EMERGENCIES IN GENERAL PRACTICE

THE ACUTE ABDOMEN IN CHILDREN

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There can be few doctors who have never missed an acute abdomen. In England and Wales from 1949 to 1953, 936 children died from appendicitis, 561 from intussusception, and 721 from other forms of intestinal obstruction. It is this background of possible catastrophe which makes every child with abdominal pain such an urgent and worrying problem. Yet the solution is by no means easy; it asks from the family doctor the prompt recognition of the acute abdomen amid the profusion of intestinal upsets which are his everyday responsibility, and from the hospital close collaboration between surgeons and paediatricians and a sufficient flow of cases to ensure that effective therapeutic skills are maintained.

It is not unfair to say that with earlier recognition, effective pre-operative resuscitation, experienced surgery, an adequate supply of fluid and electrolytes in the period immediately following operation, and the proper use of antibiotics the majority of the deaths listed above would have been avoided. The general principles which should govern our approach to the acute abdomen have already been presented in the two previous articles by Professor Milnes Walker.* We shall describe here the clinical features which are of special importance in children, and which make it possible in most cases to recognize the "surgical" emergency and at the same time to distinguish a number of "medical" conditions which may resemble it very closely. We shall also indicate, where we can, the time limits within which diagnosis should be reached and treatment started if a further reduction is to be achieved not only in deaths but also in distressing illness and the length of stay in hospital.

Symptomatology in Children

It is more important for the family doctor to suspect quickly the presence of an "acute abdomen" rather than to be correct with the final diagnostic label. The main task is to decide from the history the relationship and relative importance of pain, vomiting, fever, and alterations in bowel behaviour, and then by patient examination to assess the significance of posture and appearance, tachycardia, tenderness, increase in muscle tone, and abdominal distension. We set great store on a detailed account of the illness, taken from the person who has been in closest contact with the child, and we know that a second or even third examination after a short interval may be necessary before the physical signs can be properly assessed.

Pain.—The first essential in listening to the history is to try to decide whether the pain is continuous or intermittent, a continuous ache or an intermittent colic. For example, although in appendicitis there may be colicky exacerbations there is almost always a background of *continuous* pain, whereas the pain of acute mesenteric adenitis is *intermittent* in character. Again, appendicular pain is less severe than

the violent colic of intussusception, urinary tract obstruction, and the sharper examples of mesenteric adenitis. We must avoid being lulled into the false security of interpreting a mild continuous pain as a pain of no importance.

Vomiting is a common symptom. In both appendicitis and intussusception it may occur before the pain. The frequency and amount will vary in different children in what appear to be similar conditions, but where it is copious and persistent the probability of intestinal obstruction should come quickly to mind. In a minority of children with appendicitis and intussusception vomiting will be absent.

Fever is often present and its interpretation can be difficult. It generally occurs quite early in intussusception and is of no help in separating this from gastro-enteritis. It is usually higher in acute pyelonephritis and pneumonia than in appendicitis, but a high temperature does not exclude the latter. This is particularly the case where acute appendicitis is associated with tonsillitis or pharyngitis, or where peritonitis has already developed. Fever with peritoneal infection tends to be higher in children than adults.

Alteration in Bowel Behaviour.—This varies a good deal within the different conditions and there are many pitfalls. A newborn infant with duodenal atresia can still pass meconium. An infant with acute intussusception is rarely constipated, and many such children pass one or two apparently normal stools on the first day. Although it is unusual for an infant with acute intussusception to have more than two stools in each 24 hours, an important minority pass frequent small brown stools and are watched and treated as cases of bowel infection. Constipation, though common in appendicitis, is by no means the rule. Absolute constipation, especially with persistent vomiting, is very suggestive of complete intestinal obstruction. Where diarrhoea is the most striking feature of the illness we should think first of dysentery or gastro-enteritis, yet in our experience as many as one in eight children with appendicitis may have diarrhoea before operation.

