Postoperative intussusception in children: a keen diagnosis in postoperative ileus

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We investigated the patients who developed postoperative intussusception after a variety of intraabdominal procedures in order to identify the differentiating features and facilitate the prompt recognition and management of this entity. Fourteen patients with postoperative intussusception following an abdominal surgery between 1993 and 2010 were analyzed retrospectively. The primarily applied surgeries were: repair of diaphragmatic hernia (n=3), choledochal cyst excision (n=2), extraction of surrenal neuroblastoma (n=2), Duhamel operation (n=1), colostomy closure (n=1), Nissen fundoplication with (n=1) and without (n=1) gastrostomy, gastropexy (n=1), gastrostomy and jejunostomy (n=1), and manual reduction of ileocolic intussusception (n=1), with a median duration of 135 minutes (120-240). Patients were reoperated on the 3rd day (2-16); intussusception was ileoileal in 11, and was manually reduced in 12 of all patients. Postoperative intussusception differs from other cases of invagination with respect to the pathogenesis, clinical presentation and therapeutic approach. The original operations are mostly the major and lengthy ones, with vicinity to the diaphragm. Awareness of this entity by surgeons and differentiation from other causes of postoperative ileus are obligatory for prompt recognition and management.

Key words: postoperative obstruction, intussusception, diagnosis, child.

Postoperative intussusception (POI) is an uncommon cause of intestinal obstruction, mostly following major abdominal surgeries. It has been reported to occur after 0.08% to 0.5% of all laparotomies[1,2] and to account for 5-10% of postoperative bowel obstructions in children[3]. Obstructive signs become apparent within two weeks postoperatively in 90% of cases, in contrast to adhesive obstruction, which leads to onset of symptoms more than two weeks after the operation[3]. The differentiation of this diagnosis from the other causes of postoperative ileus is mandatory in order to prevent delay in the management. This could be achieved with the skillful observation of the specific clinical and radiological manifestations.

We analyzed retrospectively 14 patients who developed postoperative intussusception following laparotomy in order to emphasize the differentiating aspects of this entity with respect to the pathogenesis, clinical presentation, radiological evaluation, and therapeutic approach.

Material and Methods

Fourteen patients who underwent abdominal surgery for different purposes in Hacettepe University Medical Faculty, Department of Pediatric Surgery, from April 1993 to October 2010 and were found to have postoperative intussusception in the follow-up were investigated retrospectively. The patients with intussusception beyond 16 days postoperatively and those with the finding of leading point in the second operation were not included in the report. The information recorded for each patient included age, gender, the initial diagnosis and type of surgery, clinical symptoms and signs observed in the postoperative period, radiological evaluation, interval between the two operations, surgical management of the intussusception, and the outcome after the second surgery.

Results

Demographic and operative data are summarized in Table I.

Table I. Data about the Clinical and Surgical Findings

Case	Sex	Age (month)	Primary diagnosis	Original operation	Second operation time (day)	Location of intussusception	Treatment
1	F	36	Diaphragmatic rupture (trauma)	Primary repair	PO 4th	Ileoileal	MR
2	M	6	Diaphragmatic rupture (plication)	Primary repair	PO 8th	Jejunoileal	Resection
3	M	36	Recurrent diaphragmatic hernia	Primary repair	PO 3rd	Ileoileal	MR
4	M	15	Choledochal cyst	Cyst excision	PO 13th	Ileoileal	MR
5	F	18	Choledochal cyst	Cyst excision	PO 16th	Ileoileal	MR
6	F	18	Surrenal neuroblastoma	Total excision	PO 2nd	Ileocolic	MR
7	F	3	Surrenal neuroblastoma	Total excision	PO 2nd	Ileoileal	MR
8	M	14	Hirschsprung's disease	Duhamel	PO 3rd	Ileoileal	MR
9	M	108	Anorectal malformation	Colostomy closure	PO 2nd	Ileoileal	MR
10	M	10	Gastroesophageal reflux	NF, gastrostomy	PO 4th	Ileoileal	MR
11	M	36	Gastroesophageal reflux	NF	PO 4th	Ileoileal	MR
12	M	3	Gastric organoaxial malrotation	Gastropexy	PO 2nd	Jejunojejunal	MR
13	F	2	Tracheoesophageal fistula	Gastrostomy, jejunostomy	PO 3rd	Ileoileal	Resection
14	M	15	Ileocolic intussusception (Meckel)	Resection, anastomosis	PO 9th	Ileoileal	MR

F: Female. M: Male. NF: Nissen fundoplication. PO: Postoperative. MR: Manual reduction.

