A SERIES OF CASES OF APPEN- DICITIS IN CHILDREN.*

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In submitting for your consideration a series of cases of appendicitis occurring in children, we wish to draw attention to certain points which have appealed to us as being of special importance and to the conclusions we have drawn therefrom. All the patients were children under 13 years of age, and all were treated in the Aberdeen Royal Hospital for Sick Children. Out of a total of 200 cases, 126 were admitted and operated on during an acute attack.

Table showing the Condition in 200 Cases of Appendicitis in Children.

Chronic and recurrent	74
Acute cases (126):	
Acute catarrhal	28
Acute catarrhal with pelvic abscess ...	1
Acute catarrhal with spreading peritonitis ...	2
Acute gangrenous	10
Acute gangrenous with commencing or localized peritonitis ...	10
Acute gangrenous with spreading or diffuse peritonitis ...	35
Gangrenous with multiple abscess ...	7
Gangrenous with localized abscess not adherent to the anterior abdominal wall ...	24
Appendicular abscess adherent to the anterior abdominal wall ...	6
Appendicitis complicated by intestinal obstruction (catarrhal 1, gangrenous 1, with abscess 1)	3
	200

The mortality in the acute cases was 19, or 15 per cent. This includes one death under an anaesthetic. In the chronic and recurrent cases there was no mortality.

Two deaths occurred from intestinal obstruction complicating appendicitis, 2 from subphrenic abscess (1 + empyema). The other fatal cases were cases of diffuse peritonitis or of multiple abscess. In these cases (with one exception) the symptoms had been present in some degree for several days before admission, and in all of them the patient's general condition at the time of admission was very bad. Two cases developed septic pneumonia several days after admission, and died. In a few cases recovery was complicated by pleurisy, with a moderate amount of effusion which cleared up. In one case a small interlobular empyema was discovered about a month after operation for acute diffuse peritonitis.

No case of "ether pneumonia or bronchitis" occurred in the whole series, and no case of "delayed anaesthetic poisoning." One case of acute intestinal obstruction occurred two days after operation for acute gangrenous appendicitis. A piece of omentum was found fixed by a fresh adhesion to the lower end of the ileum, and the bowel above this was widely distended. This was relieved by operation, and the patient recovered.

The appendix was not removed in any case where there was an abscess adherent to the anterior abdominal wall, nor in several cases of localized abscess not adherent to the anterior abdominal wall. In all the other cases it was removed. In a small proportion of cases (about 6), where drainage had to be carried out for a prolonged period through a paracentral incision, a ventral hernia appeared some time after. A post-operative hernia has not been observed in any case where a simple muscle-splitting side incision was used, nor in any case where a paracentral incision was used and was sutured up at the time of operation.

* Read by one of us (A. M.) before the Aberdeen Medico-Chirurgical Society.

DETAILED REVIEW OF SIXTY ACUTE CASES.

A more detailed and uniform system of case-stating recently introduced has enabled us to make a more accurate study of the individual cases than was previously possible, and a closer review of the notes on 60 of the most recent acute cases seems likely to be of value. In this series there are not included any cases previously reported.¹

Of these 60 cases, 11 were acute catarrhal, 1 acute catarrhal with pelvic abscess, and 1 acute catarrhal with diffuse peritonitis; acute gangrenous, 6; acute gangrenous with commencing or localized peritonitis, 3; acute gangrenous with spreading or diffuse peritonitis, 21 (1 with perforation of the caecum); acute gangrenous with localized abscess, 13; acute gangrenous with multiple abscess, 4.

The ages of these patients ranged from 3 to 13 years. There is a history of previous attacks noted in only 10 of these cases.