Physical Findings

Tenderness.—If pain is the primary symptom, tenderness is the most important sign of an acute abdomen. It is assessed by noting whether the child consistently winces or attempts to pull away the palpating hand when gentle pressure is applied to a particular spot. In young children it is better not to ask whether a particular area is sore, as the reply is often misleading. In appendicitis localized tenderness is the most useful early sign, and for diagnosis within the first 24 hours it is dangerous to wait until guarding is added to it. The point of maximum tenderness varies more in the child than in the adult. The sites where it may be found in the first 24 hours are shown in the diagram on the next page.

Though the suspicion of intussusception should rest essentially upon the history and never be delayed in the home until the tumour is felt, in over half the affected children the tumour will be tender. Tenderness in mesenteric adenitis is less severe and more diffuse than in unperforated appendicitis, and though present in the right iliac fossa it may extend upwards and to the left, towards and

*See *British Medical Journal*, September 24 (p. 782) and October 1 (p. 842).

sometimes beyond the mid-epigastrium. The tenderness of pyelonephritis, hydronephrosis, or pyonephrosis is generally in the flank or loin, though in a large hydronephrosis it may be most evident in the upper abdomen.

Posture.—The natural position adopted by the child with an acute abdomen is a most valuable sign. The near stillness of appendicitis, at least during the day, contrasts strongly with the intermittent spasms of intussusception, the

The position of the appendix in a series of 112 children with acute appendicitis. The circles indicate the point where localized tenderness would have been obtainable in the first 24 hours.

restlessness of mesenteric adenitis, and the rolling about of severe renal colic. Parents can generally give an accurate account of the child's behaviour in this sense, and it is important to ask for it.

Facial Appearance.—Pallor following a severe spasm and the return of normal colour in the interval is characteristic of early intussusception. With the intermittent colics of mesenteric adenitis and urinary tract obstruction the child may be flushed throughout, or flushing may give place to pallor, depending on the severity of the attack. Many children with acute appendicitis have a cherry-red flush, sometimes with a faint trace of blue, and a circumoral pallor. Evident cyanosis usually means pneumonia, generalized peritonitis, or prolonged intestinal obstruction.

Tachycardia is the rule in appendicitis, intussusception, and other forms of established intestinal obstruction. Sometimes, however, the pulse will be scarcely raised in appendicitis, and if the child is seen between the colicky episodes of mesenteric adenitis or renal colic it can also be normal.

Involuntary Guarding.—This is a difficult sign to assess in the early stages, and it is essential to start with very light palpation away from the site of the suspected lesion. In most cases of appendicitis the increase in muscle tone will first be felt in the lower right rectus. The abdomen of the apprehensive child may at first appear rigid all over, but with a warm hand and slowly increasing pressure the muscles will relax unless increase in tone is present. It is also common to meet lower abdominal or even more widespread guarding on first examining the child with mesenteric adenitis, only to find the muscles relax as the child is involved in conversation while steady pressure is maintained.

Abdominal Distension.—Abdominal distension in a child with an acute abdomen means in most cases progressive intestinal obstruction or spreading peritonitis. It may, however, be present with acute pneumonia, and we have sometimes seen it in severe examples of mesenteric adenitis and with renal colic.

Acute Appendicitis

In most affected children the attack is the first of its kind, though as many as one child in four may have had one or two attacks of abdominal pain in the previous year. Pain

