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Jan Stanisław Bukowski¹, Przemysław Bombiński², Jakub Franke¹, Michał Brzewski²

Small bowel intussusception in children: single-centre observations

Wgłobienia jelita cienkiego w cienkie u dzieci – obserwacja jednego ośrodka

¹ Students' Ultrasonography Club at the Department of Paediatric Radiology, Medical University of Warsaw, Warsaw, Poland

² Department of Paediatric Radiology, Medical University of Warsaw, Warsaw, Poland

Correspondence: Jan Stanisław Bukowski, Students' Ultrasonography Club at the Department of Paediatric Radiology, Medical University of Warsaw, Żwirki i Wigury 63A, 02-091 Warsaw, Poland, tel.: +48 22 317 92 81, e-mail: bukowski.janek@gmail.com

Abstract

Aim: Small bowel intussusception is an increasingly prevalent condition reported in paediatric patients. The aims of the study were to characterise a group of patients with ultrasonographically confirmed intussusception, and review the therapeutic approach used in each case. **Material and methods:** This retrospective cross-sectional study enrolled a total of 40 children treated at a paediatric hospital who had been diagnosed with small bowel intussusception on the basis of ultrasound examination findings. **Results:** 80% of children had a single-site small bowel intussusception, and 20% of patients – a double-site intussusception or a small bowel intussusception coexisting with ileocaecal intussusception. The children presented with uncharacteristic symptoms such as abdominal pain, diarrhoea, vomiting and fever. The majority of cases (87.5%) were patients referred from the hospital accident and emergency department. More than half of the intussusceptions (55%) were found in children between 2 and 5 years of age, slightly more frequently in boys than in girls (22:18). Most of the intussusceptions (56%) were located in the middle abdomen. 66.6% of the intussusceptions were <30 mm in length. Only 6.67% of children required laparotomy. In the remaining cases, it was possible to achieve reduction of intussusception by using conservative treatment. The intussusception resolved already during the first ultrasound examination in 12.5% of children, and in only 27.5% of patients it was also present during the second scan which was performed at least 4 hours later. **Conclusions:** Intussusception length is one of the most important parameters determining the type of treatment to be used. Surgical reduction may be necessary in cases of small bowel intussusception with a length of ≥35 mm. Each case should be considered individually, and follow-up ultrasound scans should be performed not only after detecting small bowel intussusception, but also immediately before surgery.

Keywords: ultrasonography, small bowel intussusception, bowel intussusception

Streszczenie

Cel: Wgłobienie jelita cienkiego w cienkie to coraz częściej opisywana zmiana występująca u pacjentów pediatrycznych. Cele pracy obejmowały charakterystykę grupy pacjentów, u których wystąpiło ultrasonograficznie potwierdzone wgłobienie, a także analizę zastosowanego sposobu postępowania. **Materiał i metody:** Do retrospektywnego badania przekrojowego zakwalifikowano 40 pacjentów hospitalizowanych w szpitalu dziecięcym, u których w trakcie badania ultrasonograficznego opisano występowanie wgłobienia jelita cienkiego w cienkie. **Wyniki:** U 80% dzieci stwierdzono pojedyncze wgłobienie jelita cienkiego w cienkie, a u 20% pacjentów – podwójne wgłobienie lub jego współwystępowanie z wgłobieniem krętniczo-kątniczym. Dzieci prezentowały niecharakterystyczne objawy, takie jak ból brzucha, biegunka, wymioty czy gorączka. Większość (87,5%) przypadków stanowili pacjenci skierowani ze szpitalnej izby przyjęć. Ponad połowa wgłobień (55%) miała miejsce u dzieci między 2. a 5. rokiem życia i minimalnie częściej występowały one u chłopców niż u dziewczynek (22:18). Większość wgłobień (56%) była zlokalizowana w śródbrzuszu. 66,6% wgłobień miało <30 mm długości. Jedynie 6,67% dzieci wymagało laparotomii, a w pozostałych przypadkach udało się uzyskać odgłobienie przy postępowaniu zachowawczym. Wgłobienie ustąpiło już podczas pierwszego badania ultrasonograficznego u 12,5% dzieci, a tylko u 27,5% pacjentów zostało ono uwidocznione również podczas drugiego badania, które miało miejsce co najmniej 4 godziny później. **Wnioski:** Długość wgłobienia jest jednym z najważniejszych parametrów decydujących o zastosowanym leczeniu. Przy wgłobieniu jelita cienkiego w cienkie o długości ≥35 mm konieczne może być postępowanie chirurgiczne. Każdy przypadek należy rozważać indywidualnie, praktykując kontrolę ultrasonograficzną zarówno po stwierdzeniu wgłobienia jelita cienkiego w cienkie, jak i przed samym zabiegiem operacyjnym.

