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Sonographic appearances of inverted Meckel diverticulum with intussusception

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Abstract This study illustrates the sonographic findings of inverted Meckel diverticulum acting as a lead point of an intussusception in five patients. In four patients, the inverted diverticulum was seen as a segment of blind-ending, thick-walled bowel projecting for a variable distance from the apex of the intussusceptum. The larger diverticula had a characteristic bulbous shape. The central serosal surface of the inverted diverticulum was filled with fluid in one patient, with fluid and fat in another, and with echogenic fat only in the other two. The presence of fat was confirmed by CT in one patient. The features illustrated in these four patients appear to be specific. In the fifth patient, the sonogram revealed a nonspecific echogenic mass at the apex of the intussusceptum. Recognition of these features on sonography may obviate the need for further investigation.

Introduction

There is little published regarding the sonographic appearances of inverted Meckel diverticulum with intussusception [1–3]. We present the sonographic appearances in five children.

Case material

There were three boys and two girls who presented at ages 5 months, 2 years, 3.5 years, 7.5 years and 10.5 years respectively. Pain and vomiting were present in four and rectal bleeding in three. The duration of symptoms was from 6 h to 10 days prior to admission.

Results

Sonographic findings

In four patients, a blind-ending segment of thick-walled bowel was seen as a lead point extending for a variable distance from the distal end of the intussusceptum (Figs. 1–4). The normal gut signature was absent from this thickened wall. The central serosal surface of the inverted diverticulum was filled with fluid in one patient (Fig. 1), with fluid and fat in another (Fig. 2) and only with fat in the other two (Figs. 3, 4). The larger diverticula had a bulbous shape and were identified lying within the intussuscipiens (Figs. 1, 3, 4). The presence of an inverted Meckel diverticulum as the lead point of the intussusception was recognised prospectively in three (Figs. 1, 3, 4) and only retrospectively in one (Fig. 2). In the fifth patient the inverted diverticulum appeared as a more nonspecific, heterogeneous, echogenic mass at the distal end of the intussusception (Fig. 5).

Air enema reduction was attempted in three stable patients. The sonographic appearances showed the intussusception within the colon. The intussusception was irreducible by air enema in all three. The presence of an inverted Meckel diverticulum as the lead point was recognised prospectively on air enema in only one and retrospectively in two of these patients.

Air enema was not attempted in the other two patients. In one, the enema was contraindicated as the child was lethargic and peritonitis was felt to be present clinically. On sonography, the inverted diverticulum lay

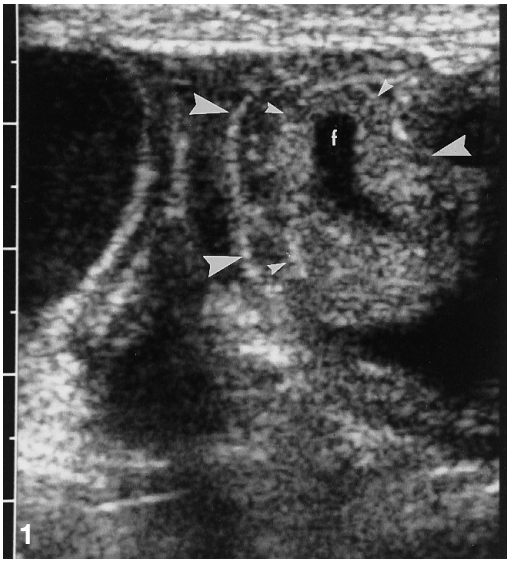
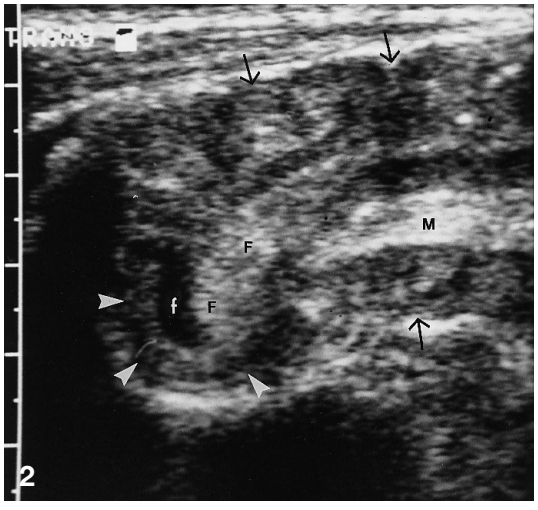
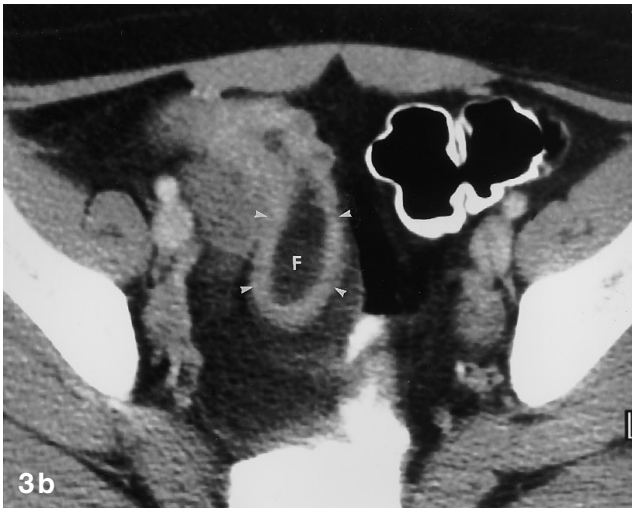