There were 5 girls and 9 boys, with a median age of 22 months (2-108 months). The primary diagnoses and the performed relevant operations were analyzed in all the cases. Diaphragmatic hernia was the initial diagnosis in three of the patients, for whom etiologies were trauma, complication of plication for diaphragmatic eventration and recurrence of congenital diaphragmatic hernia after initial repair in another center. The diaphragmatic defect was repaired by laparotomy for those three cases. For two of the others, cyst excision and hepaticojejunostomy were performed with the diagnosis of choledochal cyst. Another two of the patients were operated for the excision of a surrenal mass, with total extraction and the final diagnosis of neuroblastoma. One other case with colostomy performed in the newborn period for Hirschsprung's disease underwent Duhamel operation. One patient with a medical history of anorectal malformation underwent laparotomy for closure of colostomy and Malone procedure. Nissen fundoplication and gastrostomy were performed in one of the cases at the age of nine months, with the diagnoses of gastroesophageal reflux and cerebral palsy. Gastroesophageal reflux with the complication of esophageal stricture was treated with Nissen fundoplication in another patient three years of age. One case was operated for continuous vomiting with the diagnosis of gastroesophageal reflux and gastric organoaxial volvulus at the age of three months; gastropexy was applied, but fundoplication was not performed, since the gastroesophageal junction was observed to be normal perioperatively and reflux was thought to be secondary to gastric volvulus. The diagnosis of chronic intestinal pseudoobstruction syndrome was determined to be the cause of his motility disorder in the following years. Gastrostomy and jejunostomy were performed for another patient with acquired tracheoesophageal fistula caused by battery ingestion, at the age of two months. The last case with congenital hypothyroidism had an initial operation for ileocolic intussusception that could not be reduced by colonic enema. The leading point of Meckel's diverticulum was resected after manual reduction of the intussusception.

The duration of the previously mentioned operations was recorded for each patient, and the median value was found to be 135 minutes

(120-240). The anesthetic agents applied in those operations were found to be indifferent from the ones routinely used in other surgeries. Exploration of the abdomen in addition to performance of the primary procedure was applied in 12 of all patients. One-half of the operations (n=7) were recognized to be in the vicinity of the diaphragm.

The clinical symptoms observed in the postoperative period were vomiting (n=9), abdominal pain (n=1), bloody stool (n=1), and none (n=3). Deterioration in general appearance (n=6) and fever (n=4) were among the clinical signs observed in the follow-up. Abdominal distention (n=6) and tenderness in addition to distention (n=7) were the findings of the abdominal examination. There was no sign of electrolyte imbalance in the laboratory investigations of any case. The median duration of postoperative nasogastric tube drainage was two days (1-8), with a median amount of 200 cc (60-900). Enteral feeding was attempted in five patients in the clinical follow-up, on the 3rd postoperative day as a median value (1-5), and was tolerated for a median duration of two days (1-13).

The apparent clinical signs of postoperative obstruction necessitated radiological evaluation in the follow-up of the patients. Erect abdominal X-ray was performed in all cases, which revealed the signs of prominent air-fluid level. The serial evaluation of X-ray findings daily, which revealed no improvement in obstructive signs, was one of the important diagnostic approaches in management. Ultrasonography was the second radiologic method used in all of the cases for diagnostic purpose, which revealed the sign of intussusception in 12, but not in the remaining two patients. The localization of the intussusception could be mentioned in only four of the 12, as ileoileal. Colonic enema was performed in four of the 12 for the purpose of conservative reduction, but the sign of intussusception was observed in none of them radiologically.

The lack of improvement in clinical signs of obstruction and the supportive findings of radiological studies in most of the cases obligated explorative laparotomy in the follow-up. They were operated on the 3rd postoperative day as a median value (2-16). The diagnosis before reoperation was postoperative intussusception in all but one, who was previously operated for ileocolic intussusception, and ultrasonography was unable to reveal the sign of invagination in the follow-up. He was explored for obstruction on the 9th postoperative day, and ileoileal intussusception was determined, independent from the site of the previous anastomosis. The second case with no ultrasonographic sign of invagination in the follow-up was the one operated for gastroesophageal reflux with the complication of stricture. He was explored with the possible diagnosis of postoperative intussusception on the 4th day, relying on the clinical perception, including the prolonged bilious nasogastric tube drainage, abdominal distention and the unremitting sign of obstruction on erect abdominal X-ray in serial evaluations.

