same night a severe attack of appendicitis started. The ingesta to which the outbreak might have been attributed could scarcely have had time to bring it about. Certainly the effect of mechanical influences in determining relapses cannot be gainsaid; as a result of the first attack the appendix becomes bound down, probably at its apex, to some of the surrounding tissues, and the result of sudden exertion may be to stretch or tear these. This is particularly likely to follow if the appendix is placed posteriorly and contracts adhesions to the fascia over the psoas muscle.

The structure and position of the process also lay it open to inflammation from very slight causes. It is a degenerate organ, having practically no function in man, and being apparently of no use. It has, therefore, a very small blood supply, derived in the male sex from one single twig of the ileo-colic artery; in the female there is a small additional supply from the right ovarian trunk, and it is possible that this may explain the fact that appendicitis is nearly four times as common in men as in women. Then, again, the appendix is entirely surrounded with peritoneum, being attached to the cæcum by a definite mesentery or meso-appendix, and hence it is freely moveable. Its length varies considerably, but in all the cases that I have operated on it was long, at least three or four inches, and thus its mobility and length permit of its being doubled over or displaced in such a way as to cause it to kink, or to lead to obstruction of the nutrient artery. In furtherance of this idea, the fact may be mentioned that one usually finds the appendix on operation doubled on itself, any perforation present being located either at the convexity of the kink, or at the tip, the spot one would expect to atrophy if the nutrient vessel were obstructed.

In all probability the direction taken by the appendix is an important ætiological factor, since if it is directed downwards and backwards, it is much more likely that fæcal material will find its way into it; certainly the impression received by me from the operations that I have undertaken and seen is that the appendix is usually found behind the cæcum and directed more or less downwards. The *Bacillus coli* is a constant inhabitant of this cul-de-sac, and should

the communication with the intestine become obstructed it is easy to see that another potent predisposing element is added to the picture.

Turning now to pathological anatomy, it is essential to realise that the trouble is from the first of an infective nature, due to the migration from the intestine of organisms, prominent amongst which is the *Bac. coli communis*. Not unfrequently ordinary streptococci are also present in the early stages, but it has been shown that the bacilli usually gain the upper hand in a short time, and unquestionably in cases that come to operation the latter organisms make their presence markedly evident by the penetrating odour of the pus. The germs attack the walls of the appendix, and find their way into the abundant lymphoid tissue present in the submucous tissue; there they develop, and possibly an intra-mural suppuration is the result, the walls becoming yellow from many purulent foci. In other cases ulceration or gangrene rather than suppuration occurs, and then the peritoneum is quickly affected, and according to the rapidity and virulence of the attack, a localised or diffuse peritonitis results. It is on the extent of the peritoneal complication that the prognosis of any particular attack chiefly turns, and from this point of view three main divisions of acute appendicitis may be described: (1) that associated with merely a plastic peritonitis, leading to adhesions, but not resulting in purulent infection; (2) that in which a localised abscess develops, which is always primarily intra-peritoneal, and limited by a zone of protective adhesions; and (3) that accompanied by an acute diffuse peritonitis. In both of the latter divisions the appendix is likely to be in a condition of ulceration, perforation, or gangrene.

It must not be imagined, however, that the only dangers of this affection are due to the peritoneal trouble. A very important and serious element exists in the fact that the venous system is occasionally infected, and that pyæmia may result therefrom. The venules in the meso-appendix become thrombosed, either by direct extension from the inflammatory focus in the walls or by the kinking or torsion of the process, the thrombus being secondarily infected from the bowel. Emboli are detached from this and carried up

to the subdivisions of the portal vein in the liver, leading to portal vein pyæmia or pylephlebitis, as evidenced by high fever with recurrent rigors and distinct hepatic tenderness; true general pyæmia may subsequently develop. Another venous complication that may arise is thrombosis in the iliac veins, leading to the so-called "white leg;" this is probably due to pressure of an inflammatory mass upon the venous trunks in the iliac fossa. In addition to all these phenomena it must not be forgotten that toxæmic symptoms of a marked character manifest themselves, and that a considerable depreciation of the general powers quickly ensues from this cause, and may render an operation fatal which, undertaken under more favorable auspices, would have been successful. Some months back I was called in to operate on a young lady who had been allowed to remain in a febrile state for six weeks with a large abscess in the iliac fossa; at the time of operation there were additional symptoms of peritoneal invasion, but although the proceeding was a simple one, and the abscess easily found and opened, yet the shock was sufficient to produce a fatal issue from cardiac failure. At any time during the preceding six weeks an operation would have been justifiable and probably successful, but the condition of general asthenia from continued toxic poisoning sufficed to turn the balance in the wrong direction.

