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ULTRASONOGRAPHY AS A RELIABLE TOOL IN DIAGNOSIS AND IMAGING BASED FOLLOW-UP PROCEDURE IN CONSERVATIVELY MANAGED TRANSIENT SMALL BOWEL INTUSSUSCEPTION

Dr. Emhmed Mohamed Saaid*[1], Dr. Emraga Abohamod[2] and Dr. Momen Abdu Alkhir[3]

[1]Department of Diagnostic Radiology, Sebha Medical Centre Hospital, Sebha University-Libya.
[2]Department of Anatomy, Sebha University College of Medicine-Libya.
[3]Department of Radiology, Faculty of Medical Technology, Sebha University-Libya.

***Corresponding Author: Dr. Emhmed Mohamed Saaid**

Department of Diagnostic Radiology, Sebha Medical Centre Hospital, Sebha University-Libya.

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ABSTRACT

The paper aim is to evaluate the ultra-sonographic features of transient small bowel intussusceptions (TSBI) in paediatrics age group. In our unit, we came across six cases with TSBI cases (4 males and 2 females, the age ranges between 7–120 months (mean 38.months). Retrospective analysis of the demographic characteristics and ultrasonographic findings was done The radiological findings as location, calibre, outer rim thickness, and inclusion of mesenteric lymph nodes within intussuscipiens were compared. In TSBI, the intussusception head was located in the abdominal right lower quadrant (RLQ) in 3 (50%), the right upper quadrant (RUQ) in 1 (16%) and the periumbilical area in 2 (33%) cases. The anteroposterior (AP) diameter ranged from 0.9–2.5 cm (mean 1.38 cm), and thickness of outer rim ranged from 0.10–0.34 cm (mean 0.26 cm). No mesenteric lymph nodes were contained within the intussuscipiens. In conclusion, ultrasound examination is the preferred primary radiological diagnostic modality to evaluate and diagnose the acute abdomen with a suspected small bowel intussusception.

KEYWORDS: Intussusception, Small bowel obstruction, Ultrasonography, Laparatomy.

INTRODUCTION

Acute abdomen in paediatric age group is a common presentation to the emergency department. Among the disorders that cause paediatric acute abdomen is small bowel obstruction secondary to intussusception.[1] Intussusception is a common abdominal emergency that necessitates prompt diagnosis and adequate management.[2] In intussusception, peristalsis brings a segment of proximal bowel (intussusceptum) into a more distal segment, this results in bowel lumen obstruction, mesenteric vessels occlusion, and eventually ischaemia and necrosis of the intussusceptum in delayed presentation.[1] Transient SBI in paediatric patients is known to be uncommon, present in symptomatic or asymptomatic children and the clinical and sonographic characteristics have not been well described. Recently, Kornecki et al have reported that most of the SBI observed in children usually short-segment, small-bowel intussusceptions and revealed no lead point and spontaneous reduction was common, thus conservative observation was warranted.[3]

With the wider use of imaging modalities as ultrasonography and its improved resolution, transient small bowel intussusception is frequently detected on practical daily ultrasound.

The recent researches, suggest that careful ultrasonographic examination and/or interpretation of CT scans have disclosed many SBIs that were reduced spontaneously without any intervention. In this group of patients, conservative observation including re-imaging is recommended.[4,5,6]

The purpose of this article is to evaluate the typical ultrasonographic characteristics of TSBI.

MATERIALS AND METHODS

A retrospective evaluation of the 6 cases diagnosed with intussusception on ultrasonography during the period from January 2009 to July 2014. The medical records and the ultrasonographic features and the medical records were analysed. The ultrasonographic examination was performed by radiologist using the HDI 5000 (Advanced Technology Laboratories,). The solid abdominal organs were examined using a convex transducer, then a 5–12 MHz linear transducer was used for the detailed assessment of the bowel and mesentery. Ultrasonographic diagnostic features for intussusceptions consisted of the presence of one or more characteristic sonographic signs: a doughnut sign (an even thickened hypoechoic outer and a central hyperechoic core), a crescent-in-doughnut sign (an even outer hypoechoic rim

