Journal of Acute Medicine 9(4): 194-197, 2019
DOI:10.6705/j.jacme.201912_9(4).0006
Case Report

Small Bowel Obstruction and the Role of Bedside Ultrasonography Performed by a Pediatric Emergency Physician: A Case Report

Shinichi Fukuhara*, Yoshimichi Yamaguchi

Department of Emergency and Critical Care Medicine, Kobe Children's Hospital, Kobe, Japan

Small bowel obstruction (SBO) is a relatively uncommon urgent condition that may require surgical treatment. However, initial symptoms of patients who present with SBO are often nonspecific and may be confused with those of more common pediatric illnesses. Although the number of true SBO cases requiring emergency attention is few, distinguishing SBO from the more common less urgent pediatric abdominal conditions is vital for the most effective patient care. Therefore, immediate and accurate identification of this condition is essential in order to avoid delays in diagnosis that may increase morbidity and mortality. We report a case involving a 7-year-old girl who initially presented with abdominal pain and vomiting. A bedside ultrasonography performed by the pediatric emergency physician allowed for the initiation of appropriate, rapid decision making including extensive examination and management. Although bedside ultrasonography has been used in the past to diagnose SBO in adult patients, this is the first report on diagnosing a pediatric patient with SBO utilizing bedside ultrasonography considering criteria that are different from those for children in the past case series. Here, we also review SBO and its diagnostic modalities and the role of the pediatric emergency physician in performing ultrasonography.

Key words: *point-of-care ultrasound, small bowel obstruction, bedside ultrasonography*

Introduction

Among pediatric abdominal emergency diseases, small bowel obstruction (SBO) is a serious condition requiring early diagnosis and treatment. Diagnosis of SBO can be difficult because of the wide variety of differential diagnoses associated with abdominal pain and vomiting, ranging from benign to emergent surgical causes. Although a large number of children present to the emergency department (ED) with abdominal conditions and associated symptoms such as abdominal pain and vomiting; SBO in children is rare. Conventionally, an abdominal X-ray and abdominal computed tomography (CT) examination are diagnostic imaging modalities[1] performed and less commonly, an ultrasound examination may be performed in adults and children.[2,3]

Ultrasound examination, as part of a point-of-care evaluation, is performed for various abdominal diseases in the ED. Ultrasound examination by an emergency physician in adults has been reported to demonstrate high sensitivity and specificity for intestinal obstruction diagnosis[4] and the American College of Emergency Physicians cites intestinal obstruction as a target disease for adult abdominal disease ultrasound examination.[5] The advantage of bedside point-of-care ultrasound (POCUS) by pediatric emergency physicians is that it allows the physician to make prompt critical decisions in patients with acute abdomen pain. At present, there is no recommendation for

Received: November 5, 2018; Revised: May 7, 2019 (2nd); Accepted: June 4, 2019.
*Corresponding author: Shinichi Fukuhara, MD, PhD, Department of Pediatrics, Awaji Medical Center, 1-1-137 Shioya, Sumoto City, Hyogo prefecture 656-0021, Japan. E-mail: s_fukuhara@awajimc.jp

diagnosing pediatric SBO through POCUS.[6] Therefore, the criteria for diagnosing pediatric SBO using ultrasound examination are unclear and whether they are the same as those used for adults remains to be determined.[3,7] However, considering the usefulness of ultrasound examination in adults, it is likely that POCUS may be useful diagnosing SBO in children.

In this report, we review a case in which SBO was diagnosed through ultrasound examination using criteria that are different from those used for children in the past case series.[3] Furthermore, strangulated SBO was then confirmed via surgery.

Case Report

A 7-year-old girl initially presented to the pediatric ED with a chief complaint of abdominal pain and vomiting. The patient reported having mild abdominal pain and no stool passage for 2 days. She had a previous history of hepatoblastoma with partial right hepatectomy, percutaneous transhepatic cholangiogram and biliary drainage for the treatment of obstructive jaundice. Vital signs at presentation were as follows: pulse, 100 beats/min; respiratory rate, 20 breaths/min; temperature, 36.8°C; pulse oximetry, 96% on room air; blood pressure, 98/58 mmHg. Although the patient was alert on examination, she appeared to be in moderate distress. Physical examination showed decreased bowel sounds, mild abdominal distension, mild abdominal tenderness around the umbilical region, normal turgor, no edema, and a capillary refill time less than 2 seconds.

