

Management of pediatric intussusception in general hospitals: diagnosis, treatment, and differences based on age

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Background: Age related differences in the management and outcomes of children with ileocolic intussusception have not been previously published. The purpose of this study is to compare the differences in diagnosis and treatment of pediatric ileocolic intussusception based upon age in general hospitals.

Methods: A review was made of pediatric patients treated for intussusception at 11 hospitals between 1996 and 2007. The patients were divided into 3 groups based on age: group A: <6 months ($n=37$), group B: 6 months to 4 years ($n=126$), group C: >4 years ($n=25$). Diagnostic modality, operative reports, and hospital records were reviewed.

Results: Altogether 188 patients were treated for ileocolic intussusception. Contrast enema was performed in 80.3% of the patients. Initial treatment for the patients included contrast enema in 80.3%, immediate operation in 3.2%, and others in 16.5%. Older patients were less likely to undergo a contrast enema ($P<0.05$) but more likely to be successfully reduced. Patients in group A had the lowest rate of successful reduction ($P<0.05$). Overall, 3.2% of the patients were taken to the operating room without any diagnostic evaluations, but 65% of the patients ultimately required operative intervention. Patients in groups A and C were more likely to undergo an operation ($P<0.05$). Rates of bowel resection and length of hospital stay were similar among the three groups.

Conclusions: Enema reduction for ileocolic intussusception is moderately successful in general hospitals and lower than that reported in children's hospitals. The lowest reduction rate occurs in patients of less than 6 months old and the diagnosis of intussusception in older children is rarely made by contrast enema. There is a higher operative rate in children of less than 6 months or older than 4 years and the rate of intestinal resection is higher than that in children's hospitals.

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Introduction

Ileocolic intussusceptions are a common cause of abdominal symptoms, intestinal obstructions, and hospital admissions in the pediatric population. Estimates of annual hospitalizations secondary to intussusceptions range from 18 to 56 per 100 000 children.^[1] In the absence of indications for immediate operative intervention, contrast enemas have become the mainstay of diagnosis and treatment. Most published series report an enema reduction rate between 70%-80%.^[2]

While it is known that two thirds of pediatric intussusceptions occur in children less than one year of age, with a peak incidence of between 6-10 months,^[3] this condition remains the most common cause of intestinal obstruction in patients between 6 months to 4 years of age. To our knowledge, age-related differences in the management and outcomes of patients with intussusception have not been previously published. Therefore, this study aimed to compare the differences in diagnosis and treatment of pediatric intussusception between different age groups.

Methods

Following the approval by the Institutional Review

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Board (IRB #4850), a retrospective chart review was performed using Kaiser Permanente Medical Center's regional database, which encompasses inpatient records from 11 Southern California acute-care facilities. Pediatric patients (less than 18 years of age) treated for intussusception between 1996 and 2007 were identified using the ICD9 diagnosis code 560.0. Duplicate entries, incorrectly coded charts, and patients with atypical intussusceptions (i.e., ileo-ileal or colo-colonic) were excluded from the study. For the remaining patients, demographic data, as well as information on diagnostic modalities and results, operative findings, perioperative complications, and length of hospital stay were extracted. The patients were then divided into three age groups: group A: less than 6 months, group B: 6 months to 4 years, group C: over 4 years. Statistical analysis was carried out using ANOVA with the post-hoc Chi-square test for subgroup analysis. *P* values less than 0.05 were considered to be statistically significant.

Results

An initial database search revealed 254 patients for intussusception in the pediatric population, among them 66 were excluded for having met the study's exclusion criteria. Of the remaining 188 patients, 71% were male (male:female=2.4:1). Their median age was 9.9 months (range: 57 days to 16.7 years). Approximately 67% (*n*=126) of patients were between 6 months and 4 years of age; specifically, <6 months (*n*=37), 6 months to 4 years (*n*=126), and >4 years (*n*=25).