with a central hyperechoic crescent) or a multiple concentric rings sign (a mass with multiple alternating hypoechoic and hyperechoic concentric rings) (Figure 1&2) If the centre of the intussusception is imaged along its longitudinal axis, three parallel hypoechoic bands separated by two nearly parallel hyperechoic bands are elicited on the ultrasonography. The outer hypoechoic bands represent the oedematous everted limb of the intussusceptum and the thin intussuscipiens; the central hypoechoic band is the central limb of the intussusceptum. The hyperechoic bands are caused by the mesentery that is dragged along with the bowel loop (Figure 3). This appearance is known as the sandwich sign.[4] The anatomical location of the intussusception was documented according to the site of its head: the right upper, right lower, left upper, left lower, periumbilical or epigastric region. The diameter and the thickness of the outer sonolucent rim (outer wall to the luminal surface) of the intussusception were measured on transverse scan by using the electronic callipers of the ultrasonography equipment. The presence or absence of mesenteric lymph nodes in the intussuscipiens was evaluated. In the suspected TSBI patients, follow-up ultrasonography was performed 1–2 days after the initial examination to check for the persistence or resolving of the transient SBI.

RESULTS

On ultrasonography, transient SBI appeared as a crescent-in-doughnut (Figure 1) or multi-layered round mass on a transverse scan, and the short segmental sandwich sign (Figure 2) was seen on a longitudinal scan. In the SBIs, the head of the intussusception was located in the right lower quadrant in 3 cases (50%), the right upper quadrant in 1 cases (16,7 %) and the periumbilical area in 2 cases (33.3%). The anteroposterior diameter of the SBIs ranged from 0.84 cm to 2.4 cm with a mean diameter of 1.3 cm. The thickness of the outer rim of the SBIs ranged from 0.10 cm to 0.34 cm with a mean diameter of 0.26 cm. One patient underwent CT scan for evaluation of bowel ischaemia or perforation, but this was negative and the patient was finally diagnosed with acute gastroenteritis.

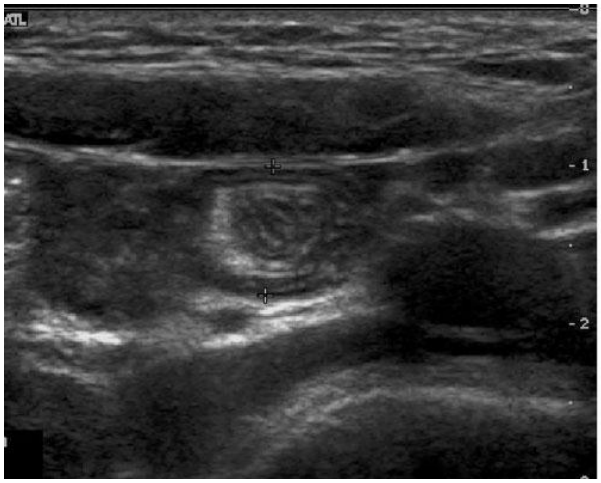

Figure 1: Ultrasonographic transverse plane image of a 7-year-old boy with abdominal pain and typical transient small bowel intussusception shows the crescent-in-doughnut sign (cursors). The diameter of the doughnut measured 0.84 cm and the thickness of the outer rim of the lesion measured 0.10 cm.

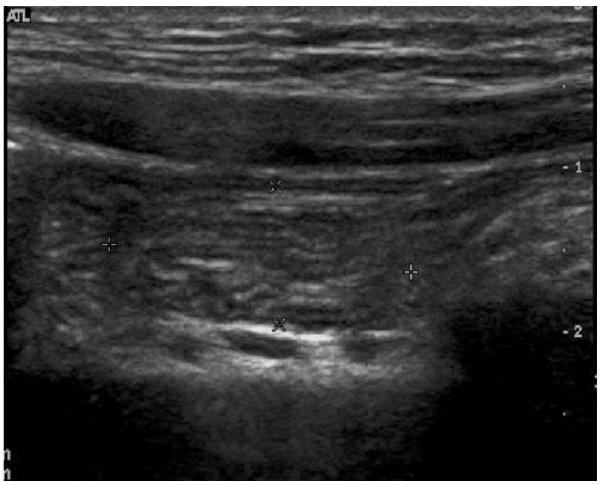

Figure 2: Ultrasonographic longitudinal plane images of a 7-year-old boy with abdominal pain and typical transient small bowel intussusception shows the sandwich sign (cursors).

DISCUSSION

More than 90% of cases of intussusception that occur in paediatric patients are of an ileocolic, ileo-caecal and most previous studies have focused on these cases.[7,8,9,10] By contrast, more than 50% of adult intussusceptions are SBI, may be as a result of underlying malignant lesions.[11,12,13] Short period abdominal pain alternative with pain free intervals as typical presentation for intussusception in children. The classical triad of (abdominal pain, bloody stools and vomiting) is present in less than half of patients with intussusception. SBI may also occur incidentally in asymptomatic patients.

