PARENTS, FAMILY DOCTORS, AND ACUTE APPENDICITIS IN CHILDHOOD

BY

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The problem of acute appendicitis in childhood is not yet solved. Nevertheless, because it is a common condition many of us feel we understand the disease and are satisfied with the way in which it is managed. There are some grounds for this complacent attitude in the steady fall in the number of deaths in England and Wales from appendicitis: in 1947 there were 305 deaths from this disease, and in 1957 only 69. This improvement has occurred at all ages in children in whom the appendix has ruptured, while the unruptured appendix carries a low and unchanged mortality rate of under 0.5% (Skyrme Rees, 1952; Fraser and McCredie, 1955; Mason Brown, 1956; Foster and Edwards, 1957; Minervini and Santulli, 1958).

The collective experience of these authors suggests that this improvement is due to better surgical and paediatric care rather than to earlier diagnosis. However, we cannot accept with complacency the deaths of 69 children with a curable disease, and when we turn from mortality to morbidity the situation is most unsatisfactory. Too many children still have a general or local peritonitis at operation, and many of these recover only after much suffering, anxiety, and hard work. Mason Brown (1956) said: "While some success has been achieved in retrieving the disaster of delay in diagnosis, we cannot entirely overcome the handicap which late diagnosis entails, and many of the very ill children who survived did so by a narrow margin."

Improvements in surgical and paediatric techniques have not been matched by prompter diagnosis, and there is little evidence that children are being operated on earlier. Mason Brown (1956), in Edinburgh, found that during the last three years of his survey (1952-4) the percentage of children with general peritonitis was higher than in the period 1929-51. Even more striking figures come from the Boston Children's Hospital, where Hudson and Chamberlain (1939), Scott and Ware (1945), and Longino, Holder, and Gross (1958) found that in 1928-39 43.1% of 848 children had a ruptured appendix, whereas in 1939-44 there were 45.2% of 234, and in 1944-57 45% of 1,328 had ruptured. The percentage of children presenting with a perforated appendix is therefore higher now than it was 30 years ago. This suggests that further improvements in the results of treatment of acute appendicitis are more likely to come from improvements in diagnosis than from improvements in technique or management.

In this paper a series of 313 children with acute appendicitis is analysed in an attempt to discover whether similar delay in diagnosis occurs in our community and the reasons for it. I was personally responsible for the general care of these children, and although a few years have elapsed since they were in hospital it is unlikely that there have been improvements in diagnosis sufficient to invalidate the conclusions.

Clinical Material

The children included in this study were admitted to the children's wards of the Royal Victoria Infirmary, Newcastle upon Tyne, between August, 1950, and December, 1953. The series includes those previously

reported by Hindmarsh (1954), who analysed his personal cases from a different viewpoint. All had proved acute appendicitis; Mr. D. Hindmarsh and Mr. J. D. T. Jones each treated approximately one-third, while the rest were under the care of members of the professorial surgical unit.

There were 199 boys and 114 girls in the group. Their ages are shown in Table I, and it is worth noting that 31 (10%) were aged 3 or under.

TABLE I.—Numbers of Children at Different Ages

Age in years ..	1	2	3	4	5	6	7	8	9	10	11	12
Number ..	6	12	13	17	26	28	30	29	42	45	50	15

At operation, 159 (50.8%) had simple acute appendicitis, and in 154 (49.2%) the appendix had perforated. Among these were 62 (20%) with local peritonitis, 61 (19.5%) with spreading or general peritonitis, and 31 (10%) with an appendix abscess. All children were operated on in the acute stage of the disease with the exception of 10 of the cases of appendix abscess, which initially were treated conservatively, but which had an interval appendicectomy later. There was one death—that of a girl of 9 who had a general peritonitis on admission. She later developed multiple faecal fistulae after drainage of central abdominal and bilateral subphrenic abscesses. The mortality rate is therefore 0.32%.

The abdominal complications were paralytic ileus in 94 cases, intraperitoneal abscess in 59, faecal fistula in 2, and wound abscess in 42. No cases of paralytic ileus occurred among the children with unruptured appendicitis, but there were seven intraperitoneal abscesses and 13 wound abscesses among them. All the other complications occurred among those children in whom the appendix had already ruptured: this fact emphasizes the high morbidity which accompanies perforation and shows how many unpleasant procedures the children have to undergo.