In the ED, intravenous access was obtained, laboratory tests results were examined, and abdominal POCUS was performed. The POCUS examination revealed a dilated intestine, decreased intestinal peristalsis (Figs. 1 and 2, also see video 1, available at http://doi.org/10.6705/j.jacme.201912_9(4).0006). The diameters of fluid-filled bowel loops ranged from 20 to 25 mm, and bowel movements were decreased.

The patient subsequently underwent an abdominal CT scan, which revealed dilatation of the small intestine to a diameter of 20–25 mm, and collapse of the intestinal tract around the umbilical region (Figs. 3 and 4). She was subsequently diagnosed with SBO. She was admitted to pediatric intensive care unit with medical treatment including nasogastric tube. However, her abdominal pain did not improve and therefore abdominal surgery was performed the next day. The operational diagnosis was SBO with ischemic change

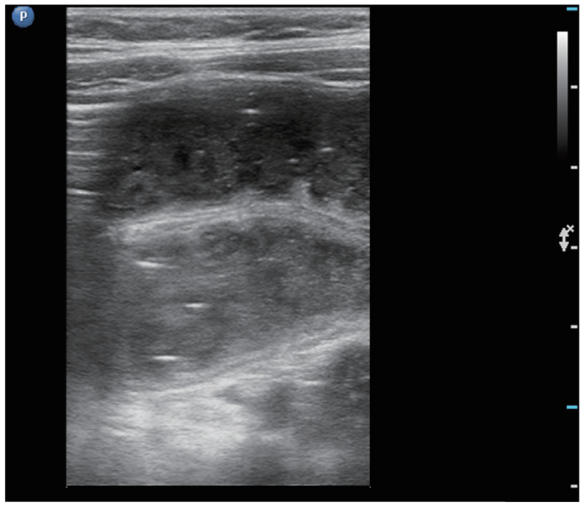

Fig. 1. Dilatation of intestines with linear probe.

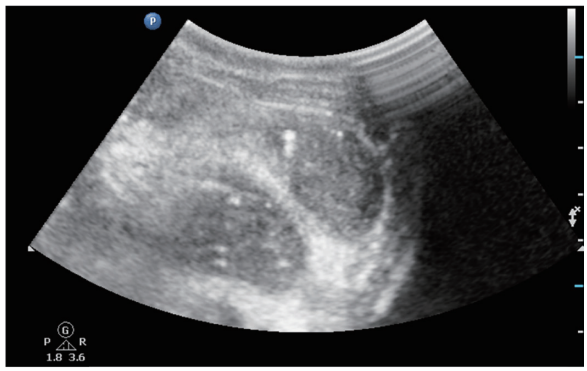

Fig. 2. Dilatation of intestines with convex probe.

due to adhesion band were found and partial small bowel resection and adhesionlysis were perform during operation. A final diagnosis of strangulated ileus was established.

Discussion

Acute abdominal pain is one of the most common presentations in the ED.[8] Determining the etiology of acute abdominal pain can be challenging, and delay in diagnosis can be potentially fatal in cases where the disease requires abdominal surgery. In some patients, the etiology of acute abdominal pain can be unclear despite a detailed history, physical examination, and laboratory investigations. Among causes of abdominal pain, SBO is an urgent condition that may require surgical treatment. It is difficult to diagnose SBO accurately from only the current medical history and physical examination;[9] therefore, the correct diagnostic imaging modality is crucial.

Fig. 3. Transverse view of abdominal computed tomography demonstrating localized dilatation of intestine.

