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ASSESSMENT OF INTRAOPERATIVE MANUAL REDUCTION OF INTUSSUSCEPTION IN CHILDREN

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Abstract

Intussusception is the commonest cause of bowel obstruction in children and is the second most common cause of acute abdominal emergency in this age group, mostly it is idiopathic (primary) and of ileocolic type. Typically, colicky abdominal pain, "currant jelly stool" and a palpable abdominal mass are the triad of presentation. The best mean for early diagnosis is abdominal ultrasound scan. Unless contraindicated, non-operative approach (using either pneumostatic or hydrostatic reduction) is the best way for management with a success rate up to 95%, otherwise, surgical intervention is indicated. Unfortunately, non-operative approaches, were not ever safe options in our health institutes because of the lack of the required hospital facilities and trained staff, so all cases of intussusceptions were managed surgically by laparotomy and manual reduction.

This study enrolled 70 children with Intussusception who were managed in two main children's hospital in Basrah city between April 2008 and December 2015 by one pediatric surgeon. The mean age of study population was 11.6 months and male to female ratio was 3.6:1. Primary intussusception was found in 91.4% of the patients and the most common anatomical pattern was ileocolic type (62.9%). Intra-operatively, manual reduction was reported to be easy in about half of the patients, those were presented early in the course of the illness (79.4% were presented within the first 24 hours) that made them very good candidates for non-operative management. Both postoperative complications and hospital stay were significantly related to the intraoperative procedure used for reduction, an easy manual reduction was associated with a less incidence of complications and a shorter hospital stay although generally longer hospital stay when compared with other studies in which intussusception is usually managed non-operatively.

Introduction

Intussusception is the commonest cause of acute intestinal obstruction in infants and toddlers[1]. It can be described as an invagination or telescoping of a portion of intestine (the intussusceptum) into an adjacent segment (the intussuscipiens). Intussusception may lead the patient to a life-threatening or even fatal complication if the diagnosis is not made timely[2,3]. Paul Barbette of Amsterdam was the first in the description of intussusception in 1674, Treves in 1899 put its definition, and John Hutchinson performed the first successful operative reduction in 1873[4,5].

About 80-95% of intussusceptions are ileocolic, other types occur in an increasing rarity like ileoileal, cecocolic, colocolic, and jejunojejunal intussusception. It can be classified into primary and secondary, primary or idiopathic type is responsible for about 90% of cases, it has no detectable anatomical leading points, but adenoviruses and retroviruses have been implicated in up to 50% of this type and usually occur in children between 5-10 months of age[6].

Around 1.5-12% of cases may have leading points that draw the bowel into each other by peristalsis, so it called secondary intussusception and mostly reported in children aged 2 years and above[7]. Meckles diverticulum, intestinal polyp and intestinal duplication are the most common leading points; others include appendix, hemangiomas, carcinoid tumor, foreign body, ectopic

mucosa, hamertomas (Peutz-Jeghers syndrome), lipomas, less commonly lymphomas, small intestinal tumors and melanomas. Other rare diseases related to intussusception are celiac disease and Clostridium difficile colitis[8].

Intermittent cramping abdominal pain, "currant jelly stool" and a palpable abdominal mass are the triad of clinical finding in the typical case. Plain abdominal radiographs raise the suspension of the diagnosis in about 50 % of cases, but the best diagnostic tool is abdominal ultrasound. An equivocal finding using this modality is usually the indication for a conventional contrast or air enema[9]. When the diagnosis of intussusception had been made, then reduction of the intussusception should be performed after adequate resuscitation, best by non-operative approach (Hydrostatic or Pneumatic reduction) except those patients who were presented with signs of peritonitis or perforation, in whom surgical approach (open or laparoscopic) should be used.

Successful reduction by non-operative approach in uncomplicated patients is seen in about 85% of cases and ranges from 42% to 95%.The advantages of non-operative reduction are decreased morbidity, cost, and length of hospitalization[1,10].

The aim of this study is to define those patients who were having an easy surgical reduction intra-operatively, such children logically can be managed non-operatively (hydrostatic or pneumatic reduction), so as to avoid the possible morbidity and mortality of both anesthesia and surgery, and to send a clear message to local health authority for providing the required resources of non-operative reduction of intussusception.