Into the *symptomatology* of appendicitis space forbids me to enter at all fully, but a few points suggested by some of my cases must be alluded to. The general features of an attack are sufficiently well known, and the usual clinical picture is very characteristic. The sudden onset of pain referred to the right iliac fossa, as also fever, vomiting, and constipation, are the cardinal phenomena. On careful examination patients usually refer their pain to what is now known as McBurney's spot, *i. e.* a point 1½ inches inwards from the anterior superior iliac spine along a line drawn from it to the umbilicus, and corresponding with fair accuracy to the attachment or base of the appendix. The pain is increased on any movements of the abdominal parietes, and hence the right leg is usually kept well flexed, and the overlying muscles rigidly contracted. The fever necessarily

varies with the character of the attack, rarely running above 101° in the mild cases; in an acute localised abscess the temperature at first is often very high, but it is not at all unusual to see it drop in a few days, probably as a result of toxæmia; in patients with diffuse peritonitis there is frequently but little pyrexia, the temperature not rising much above 101°. On palpation one frequently finds a mass occupying the right iliac fossa, which consists of coils of intestine matted together over and around the inflamed appendix. It is sometimes tympanitic, but may be quite dull. The outline of this mass is likely to be blurred and indistinct if there is much concurrent distension of the small intestine, and in cases where the appendix lies behind the cæcum there may be neither dulness nor tumour to be detected.

The formation of an abscess is not necessarily associated with any increase either of the local or of the general disturbance, and one must never be tempted to wait for fluctuation before determining as to the necessity of an operation. Thus in one of the cases I have already alluded to, the patient was taken ill on the Friday night; the temperature was high, and there was continuous vomiting and constipation. He was carefully treated, and when I saw him on the following Wednesday the temperature had fallen to the normal, the vomiting had ceased, and a natural motion had been passed. The abdomen was tense and tympanitic, but not particularly tender; the only symptom that caused much trouble was hiccough. Naturally one concluded that the stress of the inflammatory mischief was over, and that the distension would be relieved by evacuation of the bowels. This was undertaken by means of enemata and calomel, and the hiccough ceased, although the distension continued, and on Saturday, when I saw him again, was as marked as ever. Operation was then decided on, and on raising the cæcum from its bed an abscess of some size was found, connected with a kinked and perforated appendix.

The direction taken by the pus necessarily varies considerably with the position of the appendix; if it is situated on the anterior aspect of the cæcum, the abscess tends to point through the anterior abdominal wall, causing it to become red and œdematous. If, however, the appendix is located

behind the cæcum, the pus may remain limited to one of the pouches behind that viscus, or if allowed to collect in any quantity may burrow in several directions. Thus it may perforate the posterior layer of serous membrane, and get into the retro-peritoneal tissue, either coming to the surface just above the iliac crest, or travelling up behind the peritoneum to point below the ribs, perhaps on the opposite side of the body, or even getting into the connective tissue behind and above the liver, constituting a subphrenic abscess. One other fact of importance must be remembered, viz. that a retro-cæcal abscess may burrow downwards behind the rectum and form a large intra-pelvic collection of pus, particularly when the appendix is directed inwards and downwards, as is so commonly the case. Under these circumstances pain and tenderness can be detected on rectal examination, and this means of investigation should never be neglected. In one of my patients there was no sign of local tenderness on examination of the iliac fossa, but distinct pain was elicited on making a high rectal examination, and on operation an abscess was found behind the cæcum, and tending to spread downwards.