This series, then, is comparable to other contemporary series in having a low mortality rate but a high morbidity rate due to the high incidence of perforation.

Pattern of Admission to Hospital

Obviously, many factors are at work in the production of this high morbidity. In the first place it would be reasonable to expect that the longer the duration of the illness the greater the percentage of perforation. Table II

TABLE II.—Operative Findings and Duration of Symptoms

Type of Appendicitis	Duration of Symptoms before Admission (hours)					Total
	0-12	13-24	25-48	49-96	Over 96	
Simple appendicitis ..	35	57	48	17	2	159
Local peritonitis ..	3	3	23	27	6	62
Spreading and generalized peritonitis ..	2	4	21	24	10	61
Appendix abscess ..	0	0	2	9	20	31

confirms this. This gives the overall picture, and takes no account of factors such as the age of the child or the position of the appendix. It is worth noting that the complication rate rises markedly after 24 hours, and

children should be in hospital within this time if the majority of complications are to be avoided. In some instances the progress of the disease may be very rapid, since six children had generalized peritonitis even though they were in hospital within 24 hours.

Delay in admission to hospital would seem, therefore, to lead to a higher rate of perforation. But before a child is admitted his parents must appreciate that he is ill enough to warrant sending for their family doctor. The doctor in his turn has to make up his mind, not that the child definitely has appendicitis, but that he has got something sufficiently like appendicitis, or is sufficiently ill, to need treatment in hospital. It is therefore possible for delay to occur at two points: the parents may delay in asking for their doctor's advice, or the doctor may have difficulty in appreciating the situation.

The Part Played by Parents

Table III shows the time at which the family doctor was sent for in 275 out of the 313 children, the information regarding the others being not recorded, not clearly ascertainable, or not applicable. This table shows quite clearly that in many cases the parents did not appreciate the significance of their child's illness and delayed for considerable periods, sometimes for more than two days, before sending for their family doctor; it confirms Mason Brown's (1956) clinical impression that the first and most important factor is failure to send for the doctor.

TABLE III.—Time of Sending for the Family Doctor (275 Children)

Time	Number	Number Ruptured
0-12 hours	63	15 (24%)
13-24 "	80	34 (42%)
25-48 "	80	48 (60%)
Over 48 "	52	43 (83%)

It is not easy to discover all the factors concerned with this delay. Two variants which clearly play a part are the child's age and the character of his pain, and these are discussed below. When asked directly, the parents' own reason for the delay is usually that they simply had not realized their child was so ill. Their problem is, in fact, to pick out this important illness from the numerous minor illnesses and complaints of childhood, and this is not always easy.

Previous Attacks.—Recurrent abdominal pain is a common complaint in childhood. Apley (1959) found that 108 children out of an unselected group of 1,000 had a history of such attacks, and in the 1,000 Family Survey in Newcastle upon Tyne 108 (12.6%) out of 851 children had abdominal pain at the ages of 6 to 10; and at the age of 13 18.5% complained of having abdominal pain at some time (F. J. W. Miller, personal communication, 1962). In the present series 41 children had a history of previous attacks, which, from their duration and character, might well have been due to appendicitis, and 64 other children had had attacks of abdominal pain of some sort. It was thought that, with familiarity breeding contempt, the parents of these children might have delayed in sending for their doctor, but there was no evidence of this: in fact, the doctor was sent for rather earlier, as if there was increasing anxiety about the persistence of the attacks.

Social Status.—Social factors seem less important than might be expected: 24 out of the 46 children whose parents were in social classes 1 and 2 arrived in hospital with a ruptured appendix, the same proportion as in the whole series.

Parental Capacity.—A rough estimate of the level of parental care showed that, even when this was above the average, half the children still had a ruptured appendix (44 out of 86). A further point of interest is that in 18 children there was a family history of appendicitis, but this did not seem to make for earlier diagnosis, and at least one mother allowed two of her children to develop a general peritonitis before sending for her family doctor.