Patients and Method

This is a retrospective study of patients diagnosed as having intussusception in the pediatric surgical unit at Basrah hospital for Gynecology & Children and Basrah Children Specialty Hospital by the hands of one pediatric surgeon, for the period extended from April 2008 to December 2015. Patients were divided into four age groups; those aged up to 4 months, 4 to 8 months, 9 to 12 months and more than 12 months of age. Patients then were studied for demographic characteristics, source of referral, presentations, intra-operative findings, surgical procedure used and post-operative complications.

All patients were managed by surgery under general anaesthesia as non-operative treatment was not feasible due to the lack of necessary resources like fluoroscopy, special equipments and appropriately trained staff.

According to the surgical procedure which was used in the management in order to relief the bowel obstruction, this study had subdivided patients into three treatment groups; those who were managed by easy manual reduction, those who had a difficult manual reduction (serosal tear(s) and/or sub-serosal bleeding), and those who had irreducible intussusception masses in whom bowel resection followed by end to end anastomosis or fashioning of an iliostomy was performed. Postoperatively, children were further studied regarding the reported complications and postoperative hospital stay.

Results

The total number of study group was 70 children with established diagnosis of intussusception; the mean age was 11.6 months (ranged from 3 months to 5.5 years). Table I shows the demographic characteristics of the study population, out of the total number of study group which was 70 children, 55 (78.6%) were males, while only 15 (21.4%) were females. Male to female ratio was 3.6:1 and there was a significant statistical difference (P value = 0.033).

Table I also shows that more than a half (55.7%) of study population aged 3-6 months. The majority of patients were

living in Basrah peripheral districts 41(58.6%), while 29 patients (41.4%) were living in Basrah city center, and there was no statistical significant difference (P value = 0.961)

Table I: Demographic characteristics of the study population

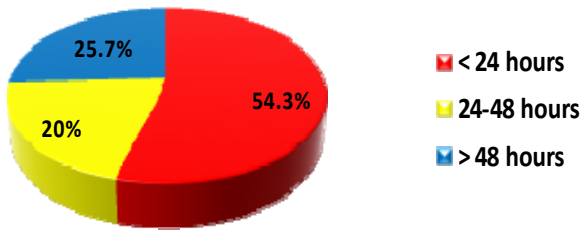
Age groups	Gender				Total		Residence			
	Male		Female				City center		Peripheries	
	No.	%	No.	%	No.	%	No.	%	No.	%
< 4 months	6	8.6	2	2.9	8	11.4	4	5.7	4	5.7
4-8 months	33	47.1	6	8.6	39	55.7	16	22.9	23	32.9
8-12 months	8	11.4	7	10.0	15	21.4	6	8.6	9	12.9
>12 months	8	11.4	0	0.0	8	11.4	3	4.3	5	7.1
P value	P value= 0.033*						P value= 0.961*			
Total	55	78.6	15	21.4	70	100.0	29	41.4	41	58.6

*Fischer's exact test

The majority of patients were admitted from the pediatric emergency unit, they were 54(77.1%), while pediatricians and surgeons clinics were the source of 9 (12.9%) and 7(10%) respectively.

The diagnosis of intussusception was made within 24 hours of the beginning of symptoms in 38 patients (54.3%), and in 14 patients (20%) the diagnosis needs 24-48 hours, while delayed diagnosis (>48 hours) was reported in 18 patients (25.7%). This was shown in Figure 1.

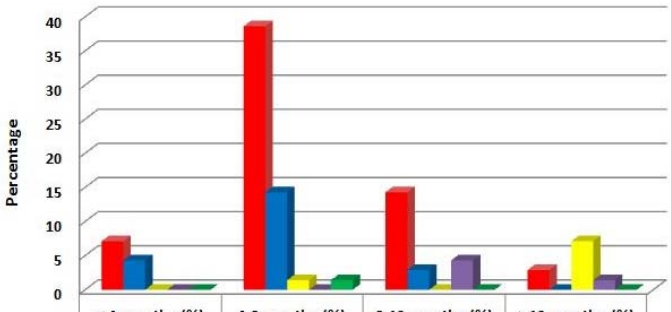
Figure 1:Duration of symptoms before making the diagnosis of intussusception



Five types of intussusception were seen upon abdominal exploration, those were: ileo-colic in 44 patients (62.9%), ileo-ileo-colic in 15 patients (21.4%), ileo-ileal in 6 patients (8.6%), colo-colic in 4 patients (5.7%) and complex intussusception in one patient (1.4%).