Causes could be related to lymphoid hyperplasia, Meckel's diverticulum duplication cyst, haemangioma, adhesions, worm infection, intramural haematoma, lymphoma, polyps, tumours and Henoch–Scho nlein purpura , more causes including, celiac disease,[14] Peutz-Jeghers Syndrome,[15] are mentioned in table (1). In the adult age group it is less common and may be due to endometriosis,[16,17] and GIST which is most common type of primary mesenchymal tumour within the wall of the gastrointestinal tract primarily caused by activating mutations in the KIT gene.[18,19]

Clinically, relatively, there is no specific signs, however, an abdominal mass, abdominal tenderness and abdominal distension may present.[1,20] The rising percentage of cases of transient SBI observed in the clinical practice , may be as a result of the increased use of abdominal ultrasound in children presenting with abdominal pain and secondary to the improvement in resolution and quality of the images.[21] Generally speaking, transient SBI occurred in older children (mean age 4 years) compared with large bowel intussusceptions (in the age group less than 2 years).[5] TSBI patients clinically, often present with non-specific symptoms, such as vomiting, irritability with crying, lethargy, fever and/or abdominal pain, or with symptoms characteristic of intussusception, such as vomiting (green from bile),cyclic cramping abdominal pain, pulling legs to the chest, a palpable mass and rectal bleeding, often with "red currant jelly" stool, which occurred in approximately one-fifth of patients. Therefore, diagnosis based on clinical examination can be problematic unless imaging studies are performed.[3]

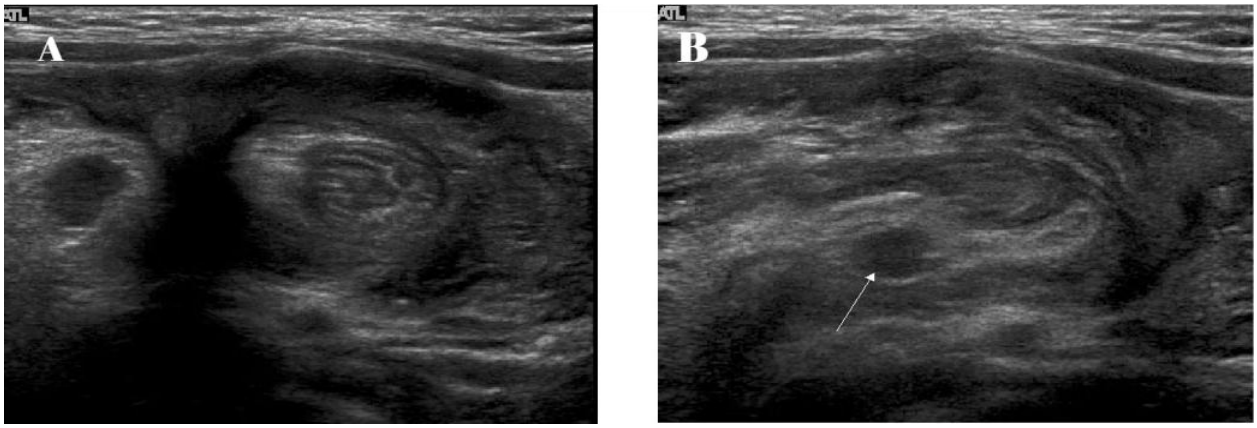

Figure 3: Ultrasonographic images of a 10-month-old boy with cyclic irritability and typical ileocolic intussusception. Transverse (A) and longitudinal (B) US scans show the diameter of the head measuring 2.88 cm and the thickness of the outer rim of the lesion measuring 0.49 cm. There was a mesenteric lymph node (arrow).

Table 1: Possible causes and lead points of small bowel intussusception.

Idiopathic
Duplication cyst
Hyperplasia of Peyer's patches
Meckel's diverticulum
Haemangioma
Peritoneal adhesions
Polyps
Malignancy & lymphoma
Henoch–Schonlein purpura
Parasitic infestation
Cystic fibrosis
Altered motility
Ventriculo-peritoneal shunt
Peutz-Jeghers syndrome
Lipoma
Endometriosis

In many instances, the causal relationship between the symptoms and SBI is uncertain. Many of the patients have additional conditions, such as acute viral gastroenteritis, mesenteric lymphadenopathy, large bowel intussusception, HSP (Henoch–Scho¨nlein purpura) and the previous laparotomy condition, all of which may be the causal factor of the abdominal symptoms.