Laxatives.—The habit of giving a laxative to a child who has a pain in his belly is still prevalent. Of the 313 children, 101 were given a laxative, 26 receiving castor oil. The proportion of perforations among these children was 62%, compared with 43% in those not given a laxative. The responsibility here lies clearly with the parents, as in only two cases did the family doctor suggest that a laxative be given.

The Part Played by the Family Doctor

Out of the whole series the family doctor was able to make a clear decision on the first visit to 220 children. In 91 others (29%), however, the diagnosis was not clear on the first visit, and further calls were necessary. Only two children came to hospital without having seen their family doctor first.

The interval between the doctor's first visit and admission to hospital is shown in Table IV. In this table the interval is shown in four different age-groups, and it will be seen that the younger the child the longer the interval between the first visit and admission. The problem of appendicitis in the younger child is discussed in more detail later. That delay by the family doctor is important and serious cannot be doubted; 62%—that is, 132 out of 213 children—of the children sent to hospital within four hours of the first visit had an unruptured appendix, whereas of the 36 children in whom over 48 hours elapsed before admission, only one still had an unruptured appendix.

TABLE IV.—Interval Between Doctor's First Visit and Admission of Child to Hospital*

Time	Age (years)			
	0-3	4, 5	6-8	9-12
0-4 hours	8	24	58	123
5-24 "	4	10	8	14
Over 24 hours	19	9	18	13

* Three cases were not applicable, and in two others the interval was not recorded.

Delay after Admission to Hospital

In four instances significant delay occurred after admission to hospital: in two the registrar who saw the child on arrival made an incorrect diagnosis, in one the surgeon decided that the child could be observed without a laparotomy, and in the fourth there was difficulty in obtaining access to an operating-theatre. In all these children the delay was felt to have contributed to the peritonitis which was present at operation.

Age of the Child

In the present series 31 (10%) of the children were aged 3 or under. The difficulties of diagnosis at this age are shown in Table V; only one child in this group had an unruptured appendix, giving a perforation rate of 96%. In the 4- and 5-year-old children the perforation rate is 79%, in those aged 6, 7, and 8 it is 48%, and in children over 8 it is only 31%. All published series agree that the percentage of perforations is much higher in the smaller child—for example, Minervini and Santulli (1958) and Bunton (1953). Most series also emphasize the presence of an appendix abscess in a high proportion of cases: Williams

(1947) states that 50% of his 42 cases had a localized abscess, and in Dennison and MacPherson's (1952) series 36 out of the 82 children were under the age of 3. In the present series 12 of the 31 younger children had an abscess on admission.

TABLE V.—Operative Findings by Age-groups

Type of Appendicitis	Age			
	0-3	4-5	6-8	9-12
Simple appendicitis ..	1	9	44	105
Local peritonitis ..	7	14	18	23
Spreading and generalized peritonitis ..	11	15	16	19
Appendix abscess ..	12	5	9	5

One question that these figures raise is whether the disease process is different in the younger child, particularly in the speed with which it develops, or whether diagnosis is more difficult in the younger child because of the difficulty of obtaining a detailed history and a satisfactory examination. It has often been said—for example, Scott and Ware (1945) and Williams (1947)—that age alone is the factor which produces the high perforation rate. In the present series, however, the incidence of perforation rises *pari passu* with delay in diagnosis and admission, and it seems probable that this is the factor responsible for the high percentage of perforations, rather than any structural abnormality peculiar to the younger child. Foster and Edwards (1957) also felt that "perforation of the acutely inflamed appendix is not related to the age of the patient but to the duration of the disease process."

A comparison of the pattern of admission at different ages shows that delay occurs at both the points mentioned above. Table VI shows that there was more delay in sending for the doctor by the parents of the younger child, and Table IV shows that the family doctor also found difficulty in the management of the younger child. Indeed, it would seem as if, in the younger child, the family doctor's difficulty in diagnosis plays at least as significant a part in the total picture as delay by the parents in calling him. In the older child the parents' difficulties seem to be the more important factor, as such a high proportion of the older ones seem to come to hospital soon after they are seen by their own doctor.