The site of intussusception was found to be ileoileal (n=11), ileocolic (n=1), jejunojejunal (n=1), and jejunoileal (n=1). Manual reduction was performed in 12 of all patients. The remaining two underwent resection and anastomosis in addition to manual reduction because of the disturbed appearance of the reduced intestinal segment. Those two were explored on the 3rd and 8th day after the initial operation. The clinical follow-up was uneventful after the second surgery in all of the cases. The nasogastric decompression was terminated on the 3rd day (2-5), enteral feeding was started on the 4th day (2-6), and discharge was performed on the 7th day (4-70) postoperatively.

The follow-up after discharge was continued for a period of 24 months (1-84), mainly for management of the primary pathologies of the cases. The only long-term complication was adhesive obstruction at the 2nd month of discharge, observed in the patient for whom gastropexy was performed initially and the diagnosis of pseudoobstruction was made in the following years. The obstruction was managed with adhesiolysis.

Discussion

Postoperative intussusception (POI) has been reported to occur after 0.08% to 0.5% of all laparotomies[1,2] and to account for 5-10% of postoperative bowel obstructions in children[3]. The incidence of POI among all laparotomies in our series was found to be 0.25%, which

is in accordance with the reported range of other series. Obstructive signs become apparent within two weeks postoperatively in 90% of cases, in contrast to adhesive obstruction, which leads to onset of symptoms more than two weeks postoperatively[3]. It is mostly seen in children less than two years of age, as in our series[3]. While equal sex distribution is mentioned in most of the reports[1,3,4], there was a predominance of boys among our cases.

Intussusception is known to be either idiopathic, mostly thought to be caused by enlarged lymph nodes, or secondary to a pathologic lead point[5,6]. The pathophysiology in POI is unclear, despite there being some putative explanations for altered peristalsis, which include early postoperative adhesions, prolonged and excessive bowel manipulation, electrolyte disturbances in lengthy surgeries, anesthetic drugs, opioid analgesics, and neurogenic factors [1,7,8]. Since a wide range of surgical procedures have been reported to precede POI, we could explain the pathophysiology with more than one mechanism. Extensive retroperitoneal dissection in colorectal pull-through, tumor excision and pancreatic surgeries[2,7] could impair bowel innervation and peristalsis, which explains the higher incidence of POI after surgeries for Hirschsprung's disease, neuroblastoma, Wilms' tumor, and hyperinsulinism[4,7,9,10]. Chemotherapy and radiation therapy could also contribute to the increased prevalence after tumor excision, by disrupting normal peristalsis[8,11]. Surgeries including Roux-en-Y anastomosis could alter peristalsis by disturbing the myoelectrical circuit, thus potentiating the occurrence of POI[12], which could partially explain the mechanism in choledochal cyst excision. The high incidence among surgeries for the management of gastroesophageal reflux[4,13] could be secondary to associated neurologic deficits and motility disorders, which underlie both the reflux and impaired postoperative peristalsis. Cerebral palsy and intestinal pseudoobstruction syndrome were the associated disorders in our cases operated for gastroesophageal reflux. Congenital hypothyroidism could have been a precipitating factor for the disturbed motility in our case who was initially operated for ileocolic intussusception. Different types of enteral feeding catheters are also known to be associated with intussusception[14,15]. Gastrojejunal tubes are usually associated with antegrade intussusception in the jejunum, which mostly undergoes spontaneous reduction[15]. Injecting force produced by feeding with pump infusion on the jejunostomy tubes can facilitate the occurrence of jejunojejunal intussusception[14]. Gastrostomy tubes can rarely cause retrograde jejunoduodenogastric intussusception by distal migration and obstruction of the duodenum. Attempts at withdrawal of the tube with the balloon inflated results in retrograde invagination[15]. In our series, enteral feeding tubes had settled in the initial operation in two of the patients. One distinguishing feature of our report from those previously published with respect to the range of surgeries is the presence of three cases operated for diaphragmatic hernia caused by different etiologies[16]. The reestablishment of bowel motility could be delayed after reduction from the thorax, which could contribute to the occurrence of POI. One commonly shared feature of most of the previously mentioned surgeries both in the literature and in our series is their long duration, which probably disturbs motility due to prolongation of anesthesia, increased segmental edema and ischemia of the bowel. A high incidence of vicinity to the diaphragm (50%) was apparent for the surgeries reported in our series, which may disturb the peristalsis by probable impairment of the celiac ganglion. We could conclude that the pathogenesis involves more than a single mechanism, and even that the contribution of more than one factor in each case could result in POI.