Figure 2 shows the types of intussusceptions reported upon abdominal exploration in each age group. Ileocolic intussusception was the most common type in all age groups apart from those aged more than a year. Ileo-ileo-colic type was the second most common type reported intra-operatively. Ileo-ileal intussusception was the most common type in patients aged one year and above. There was a very significant statistical difference (P value= 0.00).

Figure 2: Type of intussusceptions in different age groups

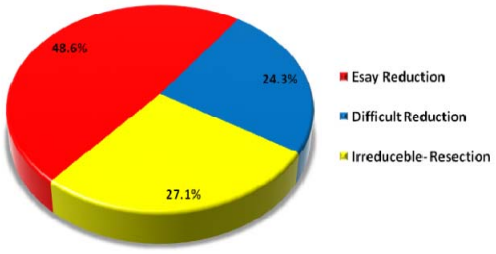


	<4 months (%)	4-8 months (%)	8-12 months (%)	>12 months (%)
Ileo-colic	7.1	38.6	14.3	2.9
Ileo-ileo-colic	4.3	14.3	2.9	0
Ileo-ileal	0	1.4	0	7.1
Colo-colic	0	0	4.3	1.4
Complex	0	1.4	0	0
Total	11.4	55.7	21.5	11.4

The majority of patients (91.4%) reported as primary intussusceptions, while only 6 children (8.6%) had secondary intussusception and Meckel's diverticulum was the leading point in those cases.

Intra-operative surgical procedure that has been used was reviewed and displayed on figure 3 in which nearly a half of the study population were managed by easy manual reduction, they were 34 (48.6%). Difficult manual reduction was reported in 17 patients (24.3%), while 19 patients (27.1%) were subjected to resection of irreducible intussusception mass, perforated or gangrenous intestine followed by end to end anastomosis or fashioning of an iliostomy.

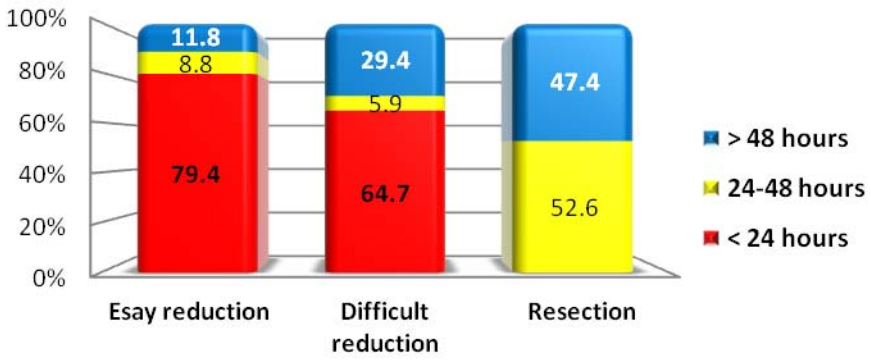
Figure 3: Types of the surgical procedure used to manage intussusception



Out of the total number of patients, 34 (48.6%) were required only easy manual reduction to manage their intussusceptions, the majority of those patients (79.45%) were presented early within the first 24 hours after the onset of symptoms, while 8.8% and 11.8% were related to those who were presented within 24-48 hours and >24 hours respectively. Difficult manual reduction is the surgical procedure which was required in 17 patients (24.4% out of the total), 29.4% of them had delayed presentations (>48 hours of the onset of symptoms). We noticed that 19 children (27.1%) were subjected to more complex surgical interventions as they have irreducible intussusception's masses for which bowel resection were involved followed by end to end anastomosis if possible, otherwise fashioning of iliostomy were the safest procedure to be adopted. No single patient in this group was presented within the first 24 hours of the onset of symptoms, 52.6%