The outcomes of the patients are shown in the Table. Overall, contrast enemas were the most commonly performed diagnostic tests in children less than 4 years of age (groups A and B). Alternative diagnostic modalities included ultrasonography and computerized tomography. Initial treatment for the patients included contrast enemas in 80.3%, immediate operation in 3.2%, and others (ultrasound, CT scan, and colonoscopy) in 16.5%. Utilization of contrast enemas was significantly less in group C (>4 years old), where only 20% of the patients underwent an enema for diagnostic or therapeutic

purposes (*P*<0.05). The use of contrast enemas was greatest (95%) in patients under 6 months of age (group A). There was an inverse relationship between the use and the efficacy of contrast enemas in children. Whereas the patients in group A were more likely to undergo contrast enema than older children, attempted enema reductions were the least successful in this group (*P*<0.05).

With regards to operative intervention, the patients in group C were more likely to be immediately taken to the operating room without any diagnostic or other therapeutic attempts (*P*<0.05). Overall, only 3.2% of the patients required immediate surgical intervention. However, the proportion of the patients who ultimately required surgery was nearly 65%. Patients at either extreme of ages (groups A and C) were more likely to undergo operative intervention (*P*<0.05). Intestinal resection was required in nearly 60% of the patients who were taken to the operating room, mostly due to intestinal necrosis. The rate of intestinal resection was similar for all three age groups (<6 months, 51.8%; 6 months–4 years, 65.0%; >4 years; 43%, *P*>0.05). Nine (4.8%) patients had a pathologic lead point as the cause for the intussusception. Three (2.4%) patients in group B had a pathologic lead point; 2 Meckel's diverticulum and 1 duplication cyst. In older children (group C), 6 (24%) had a pathologic lead point. There were 3 patients with lymphoma, 2 with Meckel's diverticulum, 1 with a duplication cyst, and 1 with an inflammatory polyp of the terminal ileum.

Three (8.6%) patients in group A and two patients in group B (1.6%) developed recurrent intussusception requiring operative intervention. All four patients in group C with completely reduced intussusception by contrast enema required operation due to recurrence or high suspicion for a surgical lead point. No operative or perioperative complications nor difference in the length of hospital stay between the different age groups were observed.

Discussion

Ileocolic intussusception is the most common

Table. Diagnosis, operative intervention and length of hospital stay based on age

Variables	Group A (<6 mon, <i>n</i> =37)	Group B (6 mon to 4 y, <i>n</i> =126)	Group C (>4 y, <i>n</i> =25)	Total (<i>n</i> =188)
Contrast enema ^{†,‡}	35 (94.6%)	111 (88.1%)	5 (20.0%)	151 (80.3%)
Reduced by contrast enema	11/35 (31.4%)	54/111 (48.6%)	4/5 (80.0%)	69/151 (45.7%)
Immediate operation ^{†,‡}	0 (0.0%)	2 (1.6%)	4 (16.0%)	6 (3.2%)
Operation ^{†,‡}	29 (78.4%)	72 (57.1%)	21 (84.0%)	122 (64.9%)
Bowel resection	15 (51.7%)	47 (65.2%)	9 (42.8%)	71 (65.2%)
Pathologic lead point	0 (0.0%)	3 (2.4%)	6 (24.0%)	9 (4.8%)
Hospital stay (d)	4.2 ± 2.2	3.7 ± 2.2	5.2 ± 2.1	4.1 ± 2.2

*: *P*<0.05, group A vs. B; †: *P*<0.05, group A vs. C; ‡: *P*<0.05, group B vs. C

cause of bowel obstruction in children less than 2 years of age. With an estimated occurrence of 18-56 per 100 000 children, ileocolic intussusception is commonly encountered throughout emergency rooms and hospitals across the country. Contrast enema remains the gold standard for diagnosing and initial treatment of pediatric intussusception.