Słowa kluczowe: ultrasonografia, wgłobienie jelita cienkiego w cienkie, wgłobienie jelita

INTRODUCTION

Intussusception refers to the invagination of a proximal segment of bowel into the distal segment in telescopic manner. Ileocaecal intussusceptions are the most common of all the gastrointestinal intussusceptions. At present, there is an increasing number of small bowel intussusceptions (SBI) reported in ultrasound examinations (Figs. 1, 2). The trend can be attributed to several factors including more widespread use of ultrasonography, better quality of ultrasound imaging equipment, and increased awareness of typical ultrasound characteristics of the condition among examining specialists. Even though SBI is an increasingly diagnosed disorder, there is still considerable uncertainty as to what type of management should be undertaken following the detection of SBI on ultrasound.

AIM OF THE STUDY

The aims of the present study were to characterise a paediatric population with ultrasonographically confirmed SBI, and review the therapeutic approach used in each case.

MATERIAL AND METHODS

This retrospective cross-sectional study enrolled a total of 40 patients treated at a paediatric hospital between November 2010 and January 2016 who had been diagnosed with small bowel intussusception on the basis of ultrasound examination findings.

RESULTS

The analysis comprised ultrasound descriptions of SBI detected in 40 patients: 22 boys (55%) and 18 girls (45%). SBI was most commonly diagnosed in children aged 3 and 4 years (8 children at each of the ages – 20%), and 5 years (6 children – 15%) (Tab. 1).

A total of 35 patients (87.5%) were referred for ultrasound examination from the hospital accident and emergency department, and 5 patients (12.5%) from other hospital departments. The most common symptoms prompting the initiation of the diagnostic work-up included abdominal pain (30 children – 75%), vomiting (13 children – 32.5%), abdominal tenderness (11 children – 27.5%), fever (7 children – 17.5%) and diarrhoea (7 children – 17.5%) (Tab. 2). Single-site small bowel intussusception was found on the ultrasound scan in 32 patients (80%). Double-site SBI was found in 5 patients (12.5%), and SBI coexisting with ileocaecal intussusception was detected in 3 children (7.5%). Overall, 45 SBIs were diagnosed in a total of 40 children. The location of SBI was described in 41/45 cases. The most common site was the middle abdomen (23 cases of SBI) (Tab. 3).

Most reported cases of SBI (10) had a length between 15 and 19 mm. Also, the reported SBI diameter was predominantly in this range (14 cases) or in the 20–24 mm range (11 cases). In 2 cases, SBI was described as “short segment