is the main symptom, and it is continuous. Though colicky exacerbations occur, the pain is generally less severe than in intussusception, mesenteric adenitis, and renal colic. A history of pain starting in the centre of the abdomen and then moving to the right iliac fossa is less common in children than in adults. The pain will often start and remain, unless perforation occurs, in any of the varied sites shown in the diagram. Vomiting occurs in nine out of ten children at some stage of the illness, and in some it will be the presenting feature. Diarrhoea is present in up to 12% of children when the appendix is situated behind the lower ileum or in the pelvis. The child lies still, on his back or right side, with his thighs flexed. He generally resents being asked to move. His facial appearance has already been described. The tongue has a fine white coating or fur, and oral fetor is generally present. The abdomen is not distended, but the lower half may move poorly with respiration. Persistent localized tenderness over one of the sites shown in the diagram, with or without involuntary guarding, is the diagnostic sign. Rectal examination is resented by the younger child and interpretation of the response is often difficult. If the diagnosis is clear without it, then it should be omitted, but if there is any doubt it should be carried out, since it may reveal an unsuspected pelvic appendicitis.

It is particularly important to remember that appendicitis does occur in young children. The picture under 3 has been vividly and accurately described by Williams.* The initial features are often deceptively general, with peevishness, irritability, feverishness, refusal of food and vomiting. What is more, the pain often seems less acute in these children, though they will say their tummy is sore and the mother generally recognizes that they are in pain. Vomiting is an almost constant symptom, and is often early and frequent. Diarrhoea also is more common than in older children, and this, with the milder pain, often leads to a delaying diagnosis of intestinal upset or infection. Yet at this age the tendency to early perforation and the development of peritonitis is greatest.

At all ages, any abdominal pain that has continued without intermission for several hours, especially if associated with vomiting, should be regarded as acute appendicitis, and expert assessment should be made at home or in the hospital as soon as possible.

Acute Non-Specific Mesenteric Lymphadenitis

This is the condition most commonly mistaken for appendicitis, and it is much more frequent. We believe that careful clinical attention is sufficient in most cases to establish the difference and so spare the child an unnecessary laparotomy. Our experience confirms in almost every detail the clear account given by Aird.† The presenting symptom is pain. This is generally central in position, but, unlike appendicitis, it is intermittent in character. Each attack rarely lasts more than 10 to 15 minutes, but some may be of great severity. In the intervals the child is entirely free from pain and much more active than any child with true appendicitis. Many of these children have had more than one previous attack of a similar kind. The child is often active in the intervals, though "twisty" and crying when the pain comes on. Vomiting will occur in a severe attack, but is less common than with appendicitis. Diarrhoea practically never occurs. Many of the children will have a history or evidence of recent pharyngitis. A clean tongue is the rule unless there is pharyngeal infection or repeated vomiting. Tenderness is less local than in appendicitis, and may spread upwards towards the epigastrium. With gentle but prolonged palpation the initial voluntary guarding will go and it is possible to feel the posterior abdominal wall in a way that would be impossible in appendicitis. The glands themselves may be felt. Mesenteric adenitis is a self-limiting though sometimes protracted disease with relapses and remissions over many months.

*Williams, H., *British Medical Journal*, 1947, 2, 730.
†Aird, I., *ibid.*, 1945, 2, 680.

There is no specific treatment or any evidence that appendectomy shortens the course of the disease. Where genuine doubt exists laparotomy should be carried out, for it is wiser to be on the safe side.

Intussusception

Intussusception mainly affects children from the second to the eighteenth month of life. The onset is sudden and the mother can often give the exact time when the initial pain or vomiting began. The pain is intermittent, is generally severe, and may be followed by pallor and collapse. Not all infants, however, respond to pain in the same way; some scream and draw up their knees, others cry loudly, others whimper and whine, while a few may be intermittently restless. The spasms may recur every few minutes, or at intervals of an hour or more. Vomiting is almost always present in the first 24 hours, and is often the presenting symptom. One or two normal stools may be passed after the onset, but increased frequency of the motions and true diarrhoea are uncommon. When blood is passed spontaneously from the rectum in association with the above picture the diagnosis is almost certain, but in nearly half the children blood is absent on that vital first day. Fever is often present, even in the first 24 hours, and is not a pointer in itself to intestinal infection. The ability to feel the tumour requires constant practice and often sedation of the child. A strong suspicion of intussusception can be obtained from the history, and delay for repeated abdominal palpation in the home is not justified. Any previously healthy child, especially between 2 months and 2 years of age, who is suddenly seized with sharp intermittent abdominal pain and vomiting, should be regarded as suffering from intussusception and sent to hospital without delay.