Turning now to the subject of *treatment*, one is at once confronted with the much vexed question as to the circumstances under which operation ought to be undertaken. On the one hand there is the extreme American school which teaches that every case should be treated actively by the surgeon within twenty-four hours of the onset, and on the other may be ranged the vast proportion of British practitioners who still persist in the belief that operation should only be performed late in the course of the case, and when definite suppuration or peritonitis is present. There is much to be said on each side, and facts and figures could be quoted upholding the ideas of each school of thought. Figures are, however, proverbially untrustworthy, and readily twisted to prove anything. The subject needs to be approached without bias, and exaggerations on each side must be avoided. Two or three introductory facts must ever be kept in mind:

1. There is a considerable proportion of cases which get perfectly well under ordinary medical treatment. We

grant that point, say the advocates of operation, but at what risk! and how prone these cases are to relapse!

2. The statistics of cases admitted into surgical wards for operation have been very unsatisfactory, the mortality being terribly high. This, again, must be admitted, but the explanation is not far to seek. The high mortality of operations for appendicitis is due to surgical assistance being sought too late; either the general peritoneal cavity has been infected before operation, or the patient is so profoundly poisoned or so much exhausted by the preceding inflammatory phenomena that the shock of the operation is sufficient to destroy his life.

3. When acute general peritonitis exists there can be no question as to the method of procedure which holds out the only hope of cure, viz. operation, but unfortunately the prognosis here is only too unsatisfactory; very few of the patients attacked in this way will be saved.

4. Another important point to remember is that no one can exactly anticipate the course which will be taken by any particular attack. All the different types start very much alike, and the uncertainty that enshrouds the prognosis is one of the most important arguments in favour of early and active interference; in other words, the surgeon ought to operate whilst the disease is limited, and has not got out of hand.

Excluding, therefore, on the one side the mild cases that only require medical treatment, and on the other those fulminating cases of acute peritonitis which are certain to be fatal apart from early and energetic surgery, and omitting entirely any consideration of chronic or relapsing appendicitis, there still remains a large group intermediate between the two former, characterised by well-marked local and general phenomena, the outcome of which is always a matter of anxiety. It is in these patients where the temperature runs high, where the local tenderness is excessive, where vomiting and constipation are urgent, and perhaps a distinct swelling forms in the iliac fossa, that surgery is so valuable at an early stage.

The considerations that have led me to take up a definite position in favour of early operation are very numerous, and some of them have been already alluded to.

1. One can never be certain that the infection of the peritoneal cavity will be limited to the neighbourhood of the appendix. A zone of strong adhesions may develop, but the practitioner can never be quite positive as to this point; and even should they form, it is always on the cards that they are incapable of checking the onward progress of the infection. Early operation and removal of the appendix will in careful hands prevent any such catastrophe.

2. If the disease is allowed to run on, the patient's general condition rapidly depreciates as a result of toxæmia; cardiac failure is a consequence of late operation, and is probably due to the influence of the toxines on the heart muscle. The shock produced by an early operation is comparatively slight, and the fact that several American surgeons have been able to publish lists of hundreds of cases operated on early with a mortality well below 5 per cent., speaks eloquently as to the value of such a proceeding.

3. The removal of the appendix is always a desirable step in the operation, but when such is delayed until a well-marked abscess has formed, removal often becomes impossible. The appendix is frequently embedded in the abscess walls, and even if found its walls are rotten and friable, so that in some cases all one can do is to tear it away, or perhaps ligature its base, at the same time expressing a pious hope that a fæcal fistula may not follow. Moreover, it must not be imagined that an inflammatory attack, sufficiently intense to cause an abscess, is always capable of determining occlusion of the appendix and a consequent immunity from the risks of recurrence. It has been shown by Stimson and others that relapses under these circumstances can not only occur, but that the appendix may be found free from adhesions; and certainly in one of my own cases this condition was present. I had opened an acute appendix abscess in a woman, and was unable to find and remove the process; the wound was allowed to heal by granulation, and a year or two later I had to operate again for a ventral hernia which had developed. The peritoneum was opened, and I took the opportunity of investigating the state of affairs in the iliac fossa; the appendix was then found free from adhesions, but thickened, and with its

intestinal end stenosed; at the apex was a bulbous dilated portion containing offensive mucoid secretion, which was certain sooner or later to have lighted up another attack.