With regard to symptoms, the classical symptoms of abdominal pain and tenderness, and vomiting or sickness, accompanied by some elevation of the temperature and of the pulse-rate, appear to have been present in practically all these cases; but frequently one of these symptoms predominated over the others. A difficult stage for diagnosis of the exact intra-abdominal condition is in many cases just after the initial storm, when the pain, tenderness, and sickness have passed off or moderated. At this time one is very apt to think that the patient is improving, but for the fact that the pulse-rate is steadily increasing, a point for the observation of which repeated examination is necessary.

Except in several cases of localized abscess, in every other case in this series note has been made of the fact that abdominal respiratory movement was greatly diminished, and this is a most important point in cases in which tenderness and rigidity are not well marked—for example:

CASE D.—Female, aged 4. Two days before admission an attack of sickness and vomiting, with complaint of abdominal pain. Tenderness was made out (at the commencement of the attack) about the umbilicus and in the right iliac fossa. On admission the child looked very ill; pulse-rate 144, temperature 101°; no rigidity or tenderness could be made out after careful examination, and nothing definite could be made out from rectal examination; but, on the strength of the history, the pulse-rate, and on account of the fact that there was practically no abdominal respiratory movement, the abdomen was opened, and a large collection of pus was found in the pelvis communicating with a smaller collection, which surrounded a gangrenous appendix lying high up in the right iliac fossa. But for the fact of there having been no abdominal respiratory movement this patient would probably not have been operated on at once.

Dr. Sandeman has recently drawn our attention to the fact that in acute peritonitis in children a very frequent attitude for the child to adopt is to lie with the back of the head supported by both hands. The explanation of this appears to us to be that this position helps to keep the abdominal muscles fixed, and also allows for a freer movement of the thoracic muscles employed in respiration.

In those cases in which a gangrenous appendix was found surrounded by a small collection of pus completely shut off behind the caecum or the ascending colon it has been noted that muscular rigidity and superficial tenderness on palpation often appeared later in the course of the attack than is usually the case.

The Significance of Diarrhoea.

In 6 cases diarrhoea was a prominent symptom; 4 of these 6 cases died and in all a diffuse peritonitis was found at operation. Such cases appear often to be misleading, as the appendicular symptoms are apt to be overlooked, the case being regarded at first as a simple enteritis. It would also appear that cases of appendicitis in which diarrhoea is present at the beginning of the attack are usually of a specially virulent type, and that the prognosis in such cases should be specially guarded, even although there has been no delay in recognizing that appendicular trouble is present. The history of one of these cases (Case 1) is of interest:

The patient—female, aged 4 years—took ill three days before admission with sickness, vomiting, and diarrhoea, and complained of severe abdominal pain. An aperient medicine was given by the parent. Symptoms continued, and a doctor gave

an opiate, which gave apparent relief, but on the third day the condition was critical, and tenderness was made out on palpation in the right iliac fossa. At operation a gangrenous appendix was found, with an extensive spreading peritonitis.

In cases of enteritis accompanied by abdominal pain, but without appendicular trouble, one finds that if any abdominal tenderness be present, it is usually over the regions of the transverse or, more likely, the descending colon, although it must always be kept in mind that inflammation in an appendix which is situated up under the liver may simulate this.

Frequent Micturition.

In 4 cases there is a history of pain and frequency of micturition. It is noteworthy that painful and frequent micturition is present when the inflammation is localized in the pelvis, as in an inflamed appendix adherent in the pelvis, in a localized pelvic abscess, and sometimes in the early stages of a spreading peritonitis, when the appendix occupies a low situation. When pus is not bound down in the pelvis, a diffuse septic peritonitis does not seem often to be accompanied by these symptoms. Such localized pelvic mischief is generally easily detected by rectal examination when this is tolerated, as in two cases where it was noted (before operation) that rectal examination elicited great tenderness only when pressure was made toward the upper part of the right side of the pelvis. In each case a gangrenous appendix was found lying at the brim. Otherwise rectal examination has not proved of much value, and it is often not tolerated by young patients. One case of pelvic abscess is of special interest. There had been complaint of pain and frequency of micturition, the frequency amounting almost to incontinence. On the abdomen being opened in the middle line, the bladder was found distended almost up to the level of the umbilicus, although the patient had passed 5 oz. of urine immediately before operation. A large abscess was found below the bladder, which, by its upward pressure, had practically divided the bladder into an upper and a lower compartment.