Acute Intestinal Obstruction

In children, acute intestinal obstruction of varied origin is much less common than the conditions already considered; but acute obstruction carries a high mortality. It can best be considered in two age groups—newborn infants and older children. In the latter the traditional features of intermittent colicky pain, copious vomiting, and complete constipation will be present, and careful examination of the abdomen in a good light will often show early distension, palpable coils of distended gut, and even visible peristalsis. On auscultation vigorous bowel sounds are heard, in contrast to the virtual silence of a spreading peritonitis.

In the first week of life vomiting, not pain, is the main feature of intestinal obstruction. The vomiting generally begins on the first or second day and is persistent. If the vomit is golden yellow or green in colour, the presence of a duodenal atresia is almost certain. It is important to remember that such children can pass meconium and that distension affects at first only the upper abdomen, so that it is readily missed. With lower intestinal atresia, malrotation of the gut, and volvulus the vomiting may develop more gradually, but it is progressive and associated with obvious distension. Intestinal obstruction in the newborn is still associated with mortality rates between 25% and 50%. It is an excellent example of the need for early recognition, effective fluid and nutritional control, and specially experienced surgery. Early recognition will be achieved only if every genuinely vomiting infant in the first week of life is examined with intestinal obstruction in mind.

Differential Diagnosis in Children

This is a big subject, and it is possible to draw attention to only the more important points. Faced with probable appendicitis, the practitioner must first consider the possibility of urinary tract infection, pneumonia, and infective hepatitis. If urinary tract infection is imitating an acute abdomen the fever will be over 102° F. (38.9° C.), there may have been an early shivering attack, and the child will be flushed and ill. In the older child there will be frequency

of micturition and dysuria, but these are often absent in younger children, and the true explanation is revealed only by the discovery of pyuria, which may necessitate the examination of several specimens of urine before the pus is found. The pain in pyelonephritis is generally continuous. With an infected hydronephrosis there may also be phases of colic. Should the latter be on the right side it can resemble retrocaecal appendicitis. There may have been several previous episodes of abdominal pain, one at least of which will have been a severe colic and have lasted more than an hour. We have also been impressed with the number of children in whom the early pain of hydronephrosis has lacked any reference to the urinary tract and has been situated in the centre of the abdomen. A helpful point is that the child, when asked to indicate where the pain is, may give the "kidney sign," grasping the affected loin with his thumb behind and his fingers in front.

In acute pneumonia the child will be restless, with high fever and rapid respirations, nostril movements, and possibly cyanosis, and there may or may not be obvious physical signs over the affected lung when the child is first seen. A preceding history of coryza or bronchitis in the child or other members of the family will help. Shivering and delirium, which may be present in pneumonia, are almost unknown in appendicitis. At first sight pneumonia may be difficult to distinguish from established peritonitis with grunting respirations and early circulatory failure; but the length of history and the abdominal signs in the child with peritonitis should be sufficient to decide between the two conditions.

In infective hepatitis anorexia is generally an early and striking symptom: vomiting tends to be more in evidence than pain, and the latter is intermittent, usually in the upper abdomen, and is often associated with an enlarged and tender liver. Bradycardia when present is suggestive, but until jaundice appears in the patient or bile in the urine the distinction from subhepatic appendicitis may be difficult.