Fig. 1 Sonogram in a 5-month-old girl shows thick-walled inverted Meckel diverticulum (*small arrowheads*) lying within the intussuscipiens (*large arrowheads*). Fluid (*f*) is present within the serosal-lined centre of the inverted diverticulum

Fig. 2 Sonogram in a 2-year-old boy shows the intussusception (*arrows*) with a thick-walled inverted Meckel diverticulum (*white arrowheads*) at the apex of the intussusceptum. Fluid (*f*) and fat (*F*) fill the central portion of the inverted diverticulum (*M* mesenteric fat normally found between the layers of an intussusception)





within the intussuscipiens which had a thickened wall suggesting that the intussusceptum had previously progressed more distally and had then undergone spontaneous, partial reduction.

In the other patient, air enema reduction was not attempted as a prior barium enema and CT indicated that the intussusception was ileo-ileal and had not reached the colon. The barium enema, performed at a referring hospital, revealed a normal colon and a bulbous filling defect in the distal ileum. A radionuclide Meckel scan was negative for Meckel diverticulum. A computed tomogram showed the intussusception with a bulbous mass at the distal end representing the inverted diverticulum (Fig. 3b). The thickened wall of the inverted diverticulum surrounded central tissue with negative attenuation values confirming the fatty nature of the central echogenic tissue identified on sonography.

In all five patients, an inverted Meckel diverticulum was found to be the lead point of an intussusception at laparotomy. The intussusception was easily reduced manually and the diverticulum everted in four patients. In the fifth patient, the intussusception could not be reduced manually and was resected. Necrosis was present in the wall of the diverticulum in two patients and in the diverticulum and adjacent bowel in the other three.

Fig. 3 **a** Sonogram in a 10.5-year-old girl shows a bulbous mass with thick, hypoechoic walls (*arrowheads*) representing the inverted Meckel diverticulum at the apex of the intussusception. The central part of the mass is echogenic (*F*) due to fat. **b** Computed tomogram with intravenous contrast enhancement shows the bulbous mass of the inverted diverticulum (*small arrowheads*) within the fluid-filled intussuscipiens. Tissue in the central part of the inverted diverticulum has negative attenuation values confirming its fatty nature (*F*). A coil spring appearance of the intussusception is present at the proximal end of the inverted diverticulum. Note the characteristic, identical shape of the central fat (*F*) in both **a** and **b**

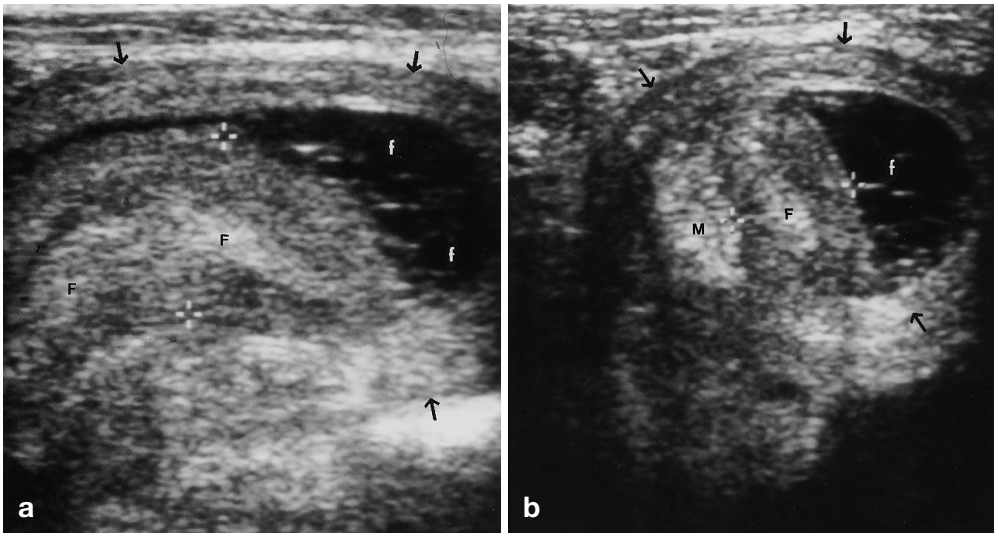


Fig. 4 **a** Longitudinal and **b** transverse sonogram in 3.5-year-old boy. Elongated mass (between + cursors) represents the inverted diverticulum with thick walls surrounding central echogenic fat (*F*). The diverticulum is surrounded by fluid (*f*) as it projects off the distal end of the intussusceptum into the lumen of the intussuscipiens (*short arrows*). The wall of the intussuscipiens is thickened suggesting that the intussusceptum had previously progressed more distally and had subsequently undergone spontaneous, partial reduction. In the transverse view **b** the double target sign is similar to that illustrated by Itagaki et al [2]: the one target representing the inverted diverticulum surrounding fat (*F*) and the other representing the distal end of the intussusception with centrally situated mesenteric fat (*M*)