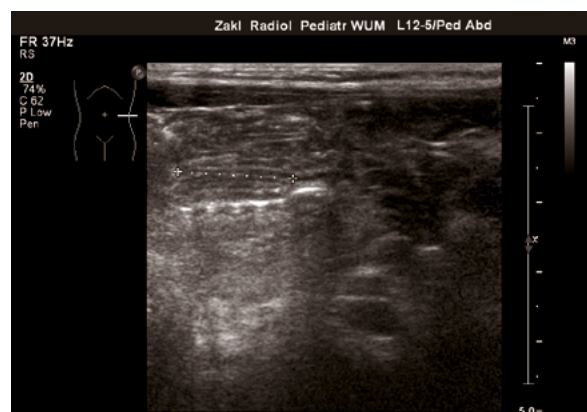


Fig. 1. Small bowel intussusception, 16 mm long – longitudinal section

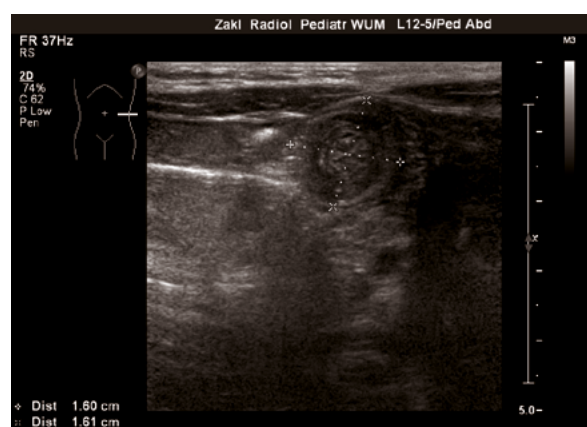


Fig. 2. Small bowel intussusception, 16 mm in diameter, located in the left middle abdomen – cross section

Age (months)	Boys	Girls	Total
0–12	1	2	3
13–24	3	1	4
25–36	4	4	8
37–48	4	4	8
49–60	2	4	6
61–72	2	0	2
73–84	3	1	4
85–96	1	0	1
97–108	0	1	1
109–114	1	1	2
198	1	0	1
Total	22	18	40

Tab. 1. Classification of patients with small bowel intussusception by sex and age

type,” without precise length specification. The longest reported SBI was 75 mm long (Tab. 4). There were no cases of SBI with a diameter greater than 27 mm (Tab. 5).

In one of the patients, ultrasound examination revealed gastrointestinal obstruction presenting as significantly dilated intestinal loops before the intussusception site. In another case, gastrointestinal subobstruction was found.

Symptom	Boys	Girls	Total
Abdominal pain	20	10	30
Vomiting	7	6	13
Abdominal tenderness	7	4	11
Fever	3	4	7
Diarrhoea	3	4	7

Tab. 2. Symptoms accompanying small bowel intussusception in the studied group of patients

Location of SBI	Number of SBI cases	Total
Upper abdomen	Left	4
	Right	1
	Unspecified	0
Middle abdomen	Left	10
	Right	5
	Unspecified	8
Lower abdomen	Left	3
	Right	6
	Unspecified	4
Unspecified		4

Tab. 3. Location of small bowel intussusception in the studied group of patients

Length of SBI (mm)	Number of SBI cases
<30	22
30–35	4
>35	5
“Short segment type”	2
Unspecified	12

Tab. 4. Length of small bowel intussusception in the studied group of patients

Diameter of SBI (mm)	Number of SBI cases
10–14	6
15–19	14
20–24	11
25–29	3
Unspecified	11

Tab. 5. Diameter of small bowel intussusception in the studied group of patients

The largest dimension of the mesenteric lymph nodes in 16 patients was in the range of 10–14 mm. In a total of 9 children, the lymph nodes were described as “normal” (longitudinal dimension <10 mm – norm adopted by the Department of Paediatric Radiology, Medical University of Warsaw).

The presence of free fluid between intestinal loops was found in 6 patients (including 3 cases where it was described as a “trace”). In a total of 31 children, no free fluid was noted. In 3 patients, the information was not included in the ultrasound findings.

During the first ultrasound examination, SBI was spontaneously reduced in 5 patients. In 3 patients, SBI recurred

during the same examination, and in 31 cases it was not reduced during the first ultrasound scan.

During the second, follow-up ultrasound examination, SBI was observed in 11 children, including 8 cases of SBI which was not reduced during the initial ultrasound scan. SBI was not detected in a total of 25 patients – in 20 cases the condition resolved spontaneously between the initial and follow-up ultrasound examinations. In 4 patients, only one ultrasound examination was performed.

The period between the first and second ultrasound examinations was 12–16 hours in 9 patients, and 4–8 and 8–12 hours in two groups of 6 children, respectively.

In 1 girl and 2 boys, SBI was not observed in the third ultrasound scan, and in 2 girls – in the fourth ultrasound scan.

Four boys were considered suitable for laparotomy.

In the first case, the decision to perform laparotomy was based on the fact that the patient’s fourth ultrasound examination revealed persistent SBI, several centimetres long, located in the terminal bowel, following prior reduction of ileocaecal intussusception using water enema. In the course of the procedure, the SBI was reduced, and a 5 cm section of the small bowel with Meckel’s diverticulum was resected.