Because of its rarity, the paucity of symptoms in contrast to primary intussusception and the nonspecific signs that could be misinterpreted as being caused by postoperative ileus, the diagnosis of POI can be overlooked easily[1]. Abdominal pain may be masked by analgesics, an abdominal mass may not be palpated because of postoperative tenderness, and bloody stool rarely occurs, differentiating POI from the classical presentation of intussusception. The surgeon should look for some other clues specific for POI to overcome the delay in diagnosis. Bilious vomiting, prolonged nasogastric tube drainage and prominent abdominal distention are among the main clinical observations[4,8,9]. The reported clinical symptoms and signs in our series are in correlation with the previously mentioned ones.

In addition to the clinical evaluation, radiologic investigation should also be performed in the therapeutic approach. Erect abdominal X-ray is a valuable primary radiologic study for initial recognition of the obstruction and for differentiation from a paralytic situation. The serial examination of radiographs with the apparent and unremitting signs of mechanical obstruction was one of the most important determinants for deciding exploration in our series, in contrast to the experience of some previously declared reports[1,9,13]. Ultrasonography is a highly accurate, supportive diagnostic method in POI as in primary intussusception[17], even though it could be more difficult to recognize at the level of the small bowel[4,18,19,20]. This radiologic investigation should not be delayed in the setting of atypical postoperative ileus to rule out intussusception. On the other hand, the absence of invagination sign on ultrasonography should not postpone the surgical decision in the presence of persistent complete mechanical obstruction, as in our experience with two of the patients. While some reports mention the diagnostic value of upper gastrointestinal contrast studies in small bowel intussusception[2,3], we do not offer this approach since it could be hazardous in mechanical obstruction, does not seem to have any superiority to the other investigations, and even appears to be unreliable in the diagnosis as observed in some of the series[4,7,21,22]. Colonic enema for the purpose of nonoperative reduction is not recommended by most of the authors[4,10], since it will not be therapeutic for small bowel intussusception, which is the most common site in POI, and also will be hazardous in the presence of bowel anastomoses. Our experience with the use of colonic enema in four of the patients verifies this recommendation, and we no longer select this method in the setting of POI.

The rate of diagnosis of POI before reoperation was found to be 93% in our series, which apparently differs from many of the others, ranging from 5% to 80%[1,4,7-9]. This could be achieved with close clinical follow-up and accurate radiological evaluation, which did not waste time or include erroneous studies and did not impede the surgical decision in the absence of correlation with clinical findings. The time interval between the first and second operation for POI declared as 3 days (2-16) in this report, mostly correlates with the others, which ranged in median value from 3 to 9 days[1,8,9,23]. The predominance of ileoileal localization of the intussusception, the absence of any lead point, the high success rate of manual reduction, and the uneventful outcome after second operation are the commonly shared features of this report with many of the others[1,9,23].

Our series is one of the largest about POI, since to our knowledge there are only three reports in the literature with a case number of more than 14[3,13,24]. The variety of primary operations and especially the presence of diaphragmatic surgeries and the standard approach with radiological evaluation also differentiate this report from many of the others.

Postoperative intussusception (POI) differs from the other cases of invagination with respect to the pathogenesis, clinical presentation, localization, and therapeutic approach. The original operations are generally determined to be the major and lengthy ones, with a high incidence of vicinity to the diaphragm. Awareness of this entity by the surgeons is obligatory for prompt recognition and correct management. Once the knowledge of basic determinants with respect to presentation and clinical evaluation is settled in experience, it will be easier to make the diagnosis of POI in a timely manner before reoperation. The surgeon should not hesitate to explore whenever the complementary clinical and radiological clues clearly designate the classical picture of POI.

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