Although ileocolic intussusception most commonly occurs in children aged 6 months to 4 years, a significant amount of patients are outside this age bracket. Therefore, we sought to identify differences in the diagnosis and management of this disease process based on age. With regards to the use of contrast enemas, older children (>4 years) were found to be less likely to undergo contrast enema (20%) and more likely to have ultrasound or computed tomography to establish the diagnosis. This finding is probably a result of a lower index of suspicion for intussusception by the initial medical provider based on the patient's age and atypical presentation. Few older children performed contrast enema and none of the patients who were found to have intussusceptions on ultrasound or CT scanning underwent subsequent enemas, leading to a higher operative rate in this group. Of those who underwent a contrast enema, the reduction rate was relatively high at 80%. Children less than 6 months of age, on the other hand, had the highest rate of diagnosis made by contrast enema. However, the reduction rate was low, which also led to a high operative rate in these young children. Reasons for such a low reduction rate are not clear, but may be due to less aggressive attempts for reduction given the higher risk of perforation in these young children.^[2] Despite the higher operative rates in the older and younger children, the overall length of hospital stay was similar between children of all ages.

While some studies have reported a successful reduction rate as high as 95%,^[2] a more recent study using information from a large national database containing records of over 3 million pediatric admissions reported a national average of 85%, with no significant difference between children's and non-children's hospitals.^[4] Although the reduction rate was high in this national study, more children went directly to surgery, thus the rates of operative intervention varied from 61% at children's hospitals to 74% at general hospitals.^[4] Although all of the hospitals included in this present study were general hospitals, our series revealed an operative rate (65%) similar to that reported for children's hospitals nationally. However, the overall reduction rate of 46% of our series was significantly lower. Reasons for the discrepancy in reduction rates are not known, but may include a multitude of factors the first of which is the experience of the radiologist performing the contrast enema. The majority (7) of the

hospitals in this study do not have pediatric radiologists on staff. Although the hospitals that do have pediatric radiologists, they are not available 24 hours a day, seven days a week. In addition, only 4 of the hospitals in this study have pediatric surgical coverage. Although no formal comparison between the individual hospitals was performed, it is possible that the radiologists may not be as aggressive in attempting reduction of the intussusception in hospitals where they do not have surgical back up. These patients will then require transfer to a center with pediatric surgeons, thus further delaying care and possibly increasing the operative rate. As shown in a previous study, one of the most important criteria in the management of intussusception is the time of presentation.^[5-7] One of the limitations of this study was that we were not able to determine the time of onset of symptoms to the time of contrast enema due to the inability to retrieve these data from the charts.

Variations in the use of repeat enemas may account for some of our observations. Interestingly, the reduced successful rate in our series did not result in a higher overall operative rate. This is likely due to the disproportionately lower number of patients who were taken immediately to the operating room offsetting the higher rate of patients warranting surgery after unsuccessful enema reduction. In the previously referenced study, 55% of patients at children's hospitals and 68% at non-children's hospitals were immediately taken to the operating room versus only 3.2% of patients in our series.

Finally, the rate of intestinal resection in our study (38% overall) was higher than previously reported rates which vary from 1% to 47% in other general hospitals and from 1% to 9% in children's hospitals.^[6,8,9] Again, we were not able to specifically look at the duration of symptoms prior to presentation, which may have contributed to the higher rates of unsuccessful enema reductions and the need for operative intervention. In the resected specimens, we encountered 9 patients with a pathologic lead point. The presence of a pathologic lead point in children less than 4 years was low, thus did not contribute to the high intestinal resection rate for this age group. However, in children older than 4 years, a pathologic lead point was noted in nearly 25% of patients, which may have contributed to the high resection rate in older children. Given the high rate of pathologic lead point in children aged more than 4 years of age, it is reasonable not to attempt a reduction of intussusception and proceed directly an operative intervention.

In conclusion, the present study identified several age-related differences in the diagnosis and management of intussusceptions treated at general hospitals. Older children were less likely to undergo

contrast enemas either initially or after other diagnostic modalities. The incidence of operative intervention was higher in patients less than 6 months and older than 4 years of age. This study also points out the challenges of treating pediatric ileocolic intussusception in general hospitals. The rate of successful reduction of intussusception in our health care system comprising of 11 general hospitals was only 45%. There was a relatively similar incidence of operative intervention in this study compared to published rates; however, the rate of bowel resection was higher than that reported elsewhere. These findings may be due to multiple factors including the lack of pediatric radiologists and the need for transferring patients to a center with pediatric surgeons, thus delaying care. A possible solution includes more prompt diagnosis of intussusception, possibly with ultrasound and earlier transfer to a center with pediatric specialty care.

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