In the second case, the decision to perform laparotomy was due to persistent concomitant ileocaecal intussusception despite the administration of rectal enemas. During the procedure, no intussusception was found in the small or large bowel. The third case involved an SBI which had increased in the longitudinal dimension (from 60 to 85 mm) and exhibited features of antiperistaltic intussusception. In the course of the procedure, the SBI was reduced, and a 10 cm section of the small bowel with Meckel’s diverticulum was resected.

In the fourth case, the patient was considered eligible for laparotomy, but a preoperative ultrasound examination found no intussusception, so ultimately the surgical procedure was not performed.

Consequently, only 3 out of 40 patients (7.5%) required surgery to reduce intussusception. In 2 cases, surgical management was associated with the presence of Meckel’s diverticulum.

DISCUSSION

Small bowel intussusception (SBI) is an increasingly common finding during ultrasound examinations performed in children. The growing number of diagnosed cases of SBI can be attributed to more accurate ultrasound imaging equipment and increased awareness of the condition among ultrasound specialists.

Frequently, the discrimination between small bowel intussusception and ileocaecal intussusception poses a diagnostic challenge. However, differentiating between both types is a crucial aspect, as they necessitate different therapeutic procedures. Another key issue is the differentiation of SBI cases requiring and not requiring surgery (transient), taking into consideration the risk of ischaemia or bowel necrosis.

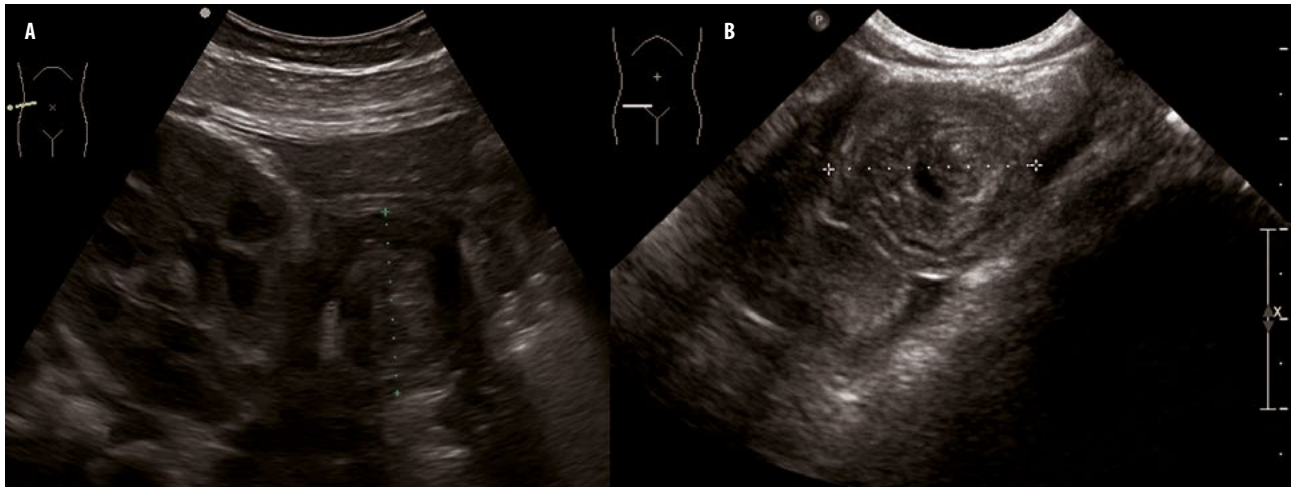


Fig. 3. Differential diagnosis of ileocaecal intussusception and SBI should be based on a number of parameters including patient age, location, diameter, and length of intussusception. A. Ileocaecal intussusception in a 2-month-old patient: right upper abdomen 2.05 cm, length 4.22 cm; B. SBI in a 6-year-old patient: lower abdomen, diameter 2.32 cm, length 3.37 cm