The most likely alternatives to possible intussusception in an infant are acute otitis media and meningitis. Severe pain at this age, whatever the site, tends to produce a similar general reaction, though the pallor and collapse which follow a severe spasm in intussusception are not found in otitis media and are rare in meningitis unless the child has had a fit. With a febrile, vomiting infant, crying, or in obvious pain, it is particularly important to examine the ears for otitis media and to look for that drowsy irritability, fullness of the fontanelle, and moderate neck stiffness which would point to meningitis. In older children with suspected intussusception Schönlein-Henoch syndrome (anaphylactoid purpura) must be remembered; here, unless the characteristic urticario-purpuric rash is present on the elbows, legs, and buttocks, the distinction may be difficult. In between the severe spasms of pain in this condition the abdomen is often free from tenderness and no tumour can be felt. Examination of the urine may reveal an associated haematuria.

The special features of obstructed and strangulated hernia and of torsion of the testis, the appendix testis, or Meckel's diverticulum will not be described here. It is wise to keep somewhere in mind that abdominal pain, vomiting, a bluish-red flush to the face, and furring of the tongue may indicate not acute appendicitis but diabetic ketosis. Except in children with Hirschsprung's disease, we have never seen constipation present as an acute abdomen, although such cases are sometimes referred to hospital as suspected acute appendicitis.

Management

The essential contribution of the family doctor to the management of the acute abdomen is its early recognition. In acute intussusception this means recognition or a shrewd suspicion and reference to hospital within 24 hours of the first symptom. It is important not to wait for the passage of blood or feeling the tumour.

In 40% of the children sent to the Royal Victoria Infirmary, Newcastle-upon-Tyne, with appendicitis in the last three years the appendix had perforated on admission. This rarely happens in the first 24 hours. Here again the aim should be diagnosis and treatment on the first day of the disease. In appendicitis, however, the responsibility for the delay in recognition rests largely with the parents. The family doctor has therefore the additional task of helping the parents in his practice and community to realize that abdominal pain in childhood should always be taken seriously. Whenever it has continued for several hours without interruption medical advice must be sought. The practitioner must also remind himself sometimes, and warn his patients always, that purgatives should never be given to a child with abdominal pain. Sedatives and analgesics, especially morphine, should be avoided in intussusception and appendicitis; and, even where peritonitis is suspected, it is wise not to start antibiotics at home.

Abdominal pain associated with vomiting and abdominal distension is an urgent call for admission to hospital, but when a confident diagnosis of mesenteric adenitis has been made the child can be cared for at home. If there is any doubt, the child should be seen at home or in the hospital by an experienced consultant, and in the latter case if the diagnosis is confirmed the child can return home under the care of the family doctor. The treatment is simply rest in bed, with aspirin, 1 gr. (65 mg.) per year of age two or three times a day, to relieve pain, and procaine penicillin, 300,000 units daily, only if the temperature is over 100° F. (37.8° C.) and a substantial tonsillitis is present. A single episode does not usually last more than a week to ten days.

Aspirin or codeine are not sufficient to relieve the pain of renal colic, and "nepenthe," one minim (0.06 ml.) per year of age three or four times in the 24 hours, should be used. There is, if required, a preparation of nepenthe suitable for injection. An acute urinary tract infection detected within the first week will generally respond to a sulphonamide alone. We use sulphadimidine in a dosage of 0.1 g. per pound (0.45 kg.) of body weight per day for eight days. Sulphonamide preparations containing sulphamerazine should be avoided owing to the risk of renal damage with haematuria. If, however, the attack is an intensification of a more long-standing infection, then admission to hospital is essential so that the organism can be isolated, the right antibiotic used, and the presence or absence of anatomical abnormalities in the urinary tract determined. A chronic urinary tract infection is a serious condition calling for persistent treatment, often for several months. Consideration of the treatment of pneumonia, meningitis, infective hepatitis, and other conditions which may imitate the acute abdomen would be out of place here. In any child with abdominal pain the urine should always be examined for pus, red cells, bile, and sugar.

The acute abdomen will always remain a serious and difficult professional responsibility, but attention to the character of the abdominal pain and the behaviour of the child, and careful examination of the abdomen, can lead to the correct management in the great majority of cases.