In a larger number of cases a bacteriological examination was made, and in the majority of cases a streptococcus or *B. coli*, or, more commonly, both together, were found present.

Prognosis.

Out of these 60 acute cases there is a mortality of 9. In 4 cases diarrhoea was from the first an outstanding symptom. All of these cases appear to have had a high degree of infection from the first, and the presence of the diarrhoea may possibly have accounted for the fact that none were sent to hospital before the third day of their illness. In each case the general condition on admission was very bad. Another patient was ill for three weeks before admission with a left-sided pleurisy, and the exact date of the onset of his appendicular trouble is very uncertain. On admission a gangrenous appendix, with spreading peritonitis, was found. A great many recent adhesions were found about the lower end of the ileum. One week after his first operation he developed signs of acute intestinal obstruction, for which an ileo-colostomy was done, but a fistula developed two days later, and he did not recover.

A case of multiple abscess from a gangrenous appendix died three and a half hours after operation. The history was one of seven days' illness. Aperiants administered by the mother failed to relieve his early symptoms, and after this he was treated with repeated doses of opium for three days and then sent into hospital, as his condition had become very grave.

A male child, aged 3½ years, was found, after a five days' illness, to have a gangrenous appendix with perforation of the caecum and a spreading peritonitis. The appendix was removed, the perforation closed, and the pelvis drained, but the child died from toxæmia fifteen days after operation. In this case there was a suspicion of typhoid fever, but blood examinations proved negative.

A diagnosis of tuberculous peritonitis accounted for three weeks' initial treatment of a case of periappendicular abscess. At operation a gangrenous appendix was found with a large abscess. The appendix was removed without any special difficulty and the abscess drained. The wall of the caecum appeared to be very unhealthy, and a fistula developed in several days. An attempt was made to close this by a second operation, but it was not permanently successful, and the patient died from inanition about six weeks after the first operation. One case of diffuse peritonitis developed a basal pneumonia on the fifth day after operation and died three days later.

In reviewing these cases the most striking point to be noticed is the direct bearing which the duration of illness has on the severity of the patient's condition on admission, on the length of time occupied in convalescence, and on the death-rate. No case operated on in the first or second day of illness died. The average period of illness in the fatal cases was six days.

Although in several instances a dose of opium was given before the patient was sent off on a long journey to hospital, in only two cases is there any record of opium having been given in repeated doses as part of treatment. In both these cases the patient's condition on admission was very grave, and both died. The figures shown at the beginning demonstrate the strikingly large proportion of cases in which gangrene of the appendix with peritonitis was present, and this is the more striking when one knows that a great number of these patients were sent to hospital as soon as possible after the first visit of their medical attendant. In this connexion, we think it right to draw attention to the fact that in several of the best textbooks the virulent character of appendicitis in early life is not sufficiently emphasized. In Keen's *System of Surgery* we find the following statements in a paragraph on appendicitis in children:²

Suppuration is the rule, but general peritonitis is less frequent.

The appendix of infants is not so prone to perforation or gangrene.

The omentum comes to the rescue more frequently and earlier in children than in adults.

Our experience has been in direct opposition to these statements. The percentage of cases of diffuse peritonitis has been much greater in children than in adults. Gangrene and perforation are extremely common. While operating for appendicitis and for other abdominal conditions, we have frequently remarked on the fact that the omentum appeared to be relatively small, and we have often found that no attempt has been made on its part to shut off an inflammatory focus which may have been present for several days.