TABLE VI.—Time of Sending for Family Doctor, by Age-groups, in 275 Children

Time of Sending for Doctor	Age-groups			
	1-3	4-5	6-8	9-12
Under 24 hours	11	16	42	74
Over 24 hours	20	20	34	58

Fields *et al.* (1957), in presenting 38 cases of appendicitis in young children, comment that 14 of them had coexisting disease, and feel that this could have been one factor which produced delay in admission. In the present series there did not appear to be any increased liability of the younger children to have coexisting illness, though eight children had specific infective fevers, four had severe respiratory infections, and infective hepatitis and acute nephritis were among the other illnesses present at the same time. Seven children had a history of preceding injury: the possible role of trauma in acute appendicitis has been discussed by Black (1948).

The Clinical Picture

It is not in keeping with the main purpose of this paper to give a detailed clinical account of appendicitis. However, in trying to discover the circumstances in which

parents and family doctors run into difficulties certain features of the clinical picture have been examined in more detail.

The diagnosis of any disease is made first by obtaining a history of the symptoms and then by eliciting physical signs on examination of the patient. Since pain is the outstanding feature of the history in a case of appendicitis it seemed justifiable to look further at the pain of this disease to see if there were any particular features which might throw light on the parents' and doctors' difficulties. The cardinal feature on examination is, of course, the finding of tenderness maximal at the site of the inflamed appendix. It is possible that there may be no tenderness at all on examination at some stage prior to admission, or that the examination may be difficult in the young child, but, these two possibilities apart, the position of the appendix is probably the main variable in the examination which might make the tenderness more difficult to elicit. In short, pain has been taken as the main variable in the history, and the site of the appendix as the main variable in the examination.

Pain

Pain occurred in all except four young children whose parents did not apparently appreciate the presence of any pain. This emphasizes the difficulty of detecting pain in young babies: a baby may show his discomfort only by slight alteration in colour or by slight wriggling, which his mother may not recognize as being due to pain.

One hundred children complained of pain which was classical in character, beginning centrally and moving to the right iliac fossa later. In 75 others the pain seemed to begin in the right lower quadrant. A further 65 children had pain which remained central throughout, and in the remainder the pain began elsewhere—for example, in the left iliac fossa or epigastrium. The onset of the illness was apparently sudden in 236 and gradual in 74; the nature of the onset was not recorded in three cases. In 74 it began in the classical way by waking the child up in the middle of the night.

Over two-thirds of the children had pain as the initial symptom. It occurred within the first 12 hours of the illness in all except 40 of them. In 196 children the pain was persistent throughout, though it varied in intensity at times, in 37 it was clearly intermittent throughout the illness, and in 70 it began as an intermittent pain but became persistent later. In 4 children there was no apparent pain and in 6 others the character of the pain could not be classified.

Tables VII and VIII show that persistent pain is more likely to draw attention to itself and to demand relief, so that the doctor is asked to see the child much earlier and

TABLE VII.—Character of Pain and Time of Sending for the Doctor by Parents*

Time	Persistent Pain	Other Types of Pain
0-24 hours	103	39
25-48 "	48	29
Over 48 "	20	32

* Not applicable or not recorded in 38; in 4 no pain at all was recorded.

TABLE VIII.—Character of Pain and Total Length of History Before Admission

Length of History	Type of Pain	
	Persistent Pain	Other
0-24 hours	89	15
25-48 "	57	35
Over 48 "	50	63

the total duration of the illness is shorter. This is reflected in the operative findings: Table IX shows these in relation to the three different types of pain.

TABLE IX.—*Character of Pain and Operative Findings*

Type of Appendicitis	Type of Pain			
	Persistent	Intermittent	Intermittent becoming Persistent	Other Types or No Pain
Simple appendicitis ..	120	10	28	1
Local peritonitis ..	36	13	12	1
Spreading and generalized peritonitis ..	29	6	21	5
Appendix abscess ..	11	8	9	3

In a similar way children with mild pain arrived in hospital later than those with severe pain; 79 out of 189 (41%) children with pain classified as "severe" or "intermediate" were in hospital within 24 hours, whereas only 22 out of the 116 children (19.3%) with milder pain arrived in hospital within that time.