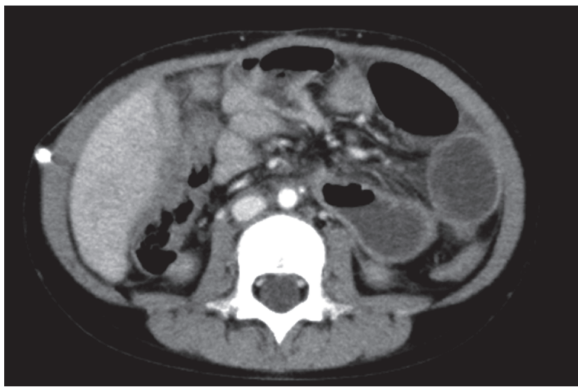

Fig. 4. Coronal view of abdominal computed tomography demonstrating localized dilatation of intestine.

Abdominal imaging can be performed with abdominal CT, ultrasonography, or X-ray examination.[1-3] Of these, an abdominal X-ray examination is often the initial diagnostic imaging modality utilized in ED; however, its sensitivity and specificity are too low to confirm a diagnosis of SBO, limiting its usefulness in the pediatric ED.[2] In contrast, abdominal CT examination has higher sensitivity and specificity; however, this is not a test easily performed on children with abdominal pain, and additionally has irradiation risks.

It has been recommended that ultrasonography should be performed by emergency physicians for SBO in adults.[5] Indeed, emergency physicians are gradually increasing the use of POCUS for diagnosing SBO.[10] Previous research has shown that POCUS performed by emergency physicians has a positive likelihood ratio of 9.55 and negative likelihood ratio of 0.04, indicating a very good accuracy and potential to play a larger role in diagnosis of acute abdominal pain.[4] In a recent systematic review and meta-analysis, sensitivity and specificity of ultrasound exam were shown to be 92.4 and 96.6%, respectively.[10] In regard to diagnosis of adult SBO, the sensitivity and specificity of abdominal CT, ultrasound, and simple abdominal X-ray examinations were 93 and 100%, 83 and 100%, and 77 and 50%, respectively.[2] In addition, emergency medicine residents can diagnose SBO with a high-degree of accuracy, comparable with that of radiology residents.[11] Considering the usefulness of ultrasound examination in the diagnosis of SBO in adults, it is likely that it may be useful in children and may easily be performed by emergency physicians.

However, the true utility of abdominal ultrasonography for SBO diagnosis in children has not yet been determined. Currently, the criteria for children are not included in the Pediatric Emergency Medicine Fellow Training in Ultrasound[6] or Pediatric emergency medicine point-of-care ultrasound,[12] both of which include diagnostic criteria for appendicitis and intussusception. The only available report is a case series by James et al.[3] involving five patients who experienced SBO. In adults, however, the guidelines mentioned by Ogata et al. are generally accepted as diagnostic criteria: those with a diameter of the intestinal tract near the collapsed intestinal tract more than 25 mm and absent or decreased peristaltic activity indicating the disappearance or attenuation of intestinal motility.[7] As another diagnostic criterion, Unluer defines SBO as those with an intestinal diameter of fluid-filled bowel loops greater than 25 mm in the jejunum and greater than 15 mm in the ileum over a length of more than 3 loops.[11] There is another criteria mentioned by Jang et al. who suggested that SBO is associated with decreased or absent bowel peristalsis defined as back and forth movements of spot echoes inside the fluid-filled bowel.[13] In a study conducted in an ED, using bowel dilation identified via ultrasound examination as a diagnostic criterion had a sensitivity of 91% and specificity of 84% for SBO, compared

with 27% and 98% for decreased bowel peristalsis on ultrasonography.[13] Similarly, James et al. reported that fluid-filled bowel loops dilated more than 25 mm along with abnormal peristalsis indicated SBO in children.[3] In our case, intestinal dilation of 20 to 25 mm was observed in both ultrasonography and CT examination, which was confirmed to be strangulated ileus by laparotomy. However, because children have smaller-diameter small bowel even in normal conditions compared to adults, ultrasound examination diagnostic criteria of SBO in children needs further investigation.