Acute appendicitis in a child is therefore a most serious condition. In many of our cases the intra-abdominal condition was much worse than the clinical symptoms gave one any indication of. In short, these cases are always worse than they appear to be. We have had several cases of diffuse peritonitis with stinking effusion where the children had been playing in the street within twelve hours before admission to hospital. In several other instances patients have walked into the out-patient department complaining of indefinite abdominal discomfort, and on examination large localized pelvic abscesses have been found. Most of these gave some history of a short illness having occurred about a week previously.

Although no death occurred in any of the cases operated on within the first twenty-four hours, in many the extent of the peritonitis and the fetid character of the effusion necessitated prolonged drainage.

CONCLUSIONS.

A consideration of the foregoing confirms our previous opinions¹ as to the type of acute appendicitis most commonly found in children, and as to the line of treatment likely to give the best results. It appears to us to justify the following conclusions:

That acute appendicitis in children is a not uncommon disease.

That it is possible to recognize it with greater accuracy than was previously the case.

That a great number of acute cases will end in a diffuse peritonitis.

That it is impossible for any one to correctly prophesy how any given case may terminate.

That complaint of abdominal pain, especially when accompanied by sickness, should always provoke most careful inquiry and examination.

That the increasing appreciation on the part of the laity of the possible significance of these symptoms is tending to lessen the death-rate from appendicitis.

In such cases, until acute appendicitis can be excluded by the medical attendant, the patient must be kept under especially careful observation, and when appendicitis has been diagnosed, or even strongly suspected, the case should be treated surgically.

Then, further, that no aperient medicine should be given by the mouth or by any other route.

That all food should be withheld, and rectal salines may be given after the lower bowel has been cleared by an enema. Whenever an acute abdominal condition is suspected the patient should be kept in a semi-recumbent position, in order that any septic products may gravitate to the pelvis instead of tending to become diffused throughout the upper abdomen. This point needs emphasis, as it is by no means systematically attended to.

That under no circumstances should opium be given to a child whose symptoms in any way suggest the possibility of an acute abdomen being present, although in cases where a definite diagnosis has been made a single dose of opium sufficient to relieve pain is of the greatest advantage to a patient who has to travel some distance to hospital.

In this connexion we suggest that it would be of advantage to the community if cottage hospitals throughout the country could more fully utilize the services of experienced operators for the treatment of acute cases occurring in their immediate neighbourhood.

Lastly, that it will be of advantage to the medical attendant himself, and therefore to his patients, if, where at all possible, he makes a point of being present at operation on a patient whom he has had under his observation, and whom he has sent into hospital for treatment.

REFERENCES.

¹ Mitchell, Contribution to the Study of Appendicitis in Children, *British Journal of Diseases of Children*, 1912. ² Keen's *System of Surgery*, 1908. The Surgery of Appendix Vermiformis, by John B. Murphy, M.D.

SOME OBSERVATIONS ON THE OPERATIVE TREATMENT OF FRACTURES BY METAL PLATES AND SCREWS.*

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THESE observations do not profess to be complete, but raise certain points which seem worthy of consideration and discussion. They are based on 25 cases of operation on the long bones in adults by Lane's plates and screws, and on a survey of some of the recent literature of the subject.

Preliminary Remarks on Non-operative Treatment.

It ought to be an axiom that every paper on the operative treatment of fractures should start by emphasizing the necessity and importance of the frequent study and practice of non-operative treatment, and such necessity I desire to emphasize. Particularly does the necessity arise in hospitals with attached medical schools, whence the students go to all parts of the world to practise under all manner of circumstances—it may be far from hospitals, from *x-ray* apparatus, from special environment, and from specially skilled hands. Many fractures do not need, many cannot get, operative treatment. Fractures are common, occur anywhere, and often have to be treated where they occur. Just as the *x-ray* should not supplant other methods of diagnosis, so the operative should not cause to be ignored other methods of treatment. Non-operative reduction, often only possible under full general anaesthesia, the intelligent use of suitable fixation apparatus, and the use of massage and movements may none of them get full attention in hospitals where operative treatment is entirely the vogue. There is an obligation upon surgeons, particularly those engaged in teaching, to see that the non-operative treatment of fractures is never neglected.