Next article on Emergencies in General Practice.—
"Dangerous Bronchitis," by Dr. E. Keith Westlake.

Refresher Course Book.—Copies of the second volume of collected articles from the Refresher Course for General Practitioners are still available at 25s. (postage 1s.) each. The first volume is now sold out.

Clinical Pathology Book.—"Clinical Pathology in General Practice," a collection of 39 articles on clinical pathology that appeared in the *Journal* as part of the Refresher Course for General Practitioners, is now available, price 21s. (postage 9d.).

Both these volumes are obtainable from the Publishing Manager, B.M.A. House, Tavistock Square, London, W.C.1, or through any bookseller.

BIOLOGICAL ASPECTS OF DISEASE TRANSMISSION

A symposium organized by the Institute of Biology was held in London on September 29 and 30 and October 1 on "Biological Aspects of the Transmission of Disease." This took a wide view, including veterinary diseases and also those which attack plants, and considering such theoretical matters as the evolution of animal viruses and of trypanosome parasitism, as well as the various factors which control the population of infecting organisms and hence the frequency of disease and the outbreak of epidemics. Over 20 papers were prepared and circulated beforehand as the basis of discussion.

Fungal Diseases

At the first session Dr. G. C. AINSWORTH discussed the spread of fungal diseases. Moniliasis and actinomycosis were world-wide in distribution, the causative organisms being often found in the normal microflora of the mouth without causing any illness, and rarely found apart from man and animals. Spread was probably by direct contact or droplet infection. Ringworm fungi were probably also world-wide, though the diseases they caused were geographically distinct and localized. The reason seemed to lie in unknown environmental factors, possibly in differences in racial susceptibility. *Microsporon audouini*, which causes epidemics of head ringworm in Western Europe, does not seem to establish itself well when introduced into tropical countries, while *Trichophyton ferrugineum*, which is characteristic of the Tropics, fails in Europe. In contrast, histoplasmosis and coccidioidomycosis were fungal infections of the respiratory tract which were chiefly observed in North America in geographically distinct areas.

The development of skin testing had shown that many extremely mild or symptom-free infections must occur. Histoplasmosis is endemic in the central Mississippi and Ohio valleys, and there was a good correlation between the incidence of positive skin test and the occurrence of a certain type of soil. The reservoir of infection was in the soil, and the fungus reached the lungs by dispersal in dust. *Coccidioides immitis* was probably similarly spread, though some workers thought that desert rodents, which are very frequently infected, might be the true natural reservoir of infection, which would then be a matter of contact rather than air spread. Evidently, however, human susceptibility to fungal diseases was much more important than their mode of spread in deciding the appearance of frank cases.

Dr. S. D. GARRETT took up the theme of the soil as a reservoir of pathogenic micro-organisms, but discussed only plant root pathogens, and pointed out that some of these fungi could exist freely in the soil as well as parasitically, while others could manage in dead host tissue but not otherwise. The parasite's range of capabilities decided how well it competed with other species. Dr. J. W. G. LUND (fungal diseases of plankton algae) and Dr. J. E. CROSSE (the dispersal of plant bacterial pathogens) also read papers at this session.

Pathogenic Amoebae

At the second session Dr. R. A. NEAL described the lives of pathogenic amoebae. *Entamoeba histolytica* lives in the lumen of the human gut and in a proportion of cases invades the gut wall and causes the symptoms of amoebic dysentery. Periodically, for unknown reasons, the amoebae of the lumen encyst, and on some days as many as 45 million cysts may be passed in the faeces, while on other days there are none. Spread of the cysts may be by water contamination—as in countries with primitive sanitation—or by flies and cockroaches, which may pass viable cysts for one or two days in their faeces after they have swallowed infective material. Many monkeys are naturally infected, and may be a primitive reservoir of infection. Rats also suffer, but it is thought