Conclusion

Diagnosis of SBO based only on symptoms and physical examination is difficult, and therefore diagnostic imaging modalities are essential. The effectiveness of ultrasound examination in the medical care of adults indicates that it may be a useful alternative to the less accurate abdominal X-ray examinations. In order to use POCUS for the diagnosis of SBO in children as well, it is necessary to accumulate more evidence based on outcomes of pediatric cases and to standardize diagnostic criteria. In this case study, we discussed how POCUS performed by an emergency physician facilitated the early diagnosis of SBO in a pediatric patient who initially presented with vomiting and abdominal pain. Other research has also indicated that POCUS is useful for diagnosing numerous abdominal disorders in children and can be used to quickly differentiate SBO from other abdominal symptom etiologies. Therefore, despite limited evidence, SBO diagnosis using POCUS has been a very useful tool for emergency physicians in the management of pediatric patients.

Conflicts of Interest Statement

None.

References

1. Jabra AA, Eng J, Zaleski CG, et al. CT of small-bowel obstruction in children: sensitivity and specificity. *Am J Roentgenol* 2001;177:431-436. doi:10.2214/ajr.177.2.1770431
2. Suri S, Gupta S, Sudhakar PJ, Venkataramu NK, Sood B, Wig JD. Comparative evaluation of plain films, ultrasound and CT in the diagnosis of intestinal obstruction. *Acta Radiol* 1999;40:422-428. doi:10.3109/02841859909177758
3. James V, Alsani FS, Fregonas C, Seguin J, Tessaro MO. Point-of-care ultrasound in pediatric small bowel obstruction: an ED case series. *Am J Emerg Med* 2016;34:2464.e1-2464.e2. doi:10.1016/j.ajem.2016.06.021
4. Taylor MR, Lalani N. Adult small bowel obstruction. *Acad Emerg Med* 2013;20:528-544. doi:10.1111/acem.12150
5. Tayal V, Raio C. Ultrasound guidelines: emergency, point-of-care and clinical ultrasound guidelines in medicine. *Ann Emerg Med* 2017;69:e27-e54. doi:10.1016/j.annemergmed.2016.08.457
6. Vieira R, Hsu D, Nagler J, Chen L, Gallagher R, Levy JA. Pediatric emergency medicine fellow training in ultrasound: consensus educational guidelines. *Acad Emerg Med* 2013;20:300-306. doi:10.1111/acem.12087
7. Ogata M, Mateer JR, Condon RE. Prospective evaluation of abdominal sonography for the diagnosis of bowel obstruction. *Ann Surg* 1996;223:237-241. doi:10.1097/00000658-199603000-00002
8. Reynolds SL, Jaffe DM. Diagnosing abdominal pain in a pediatric emergency department. *Pediatr Emerg Care* 1992;8:126-128. doi:10.1097/00006565-199206000-00003
9. Jang TB, Schindler D, Kaji AH. Predictive value of signs and symptoms for small bowel obstruction in patients with prior surgery. *Emerg Med J* 2012;29:769-770. doi:10.1136/emj.2010.100594
10. Gottlieb M, Peksa GD, Pandurangadu AV, Nakitende D, Takhar S, Seethala RR. Utilization of ultrasound for the evaluation of small bowel obstruction: a systematic review and meta-analysis. *Am J Emerg Med* 2018;36:234-242. doi:10.1016/j.ajem.2017.07.085
11. Unlüer EE, Yavaşi O, Eroğlu O, Yilmaz C, Akarca FK. Ultrasonography by emergency medicine and radiology residents for the diagnosis of small bowel obstruction. *Eur J Emerg Med* 2010;17:260-264. doi:10.1097/MEJ.0b013e328336c736
12. Marin JR, Abo AM, Arroyo AC, et al. Pediatric emergency medicine point-of-care ultrasound: summary of the evidence *Crit Ultrasound J* 2016;8:16. doi:10.1186/s13089-016-0049-5
13. Jang TB, Schindler D, Kaji AH, Bedside ultrasonography for the detection of small bowel obstruction in the emergency department. *Emerg Med J* 2011;28:676-678. doi:10.1136/emj.2010.095729