It seems, therefore, as if intermittent or mild pain accounts for some of the difficulties and delays before admission, though there were a substantial number of children whose parents did not send for the doctor within 12 hours of the onset of persistent abdominal pain. Perhaps the natural resilience and toughness of some children misleads the parents into underestimating the pain; one child walked three-quarters of a mile to hospital with a gross general peritonitis, and another boy of 8 arrived in hospital late one evening with a similar condition direct from a ballroom-dancing competition which he had won with his sister as a partner.

Position of the Appendix

In the 303 patients who were operated on in their first admission the appendix was in the classical subcaecal position in 100, retrocaecal in 81, pelvic in 75, and in 35 it was in another position—namely, retro-ileal, splenic, sub-hepatic, anterior, etc. The position was not clearly defined in 6 and not recorded in a further 6.

Table X shows the operative findings in relation to the position of the appendix. When this was in the classical position 64% were unruptured, but the proportion fell to 54% in retrocaecal appendices, 42% in pelvic appendices, and 43% in those in other positions. To some extent this is reflected by the interval between the family doctor's first seeing the child and his arrival in hospital: 77% of the children whose appendices were in the classical position arrived in hospital within four hours, but only 60% of those with pelvic appendices did so. At the other end of the scale, delay of over 48 hours after the doctor's first visit occurred in only 5% of classical appendices, but in 15% of pelvic ones. Retrocaecal appendices and those in other positions were intermediate between these two groups. These figures seem to suggest that tenderness in an unusual site is more difficult to elicit or to interpret. Perhaps the family doctor's natural reluctance to carry out a rectal

TABLE X.—*Operative Findings and Position of Appendix*

Type of Appendicitis	Position of Appendix				
	Classical	Retro-caecal	Pelvic	Other	Not Defined or Not Recorded
Simple appendicitis ..	64	43	32	15	5
Local peritonitis ..	17	14	21	9	1
Spreading and generalized peritonitis ..	14	19	18	10	0
Appendix abscess ..	5	5	4	1	6

examination on a child is partly to blame, but with suitable explanation beforehand, using words that the child knows and understands, and with gentleness, reasonable co-operation can be obtained in most children.

Discussion

The histories and findings on examination of the children on which this paper is based were collected in the course of routine admission to hospital. A detailed history was taken of every child, but the needs of this paper were not envisaged at the time and therefore there was no bias in the figures as they were collected. The main purpose of the original analysis of the notes was to study the natural history of the disease, and the figures used here were not obtained in order to criticize the way family doctors handle appendicitis. Yet it is felt that this is a valid study of the difficulties faced by a general practitioner. The plain fact is that the percentage of children in whom the appendix has already ruptured is high, and that this is related almost entirely to the duration of illness before admission. Much of this delay can be ascribed to the parents' reluctance to send for their doctor, particularly in cases where the pain is inconstant or mild; but the family doctor finds difficulty in diagnosing the disease in the young child and in cases where the appendix is not in the classical site.

Many of these points, and others in addition, were made by Mason Brown in his Simpson Smith Memorial Lecture in 1955. His findings are similar to those in this paper and his comments so excellent that the only regret is that the lecture was published in a journal which unfortunately is not likely to be widely read by family doctors.

In so far as we can affect the situation the remedies appear to number three:

1. The informing of parents that continued abdominal pain, even if not very severe, should not be ignored, and that they should send for their doctor if the pain lasts for eight hours or more. Conversely, they can be told that, by and large, abdominal pain is not likely to be of any consequence until it has lasted that length of time—unless, of course, the child is clearly severely ill within that time. By this means the family doctor will be called early enough to important cases, and will avoid being called unnecessarily to cases of transient abdominal colic, the majority of which settle spontaneously in under six hours. This information could reach the parents by three main routes: by direct explanation and advice given by the family doctor himself as the occasion arises, by health-education propaganda, and by the incorporation of suitable information in programmes with a medical bias on television and radio.

2. The family doctor must remember that appendicitis can occur in young children. In this connexion perhaps more use could be made of sedatives in order to examine a fretful baby or toddler, intramuscular paraldehyde being very satisfactory. With the use of a sedative the cardinal physical sign of acute appendicitis—namely, constant tenderness at the site of the appendix—will be more easily demonstrated. If there is also a constant increase in muscle tone the diagnosis is further strengthened. Finally a rectal examination must be made before appendicitis can be excluded in doubtful cases. This emphasis on the physical examination is deliberate, as the history, although often typical, is in some cases unusual and even misleading.