Selection of Cases for Operation.

The cases for operation can be divided broadly into two classes: First, that in which operation is a necessity to avoid or remedy a deformed, disabled, more or less useless limb; secondly, that in which operation is more likely to give a better result—a nearer perfect limb—than no operation, although skilled non-operative treatment may be

followed by good functional recovery. Cases of the second class should never be operated on except by practised hands, with special tools and in the very special aseptic environment necessary. Given such circumstances, there is undoubtedly this large second class of cases in which better results can be obtained with operative than with non-operative treatment—results which can often be described as perfect—and the operation risks, in cases selected with due regard to the general health and the local condition, are small. Many surgical advances have been brought temporarily into disrepute, not only by the failures resulting from inexperience, but also by the selection of only difficult or late cases for operation. So with fractures, operators at first had many disappointing results; but with increasing knowledge of the imperfect end-results obtained in many cases not operated on came a widening of the operative field, so as to include easy and early cases, and this widening, coupled with improved technique, led to greater operative success, giving patients better limbs, and enabling them to live more useful lives.

Early and Late Cases.

These are two distinct classes. A case is early when the bone can be brought into perfect alignment and the broken ends and pieces imbricated. This may be possible for as long as two months after the injury. A case is late when callus and bone ends have to be removed to obtain alignment. After a week or ten days it becomes increasingly difficult, as time goes on, to obtain perfect imbrication and alignment. The late cases are much less satisfactory to operate on than the early ones. In the late cases the trauma is greater, and there is therefore more risk of sepsis and of shock; the bone ends cannot usually be got into absolutely perfect apposition; it is difficult to avoid some "winding-up" of one fragment on to the other; from removal of bone limb-shortening results. Each late case operated on is a reproach to its early treatment.

Should Fresh Compound Fractures be Operated on?

The answer to this question should not be a universal "No." When the bone has just punctured the skin and then gone back, it is best to wait until the wound is healed, retaining the broken bone in the best possible position meanwhile. Where the wound is a wide one with exposed projecting fragments, plates and screws should be used, and although there will almost certainly be more or less sepsis and they will have to be removed later, a good position is maintained, and often union in a good position results. If such a fracture is left to heal the healing may take many weeks; the operation will be difficult, through much scar tissue, to encounter perhaps irremediable deformity.

The Value of X Rays.

Much of the fascination of this class of operation centres round the beautiful *x-ray* pictures before and after operation. An *x-ray* photograph before operation, in whatever plane taken, must have the anticathode of the tube plumb over the seat of fracture; otherwise, in these "shadow pictures," the "deformity will be distorted—either disguised or exaggerated. An *x-ray* photograph after operation which shows perfect alignment and perfect position of plates and screws may not mean a perfect functional result. Such photographs may be obtained from fractures where sepsis is present, and where later in the case screws loosen and plates become displaced with accompanying deformity; or they may be obtained where there is excess of painful callus or crippling stiffness of a neighbouring joint. The conscientious operator must record his results not only in terms of *x-ray* photographs, but also having regard to all points which concern the functional capacity of the limb.

Avoidance of Shock.

In operations on fractures of the femur, particularly late operations in debilitated middle-aged patients, there is risk of death from shock. Two such late cases on which I operated died from shock. In another late case I sent the patient back from the operating table because of his weak condition, and operated later. I now operate on femur cases under spinal anaesthesia; stimulants are given before operation, food is not withheld for long; if the patient is particularly weak, subcutaneous infusion of saline is given during the operation; the operation is

* Read before the South Wales and Monmouthshire Branch of the British Medical Association, December 4th, 1913. A number of illustrative skiagrams were shown at the meeting.