The symptoms of SBI are uncharacteristic. The authors of most publications mention abdominal pain, vomiting or abdominal tenderness as the most prevalent manifestations of SBI. Less common symptoms, including bloody or gelatinous stools and palpable masses in the abdominal region, are associated by the majority of examining physicians with ileocaecal intussusception. Another difficulty of differential diagnosis is the most characteristic feature of the paediatric population, i.e. considerable variability of intussusception dimensions depending on the patient's age. This can be illustrated with the example of 2 patients who were evaluated by ultrasound in our department. In a 2-month-old child, the diameter of ileocaecal intussusception was 2.05 cm, while in the case of a 6-year-old boy the diameter of SBI was 2.32 cm (Fig. 3). Nevertheless, both the location and diameter of intussusception adjusted for the patient's age continue to be recognised as the most important factor for differentiating between SBI and ileocaecal intussusception.

Ko et al. reported that ileocaecal intussusception occurred in children under 2 years of age, particularly between 3 months and 1 year of age, and its prevalence was twice as high in boys than in girls. Among paediatric patients, SBI was more common in older children (mean age: 4 years and 7 months), with a similar prevalence in both sexes⁽¹⁾.

In the present study, SBI was most common in children over the age of 2 and up to the age of 5 (22/40; 55%), and the mean age of the patient with SBI was 4 years and 5 months. The prevalence in boys was slightly higher than in girls (22:18). These findings are in accord with the results reported by Ko et al. (mean age: 4 years and 7 months; boys:girls – 10:9), and with the study by Kim (mean age: 4 years; boys:girls – 18:14 in the group receiving conservative treatment, 4 years and 7 months; boys:girls – 10:9 in the surgically treated group)^(1,2).

SBI is not treated using typical methods employed to reduce ileocaecal intussusceptions such as water enema or air enema, which is no longer the treatment of choice in the authors' department.

The majority of SBI cases diagnosed in the paediatric population are reduced by conservative treatment. In the present study, SBI resolved without surgical intervention in 42 cases (93.33%). Similar results were reported by Kim. A total of 32 patients (94.12%) received conservative treatment, and in 2 patients intussusception was no longer present during the procedure⁽²⁾. It needs to be noted that the analysis performed by the authors also included cases where spontaneous reduction is likely to have occurred – in 1 case during, and in 2 cases immediately before surgical procedure. Doi et al. reported that 100% of SBI cases (21/21) were successfully reduced without surgical intervention. In a study by Kornecki et al., the corresponding figure was 90.91% (40/44)^(3,4). Different results were obtained by Munden et al. In their study, 13/35 (37.14%) patients required surgical intervention. A predictor of the need for surgery was intussusception with a length greater than 3.5 cm which was not self-limiting⁽⁵⁾.

In accordance with the standard procedure followed in the Department of Radiology, each time SBI is detected, an attempt is made to correct it by exerting pressure with the ultrasound head. According to the authors' findings, 20/31 (64.52%) SBIs which were not reduced during the initial ultrasound examination were no longer seen in the follow-up ultrasound scan performed within a few (up to a dozen or so) hours of SBI detection. Munden et al. reported that 13/22 (59.09%) cases of SBI resolved spontaneously within several minutes of the initial examination. Unlike the remaining 9/22 (40.91%) cases, they were not seen in the follow-up ultrasound examination⁽⁵⁾. Kornecki et al. showed that 39/44 (88.64%) cases of SBI resolved either during the initial examination or within 45 minutes of its performance⁽⁴⁾.

Based on the description of 4 cases in which surgery was either considered or undertaken, it is difficult to identify the common features found at the beginning of the diagnostic work-up that would determine the selection of surgical management. All these cases involved boys with SBI that was 60 mm, 60 mm, 35 mm and 55 mm in length (Fig. 4).

