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In considering the natural history of the disease it was found that the white and colored races were equally represented, according to hospital admissions; males predominated over females in the ratio of 1.9 to 1; 44 per cent of the children were wholly breast fed and almost all of them were taking solid food by the time they were four months old. Three patients in this series had a history of intussusception in immediate or closely related members of the family. Forty-five per cent of the cases occurred in the first child and an additional 20 per cent in the second child. The usual description of a healthy, well-developed infant was borne out by the finding that most patients fell within a normal weight limit for age and height. Characteristically, these children are healthy and have little which might be considered significant in their past history. In this series there were, however, 11 with a history of recent or fairly recent diarrhea, four with history of previous intussusception, and five with a history of allergy.

The outstanding features of the histories were: Acute onset, intermittent pain, vomiting, and a bloody bowel movement following the onset of the illness. It might be well to point out, however, that 20 per cent of the patients had perfectly normal bowel movements after the symptoms began. The most frequently noted physical findings were: Good nutrition and hydration, a palpable abdominal mass, and blood on rectal examination. About 30 per cent of the patients had increased temperatures and white counts above normal, although, in general, this information was not of much value except in the cases of marked elevations, when it was considered to be a poor prognostic sign.

In ten cases in which the barium enema was used as a diagnostic aid, it was positive, and in an additional case of the ileo-ileal type, abnormality in the region of the terminal ileum was suggested.

The average duration before admission for this group was 33 hours, and 44 per cent were seen within the first day of illness. It is discouraging to note that there has been no improvement in these figures when five-year groups are compared over the period studied. Twenty-five per cent of all children had been ill three days or longer; this is hard to understand when one considers that the patients are drawn from a large metropolitan population within easy reach of doctors and hospitals.

The age distribution placed 75 per cent of the cases in the ages three to 11 months, with one case less than one month old and three cases over four years of age. As noted previously, the yearly rate has been fairly constant and there has been no noticeable seasonal variation in incidence.

Because of the uncertainties attendant upon nonoperative treatment by carefully controlled barium enema and fluoroscopy, this method has been rarely used. In all, five patients were so treated; in one there was complete reduction and uneventful recovery took place; of the remaining four, in one there was failure within limits of what was considered safe pressure, and one promptly recurred with evacuation of the barium. The two remaining patients were operated upon because of some uncertainty as to the completeness of the reduction. One was found to have an ileo-ileal intussusception in the terminal

ileum, while the other was found to have been completely reduced by the barium. There were three instances of spontaneous reduction, one following an enema, and two following an anesthetic. One of the latter was operated upon and evidences of the intussusception were found. All three made uneventful recoveries.

In two nonoperative cases the diagnosis was made at autopsy; both of these were very young infants who were admitted to the hospital in poor condition, and one showed on postmortem an ileo-ileal intussusception, and the other a double jejunojejunal intussusception.

The increasing appreciation of the value of parenteral fluids and blood in the preoperative preparation of such cases is well-illustrated in this series. In fact, it seems to be the one addition to treatment which might be considered accountable for the diminution in the mortality rate. During the years 1927–1931 one-fifth of the patients received some form of preoperative fluid therapy, and the mortality rate was 20 per cent, whereas during the years 1941 to 1945 the mortality rate fell to 10 per cent, and almost half of the patients received preoperative supportive fluids. Postoperative therapy of this type has always been at a somewhat higher level, though it, too, has increased. The impression gained, however, is that in many instances it was too little, and too late. Too much importance cannot be attached to this form of therapy. All such cases should be brought into adequate fluid and blood volume status before, during and after the acute surgical phase of their treatment.

Another form of preoperative therapy which has been minimally used in this group is that of gastric or duodenal suction. Gastric lavage should always be done and continuous gastric suction instituted if distention exists.

The striking drop in mortality rate in acute intestinal obstruction in adults following the adequate use of these forms of therapy is well-known, and they should certainly not be neglected in such cases in children.

The operative technic has not changed much during the period studied, ether being the anesthesia of choice, and a paramedian right rectus muscle-splitting incision the one customarily employed. The intussusception is then gently reduced by milking from below, and the characteristic dimple and edema in the area of the cecum ironed-out by the use of hot packs and gentle pressure before the intestine is replaced into the abdomen. A layer-closure of the abdomen is always done, and the suture material most frequently used is chromic catgut, with usually two or three heavy silk retention sutures. Appendicectomy was performed in 13 cases; in three the appendix was found to be abnormal on pathologic examination. Generally speaking, appendicectomy is considered unwise unless, of course, the appendix appears grossly to be involved.

Nine cases required resection because of irreducibility, gangrene or perforation. In five of these, anastomosis was effected by the suture method, and in four by a Mikulicz procedure. In the cases done by suture there were three deaths and one survival under one year of age, and in the cases done by the Mikulicz procedure there were two deaths and two survivals under one year

of age. It would appear from this limited experience that there might be some virtue in the employment of the Mikulicz procedure, particularly in very young patients.[3, 4]

The postoperative course of the uncomplicated case is usually uneventful, though they may have a sharp temperature rise during the first two or three days, perhaps due to absorption of toxic products from the injured bowel. Feeding is usually not a problem, and the foul diarrhea mentioned by some authors[4] has not been noted in this group. The postoperative complications most frequently noted were shock, pneumonia, disruption, and obstruction.