3. The better training of the young family doctor. In this connexion I cannot do better than quote Mason Brown: "Doctors will miss the diagnosis in the early stages because the early clinical features are slight, and the diag-

nosis depends upon clinical judgment. This is given to few: most have to learn it, often by bitter experience. Can we expect newly qualified doctors after a six-year undergraduate course in which most have never had the opportunity of examining a child with a suspected acute abdomen . . . to be expert in handling children? The time allocated to paediatrics, and more particularly to the clinical surgery of childhood in the medical course, is out of proportion to their importance in the work of the general practitioner." In this department medical students have one month's residence in hospital on combined medical and surgical wards during the course of their three months' paediatric training, so that they will be able to see the "acute abdomen" on arrival in hospital among the other emergency admissions. It would be even more important and useful for the student to see such children in their own homes with an experienced family doctor so that he can observe how the latter tackles the problem at first hand.

But, however careful and detailed the teaching at the undergraduate stage, the high level of diagnostic skill so rightly demanded by Mason Brown cannot be achieved at that stage. Practical postgraduate experience must be added to theoretical knowledge, and the doctor who wants to practise good family medicine must be ready to give sufficient time to prepare himself for it. Six months of experience in paediatrics, preferably in a combined medical and surgical unit, should be an essential part of the training of the future family doctor.

Summary

The facts about 313 children with acute appendicitis are presented and analysed with particular reference to the difficulties and delays in diagnosis.

The high rate of perforation is related to the length of history. In many cases parents are to blame for failure to send for their family doctor, and he in turn finds difficulty in diagnosing the disease in the younger child and in those in whom the appendix is lying in a position other than the classical one. In older children the fact that the pain is intermittent or mild is a contributory factor. In making a diagnosis of acute appendicitis the history of the disease is of less help to the doctor than the physical examination.

A plea is made for the better education of parents in the significance of abdominal pain in childhood, and for a period of paediatric residence, preferably in a combined medical and surgical unit, for doctors intending to go into family practice.

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SMALLPOX VACCINATION

SUCCESS RATES OF SCRATCH AND MULTIPLE PRESSURE TECHNIQUES

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An outbreak of smallpox occurred in England early in January, 1962. A number of the students returning to Trinity College, Dublin, for Hilary Term, 1962, had spent their vacation in England, and some even in Bradford, where the initial outbreak had occurred (Douglas and Edgar, 1962). In response to their many requests for smallpox vaccination the University authorities decided that vaccination should be offered to any student who wished to avail himself of it.

Material and Methods

Notices were displayed in the College informing students that vaccination would be available to those who wished to be vaccinated. Persons under 21 years of age were required to have the written consent of their parents or guardians.

The vaccine used was calf lymph supplied by Connaught Laboratories, Toronto. The batch was stored at 7° C. and small quantities were taken as required. Alternate subjects were vaccinated by linear scratch and multiple-pressure techniques, using a separate capillary tube of lymph for

each individual. The inoculation was made with the sterile round-bodied needle supplied with the lymph, and the needle was then discarded. Three doctors (X, Y, Z), working together, carried out the initial vaccinations in the same hall on two successive days.

Details of Technique

Doctor	Scratch Method (Single Linear)	Multiple-pressure Method (Less than $\frac{1}{4}$ in. (6 mm.) Diameter)
X	Skin break—vertical and less than $\frac{1}{4}$ in.	{ Primary —10 pressures Revaccination —30 "
Y	Skin break—vertical and $\frac{1}{4}$ in.	{ Primary —10 Revaccination —10 "
Z	Skin break—transverse and less than $\frac{1}{4}$ in.	{ Primary —24 Revaccination —24 "

The skin was gently cleaned with an ether swab and allowed to dry. The lymph was expelled from the capillary tube (by means of the rubber bulb provided) on to the skin approximately 1 in. (2.5 cm.) above the insertion of the deltoid, and the vaccination was made through the lymph. Vaccination on other sites was discouraged, but three females who made repeated requests were vaccinated on the lateral thigh. In the scratch method the vaccination was made deep enough (Cross, 1961) to draw the smallest

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