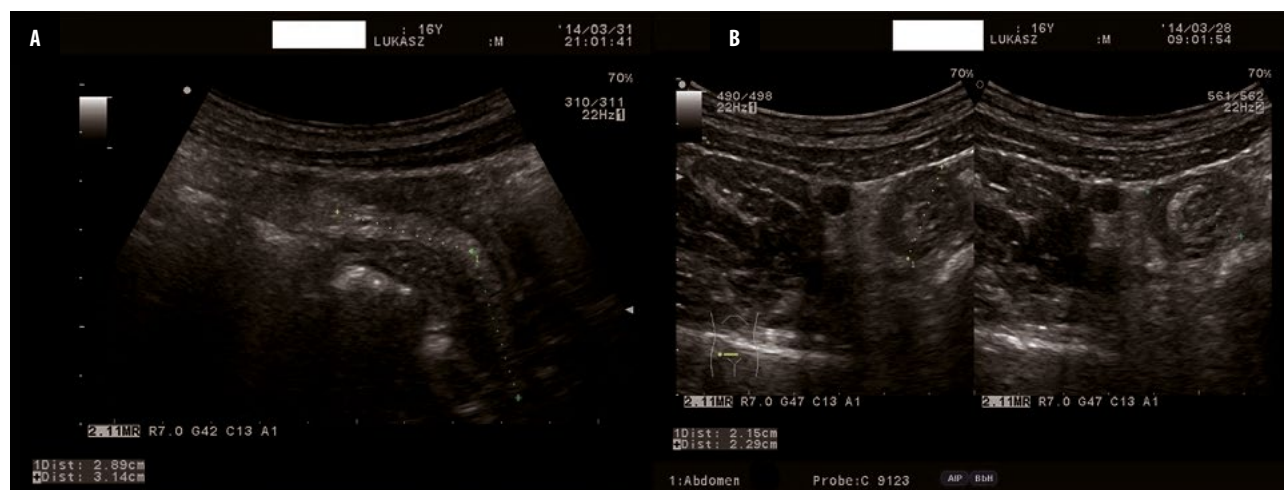


Fig. 4. Small bowel intussusception in a 16-year-old patient requiring surgical intervention. **A.** Longitudinal section; **B.** Cross section. Meckel's diverticulum identified intraoperatively as a lead point

The findings were in agreement with the results reported by Munden et al. who concluded that intussusception length greater than 3.5 cm determined by abdominal ultrasound was the most important independent predictor of the need for surgical reduction of SBI⁽⁵⁾. Studies conducted by Kim show that one of the characteristics of transient SBI which can be reduced without surgical intervention is its length (<3 cm)⁽²⁾. Rajagopal et al. also presented findings in which the mean length of transient SBIs was 2.25 cm (1.8–4.5 cm), while the mean length of SBIs necessitating surgical intervention was 5.6 cm (2.3–7.8 cm)⁽⁶⁾. It is important to stress that the value ranges given in both cases overlap to a major extent. In the present study, a lead point (Meckel's diverticulum) was detected during the procedure in 2 out of 3 (66.67%) patients treated by surgery. The observation is consistent with the data presented by Munden et al. – 69.23% (9 of 13 surgically treated patients)⁽⁵⁾. The lead points reported in their study included Meckel's diverticulum in 4 cases, polyps in the intestinal lumen – in 3 cases, and enlarged lymph nodes – in 2 cases⁽⁵⁾. Kim and Rajagopal et al. also pointed to the markedly higher prevalence of the lead point in cases requiring surgical intervention – 44.4% and 80%, respectively^(2,6). The authors' findings show a significant difference between the mean age of patients treated conservatively (4 years and 1 month) and surgically (9 years and 2 months). A similar correlation is found in the paper by Munden et al., the mean patient age being 4.2 and 7.5 years, respectively⁽⁵⁾. A limitation of this study is its retrospective design and, consequently, lack of all data necessary for a more in-depth analysis.

CONCLUSIONS

Most cases of SBI in the paediatric population resolve after conservative management (attempts to reduce the intussusception using the ultrasound head, spontaneous reduction in time).

Based on our observations, the most important parameter for determining whether SBI should be reduced surgically is the length of the intussusception (≥ 35 mm). This finding is consistent with the available literature. Importantly, each case should be considered individually, and follow-up ultrasound scans should be performed both after detecting small bowel intussusception and immediately before surgical procedure.

The development of recommendations for the management of small bowel intussusception in the paediatric population requires further studies, preferably based on the prospective design.

Conflict of interest

The authors do not declare any financial or personal links with other persons or organisations that might adversely affect the content of the publication or claim any right to the publication.

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