Confirming the findings of others, 83 per cent of the cases showed no visible reason for the development of intussusception. The most frequently noted accompanying pathology was enlarged mesenteric lymph nodes. This finding was also noted by Wakeley and Atkinson,[5] and as a possible evidence of generalized lymphatic hyperplasia, would seem to lend credence to the theory that lymphatic hypertrophy in the region of the terminal ileum and ileocecal valve is an important etiologic factor in these cases. Six per cent of the cases showed some definite organic abnormality which was considered to be a precipitating factor; these were listed previously. Again, coinciding with the experience of others, 85 per cent of the cases were of the ileocecal type, 12 per cent of the enterocolic or double type, and 3 per cent of the entirely enteric variety. No instance was recorded in this series of a colocolic intussusception.

Wound-healing complications, as recorded, included four disruptions, with no fatalities, three trivial wound infections, and two serious wound infections, with one fatality.

There were 16 deaths, or an over-all mortality rate of 13 per cent. The average duration of the disease in these cases before hospitalization was three days, and over. The major causes of death are listed in the following order: shock, peritonitis, and pneumonia. In one death, which occurred in the operating room, the intussusception was complicated by a volvulus of the entire small intestine. Another death occurred on the 49th day, with recurrence of intussusception following an apparently successful resection. Two nonoperative deaths occurred in young infants who were admitted to the hospital in poor condition and with rather obscure histories; one of these cases was found at autopsy to have a double jejunojejunal intussusception, and the other an ileoileal intussusception. While the enteric and enterocolic types of intussusception constituted only 15 per cent of the group, the mortality rate in cases of this type was 55 per cent. The mortality rate tended to be higher in all types as the intussusception progressed toward the rectum.

There were two cases of what might be considered chronic intussusception, one of four weeks' duration and one of one week's duration. The diagnosis of partial intestinal obstruction was made roentgenologically, and confirmed at operation. Both were successfully reduced and made uneventful recoveries.

There were four cases of recurrent intussusception; with one exception the time to first recurrence was less than one year. One case recurred three times in nine years, and another twice in five years. These cases were all of

the ileocecal type, and no cause was found to account for the recurrent intussusception. In three cases, side-to-side suture of the portion of the terminal ileum to the ascending colon was done, twice on the occasion of the first recurrence. One of these cases subsequently had two recurrences, the other was apparently cured. The third case was so treated on the second recurrence, and had no further trouble. The fourth case received no preventive treatment, and has remained well. Though no conclusions can be drawn from this experience, in general, it is felt that preventive measures are of no avail.

There appear to be two main factors influencing the mortality rate in this condition; first, the duration of the disease; and second, the type of intussusception. The mortality rate in those cases seen in the first 24 hours was less than 2 per cent, whereas in those ill three days or longer it was 72 per cent. As noted previously, the enteric and the enterocolic type of intussusception, while comprising only 15 per cent of the total, carried a mortality rate of 55 per cent. Physical findings of poor prognostic import, and probably related to the above factors, were poor hydration, distention and elevated temperature. As noted previously, the mortality rate tended to increase in all types of intussusception as the intussusception progressed toward the rectum. The greater hazard inherent in the enteric and enterocolic types of intussusception is brought out further by figures indicating that resection was necessary in 21 per cent of these cases, and in only 4 per cent of the ileocecal type.

Sixty-one per cent of these cases have been followed in the clinic for an average of three years. Two of the group have small postoperative herniae, and two have symptoms which might be considered related to the disease, namely, repeated attacks of colic, and severe constipation.

SUMMARY AND CONCLUSIONS

(1) Figures relating to the natural history, signs, symptoms and pathology of this condition as reported by other authors[4, 5, 6] have, in general, been confirmed.

(2) Factors of poor prognostic significance in this series were found to be duration over 24 hours; the enteric, or enterocolic type; advanced progress toward the rectum of the intussusceptum; poor hydration; bowel distention; and elevated temperature.

(3) The time before hospitalization has not changed since the last series reported from this hospital 23 years ago. A plea is made for earlier recognition of this surgical emergency.

(4) It is concluded that the safest and surest treatment is surgical, although the experience with insufflation methods under fluoroscopic control has been limited.

(5) Fluid balance and blood volume should be restored and maintained during the preoperative and operative period by parenteral means, and continued during the postoperative course, as indicated. A more liberal use of such measures is urged.

(6) All cases should receive a gastric lavage preoperatively, and if abdom-

inal distention exists, continuous gastric or duodenal suction should be instituted.

(7) Nine cases of resection are reported, with a mortality of 55 per cent. It is suggested that a Mikulicz procedure may be of value in reducing the mortality, particularly in young infants.

(8) Follow-up data are given on 61 per cent of the cases followed for an average of three years.

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