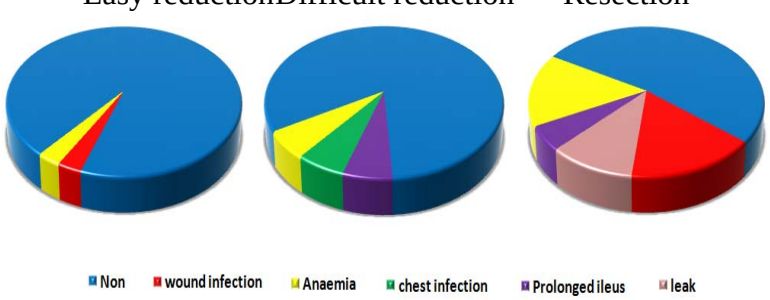
were presented within 24-48 hours, and 47.4% had a delayed presentation (>48 hours), as shown in figure 4. The relation between the duration of symptoms and the type of surgical procedure was found to be very significant (P value= 0.00).

Figure 4: The relation between duration of symptoms & types of surgical procedures



Postoperative complications were reported in 14 children (20%). Figure 5 shows these complications in each surgical procedure used in this study. Two patients (5.8%) out of 34 who had been managed by easy manual reduction were reported to have complications in the form of wound infection and a significant postoperative anemia for which blood transfusion was needed (2.9% for each). A complication rate of 17.6% was reported in children who had been managed by difficult manual reduction. Nine patients (47.4%) were reported to have postoperative complications out of 19 children in whom bowel resection was used during surgical management, three children (15.8%) suffered from superficial site infection, another 3 children (15.8%) were reported to have postoperative anemia, anastomotic leak was reported in 2 patients (10.5%) and a prolonged ileus was seen in one patient out of 19 (5.3%). P-value was 0.05 and no reported mortality in this study.

Figure 5: Postoperative complications according to the type of surgical procedure



On reviewing duration of hospital stay according to the type of operative procedure used in surgery. Mean hospital stay was 4.7±3.4 days and the median was 3.4 days (ranged from 1 to 18 days), table II and figure 6 clearly showed the relation between the surgical procedure and hospital stay, in which the majority of patients spent 2-6 days in the hospital

regardless the surgical procedure which was used in the management.

Nine patients (26.5%) of those who were managed by easy reduction and one patient (5.9%) of those treated by difficult reduction had a hospitalization period of less than 2 days.

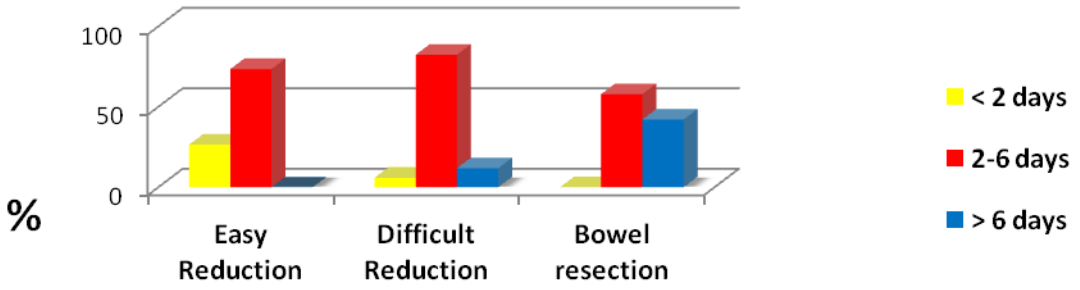
A longer hospital stay (>6 days) was reported in 8 patients (42.1%) of those treated with bowel resection and in 2 patients (11.8%) of those who were managed by difficult manual reduction. There was a highly significant statistical difference (P value = 0.00).

Table II: The relation between the intra-operative procedure and post-operative hospital stay

Intra-operative procedure	Post-operative hospital stay							
	< 2 days		2-6 days		> 6 days		Total	
	No.	%	No.	%	No.	%	No.	%
Easy manual reduction	9	26.5	25	73.5	0	0.0	34	100.0
Difficult Reduction	1	5.9	14	82.4	2	11.8	17	100.0
Bowel resection	0	0.0	11	57.9	8	42.1	19	100.0
Total	10	14.3	50	50.0	10	14.3	70	100.0

P value = 0.000 (Fisher exact test)

Figure 6: Distribution of patients according to the hospital stay and the intra-operative procedure