The following factors are thought to predispose children to develop SBI:

1. Anatomical change and swelling of the bowel wall;
2. Abnormal gastrointestinal motility; and
3. Scar or adhesion of the bowel from previous insult.[5]

In the diagnostic work for TSBI, sonography has been reported to be highly sensitive (98–100%) for the diagnosis of intussusception.[7,10,22]

Tiao et al (2001) also reported that the sensitivity of sonography for detecting SBI among paediatric patients was 84% , although a detailed sonographic evaluation of the abdomen may occasionally be limited by excessive bowel gas in the dilated bowel loops and the irritability of the very young patients.[23] In presence of bowel ischaemia, the ultrasonography may detect peritoneal fluid collection entrapped within an intussusception between the serosal layers of both limbs of the intussusceptum, its incidence is <15%.[22] This complication appears on the axial scan appear as the double crescent-in-doughnut sign (Figure 1). This finding was not seen in any of our transient SBI patients. Transient SBI in paediatric patients isn't easy to detect as the lesions are usually smaller and atypically located and, thus, more experience is necessary. In one report, real-time evaluation on the video records showed peristalsis of the invaginated bowel wall in all of the 2 transient SBI patients that were recorded. Visible wall motion on real-time ultrasound observation may also suggest an early reduction for TSBI.[5]

The other value of the ultrasound evaluation is the possibility of the differentiation between the ileocolic and small-bowel intussusceptions (Figure 3). The demonstration of presence of an inner fatty core in the intussusception, lesion diameter assessment, wall thickness measurements, the ratio of fatty core thickness to outer wall thickness, and the presence of lymph nodes in the lesion may enable reliable differentiation between ileocolic and small-bowel intussusceptions.[24]

Despite the sonographic identification of various lead points, such as enterogenous cyst, lipoma, lymphangioma, tumours, Meckel's diverticulum and Peutz–Jeghers syndrome, in cases of SBI,[25,26,27,28] it may be very difficult to detect the underlying lesions preoperatively on ultrasonography,[23] The use of CT has been reported to be a sensitive modality to diagnose the intussusception and the demonstrate the presence of any associated lead points. In addition, it provides opportunity to have a detailed preoperative evaluation of the possible extension and/or dissemination of a malignant neoplasm, if present, and was also helpful in excluding other abdominal conditions and complications.[11,13] Even so, the routine indication of CT for all paediatric patients with non-specific abdominal symptoms and signs is of doubtful use due to radiation hazard.[29] If the ultrasonographic findings are typical of transient SBI, conservative management is recommended and ultra-sonographic follow up appears to be adequate for subsequent monitoring to confirm a spontaneous reduction as long as it is performed by an experienced radiologist and the clinical picture supports this.[5] Therefore, CT should be avoided, protecting the child from unnecessary radiation exposure t. Because most cases of transient SBI resolve spontaneously rapidly, our recommendation is that, the timing of follow up ultrasound examination should be 1 hour or at least within 1 day from the initial assessment.

Although SBI that needed surgical intervention were not included in our study, transient SBI should be differentiated from these cases. The lesion generally gets larger as swelling of the bowel wall progresses, as was demonstrated by the different outer rim thicknesses in the two groups (mean 0.26 cm vs0.72 cm for the transient and surgically managed SBIs, respectively). The lead point contained within the intussusception may also increase the size, which occurred in 46% of the surgically managed SBI cases,[30] Other ultrasonographic findings known to be associated with difficult spontaneous reduction of the intussusceptions include the presence of bowel obstruction, free fluid and fluid trapped between the intussuscepted bowel walls,[31] all of these which were more frequent in the patients with SBI and underwent surgical management. The reported rates of post-operative SBI in children have ranged from 4% to 16%. The reported incidence is even higher in patients with neuroblastoma and in trauma patients after laparotomy. The diagnosis of postoperative SBI remains challenging because its clinical presentations mimic the common post-operative events as abdominal pain, nausea, vomiting and ileus, and radiographic imaging studies are usually inconclusive due to presence of post-operative changes. Therefore, close ultrasonographic follow up for patients after surgery should be carried out for possible SBI.[30]

CONCLUSION

Ultrasound is the preferred primary radiological diagnostic modality to evaluate and diagnose intussusception related abdominal pain in children because it is non-invasive, easily accessible, fast, and eliminates the growing concern of CT related cumulative radiation hazards. Ultrasound also is reliable tool in follow-up assessment of conservatively managed cases of TSBI.

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