Early operation enables one to remove the appendix in almost all cases. The adhesions present are slight, and are easily separated without causing much bleeding; the matting of the parts together is so limited that one can readily reach the focus of the mischief; the appendix itself is usually firm enough to enable one to amputate it satisfactorily, and therefore a fæcal fistula is less likely to form; the operation need not take many minutes, and hence shock is minimised; the incision can often be much shorter, and the wound, even if it cannot be safely closed in its entirety, need not be left widely open for the removal of gauze stuffing, and therefore the risks of the subsequent development of a ventral hernia are much less. Again, relapses are entirely prevented, and the necessary limitation of diet and exercise, which is such an important measure after the cure of a bad attack of appendicitis by medical means alone, is not required. The patient is left quietly in bed for three weeks or more, according to circumstances, and at the end of his convalescence returns to his ordinary avocations without any prolonged period of medical supervision.

It must be clearly understood, however, that what is meant here by early operation is a proceeding which is more nearly akin to American ideas than to those usually held in this country. Treves, whose reputation in this branch of abdominal surgery is well founded, states that in his opinion operation, though justifiable on the fifth day, is rarely needed during the first week, and that the essential feature in this treatment consists in "a free incision down to the inflamed area as soon as there is evidence that suppuration has taken place" (Clifford Allbutt's 'System of Medicine'). With this opinion I cannot agree. The facts brought forward by me above are to my mind quite sufficient to justify the surgeon in *anticipating suppuration*, and I cannot but believe that a more frequent recourse to operative proceedings would diminish the death-rate of this disease. Certainly one has often regretted delay in treatment; I have never known or heard of a case where one could be

blamed for operating too soon. Hence the rule of treatment which I would submit as justifiable is — *That if under suitable medical measures the condition is not at a standstill or actually improving at the end of forty-eight hours, operation should be undertaken.* Of course there are exceptions to every rule, and this must not be taken as a rigid, inflexible dogma; exceptions to it will occur, and must always be allowed for. The surgeon under these circumstances will not wait for œdema or congestion of the abdominal wall, or for the existence of fluctuation. The patient when first seen is put to bed and kept absolutely quiet. If constipation has been previously well marked, an enema should be administered to clear away irritating material from the lower bowel. The diet is restricted to fluids, and possibly if vomiting is very urgent rectal alimentation may be needed. Hot fomentations should be applied to the lower part of the abdomen, and a little morphia ordered. This treatment should continue for forty-eight hours, unless signs of general peritonitis are already present; if the symptoms persist or are becoming aggravated at that time, operation should be resorted to without hesitation. As particularly bad signs may be mentioned (i) a rising temperature, (ii) a falling temperature with increased rapidity of the pulse, indicating a steadily progressive toxæmia, and (iii) the existence of hiccough or fæcal vomiting.

As to the details of the operation, space forbids me to give more than the baldest outlines. The best incision is an oblique one, corresponding to the fibres of the external oblique, and located nearly parallel to Poupart's ligament and above its outer third; it should pass through McBurney's spot. The abdominal muscles are cleanly divided, and the peritoneum opened; the greatest care should be taken in incising this latter structure, as the cæcum may be intimately adherent to its under surface, and then runs considerable risk of being injured. In some cases the appendix will at once present, but not uncommonly it has to be carefully looked for. Possibly the omentum is adherent across the face of the cæcum, and must first be detached or divided. The cæcum is then gently lifted from its bed, and the appendix is very commonly found behind it. Some assistance may

be gained by remembering the fact that the three bands of longitudinal muscle fibres converge to form the outer muscular coat of the appendix. When once found the process is freed from its connections, the meso-appendix being, if need be, ligatured and divided. Sometimes all one can do is to tie the base of the appendix with a silk ligature; but if practicable, a definite amputation should be undertaken. The serous and muscular coats are divided by a circular incision about one centimetre from the cæcum, and turned back like a cuff from the central tube of mucous membrane. This is then ligatured, divided, and purified by touching with pure carbolic acid; the sero-muscular cuff is then drawn forwards again and sutured securely over the divided mucous membrane.

The question of drainage cannot be treated dogmatically; the character of one's practice must depend upon the case. If pus has been present, it is probably wise to insert a large tube, and stuff strips of gauze into the interstices of the wound around it; but if suppuration has not occurred, the tube may be dispensed with, and merely a gauze packing utilized, the amount of which is dependent on the condition of the appendix and the probable extent of the bacterial invasion. The closure of the wound will also vary considerably; the larger the amount of stuffing, the fewer the stitches which are inserted.

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