Discussion

Intussusception is the second most common cause of acute abdominal emergency in children after acute appendicitis[11]. In this study, 70 patients were managed surgically by a one pediatric surgeon. The mean age of the enrolled children was 11.6 months (ranged from 3 months to 5.5 years) and that was less than what was reported by Valérie Flaum et al[12] who reported a mean age of 23.8 months and Yap Shiyi E and Ganapathy S. study who were reported a mean age of 2.59 years[13], this is may be due to the higher incidence of viral upper respiratory tract and gastrointestinal infections in our community (as any developing countries) which may predispose to primary intussusception[14,15]. Male patients were seen to be affected more than females, a same finding seen in both Valérie Flaum et al[12] and Yap Shiyi E-Ganapathy S[13] studies. In this study 54.3% of patients were presented within the first 24 hours of the onset of symptoms i.e. an early presentation, which made those patients good candidates for

non-operative management which unfortunately not available.

Regarding anatomic pattern of the intussusceptions reported in this study, 59 patients (84.3%) were of ileo-colic and ilio-ileo-colic type of intussusception, this finding is consistent with that of Moori et al which had reported 84% of intussusception was of ileo-colic type[16], and many other studies in which this type of intussusception was reported in more than 80%[6,17].

Generally, non-operative approach is the corner stone of management of intussusception worldwide and surgical interventions (both open and laparoscopic) are usually reserved to those patients in whom non-operative approach failed or contra-indicated e.g. intestinal perforation (free intra-abdominal air), peritonitis and persistent hypotension[1]. Non-operative approaches, namely pneumostatic and hydrostatic reduction, were not ever safe options in our health institutes because of the lack of the required hospital facilities.

As we have limited hospital facilities, laparotomy and manual reduction under general anesthesia in the cornerstone management option, all our already diagnosed patients were sent to the operation room after adequate resuscitation.

Intra-operatively, the manual reduction of intussusception was easy and quick in 34 (48.6%), the majority of those patients (79.45%) were presented early (within the first 24 hours) after the onset of symptoms i.e. those patients presented early and the surgical reduction was easy, these two points makes this spectrum of patients logically a good candidate for non-operative approach (hydrostatic or pneumostaic reduction) under sedation, so as to avoid the risks of general anaesthesia, wound morbidities and the psychological trauma to both the children and their families, in addition to the obvious economic advantages[1].

Obviously, general anesthesia in children carries many possible hazards including the risk of cardiac arrest, which was estimated in the 1990s to be 1:10,000[18,19], more recent reports yield an estimation of anesthesia-related mortality of 1:250,000 in healthy children. The significant reduction in the anesthesia related mortality was attributed to many recent advances in pediatric anesthesia like the decline in Halothane use, the advent of Sevoflorane, and the advent of end-tidal CO2 (ETCO2) monitoring[1]. Unfortunately, these facilities are not widely available in our hospitals.

Postoperative complications were reported in 14 patients (20%), a higher incidence of complications rate was reported in those patient subjected to more aggressive surgical intervention (difficult reduction group and bowel resection group) than those who were treated with easy manual reduction, that was because of more advance intussusception masses that resulted in more bowel manipulation and in turn tissue trauma.

The same is true regarding hospital stay; the more aggressive surgical procedure resulted in a significantly longer hospitalization period. It's a well-known fact that a short hospital stay is one of major advantages of non-operative reduction of intussusception[1].

We had reported a median hospital stay of 3.4 days (ranged from 1 and 18 days), this was a longer period than what had been reported by many centers which are routinely using non-operative approach, like V. faluam et al study who reported a median hospital stay of 24 hours (ranged between 1 hour and 30 days)[12], and to a less extent longer than what had been reported by both Wong et al study[20] which was 3 days (ranged between 1 and 12 days). There was an Italian study done by Costantino et al[21] which had reported a longer hospital stay in spite of using non-operative approach, it was 4 days (ranged between 3 and 6 days).

In conclusion, pediatric intussusception is an important surgical problem that once the patient present early in the course of

the disease non-surgical management (Pneumostatic and Hydrostatic) can be used with a high success rate and low complication rate. This study documented clearly that a wide spectrum of our patients who were managed by surgical operation were good candidates for non-operative reduction, that was due to limited hospital facilities. So, it's recommended to provide pediatric surgical centers in our hospitals with the required resources in order to avoid unnecessary surgical interventions when possible.

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