Discussion

The five cases described illustrate the sonographic findings of inverted Meckel diverticulum acting as a lead point of an intussusception (Figs. 1–5). In four patients, the inverted diverticulum was easily recognised as a segment of blind-ending, thick-walled bowel projecting for a variable distance from the apex of the intussusceptum (Figs. 1–4). Lack of the normal sonographic gut signature is due to oedema, haemorrhage, ulceration and ischaemic changes in the wall of the diverticulum. The larger diverticula had a characteristic bulbous shape and were identified lying within the intussuscipiens (Figs. 1, 3, 4).

The central serosal surface of the inverted diverticulum was filled with fluid in one patient (Fig. 1), with fluid and fat in another (Fig. 2) and only with echogenic fat in the other two (Figs. 3, 4). In the only child in this series to be studied by CT, the appearances mirrored those seen on sonography (Fig. 3 b). The central tissue had negative attenuation values confirming the fatty nature of the central echogenic tissue identified on sonography. In the fifth child, the sonogram revealed a more nonspecific, heterogeneous, echogenic mass at the apex of the intussusceptum (Fig. 5).

Early reports [1, 4] showed non specific sonographic appearances of intussuscepted, inverted Meckel diverticulum. However, in 1991 Itagaki et al. [2] described a double target sign on sonography in two children with intussuscepted, inverted Meckel diverticulum, suggesting that this might be more specific. In 1996, Pantongrag-Brown et al. [3] illustrated the echogenic centre of inverted Meckel diverticulum in two patients.

In 1989, Black et al. [5] reported the CT appearances of an intussusception due to an inverted Meckel diverticulum. The elongated mass at the end of the intussusceptum contained fat in the centre surrounded by a thick, soft-tissue collar. In 1996, similar CT appearances were reported by Pantongrag-Brown et al. [3]. In the only one of our patients who was studied with CT, the appearences were the same as those described by Black et al. [5] and Pantongrag-Brown et al. [3], with tissue of negative attenuation values in the centre (Fig. 3 a) confirming the fatty nature of the echogenic tissue identified on sonography (Fig. 3 a).

The tip of a Meckel diverticulum and the artery supplying the tip are often enveloped with fat. This fat represents stromal remnants of the omphalomesenteric duct extending from the tip of the diverticulum [5]. Inversion of the diverticulum pulls this fat into the centre of the lesion. Black et al. [5] found fat evident on the serosal surface in 20 of 23 gross pathological specimens of Meckel diverticulum and also found that fat was present centrally in five of nine patients with an intussuscepted inverted Meckel diverticulum. They therefore felt that an intraluminal ileal mass or polyp with a fatty core and thick soft-tissue collar is pathognomonic for inverted Meckel diverticulum on CT [5]. The differential diagnosis would include a lipoma of the small bowel but this lacks a thick, soft-tissue collar.

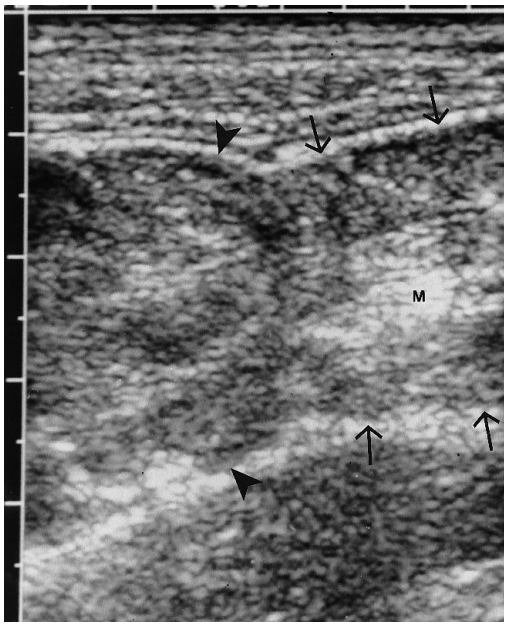


Fig. 5 Sonogram in a 7.5-year-old boy shows a soft-tissue mass (*arrowheads*) at the apex of the intussusception (*arrows*). The mass has a nonspecific, heterogeneous echo appearance and represents the haemorrhagic, inverted Meckel diverticulum. (*M* mesenteric fat between layers of the intussusception)

The sonographic appearances illustrated in this study (Figs. 1–4) are more detailed than in previous reports. The detailed anatomy depicted with high-resolution sonography enabled us to identify clearly the inverted diverticulum as the lead point of an intussusception feature is the bulbous shape of the mass at the distal end of the intussusceptum lying within the intussuscipiens (Figs. 1, 3, 4). This shape corresponds to the shape of inverted Meckel diverticulum illustrated previously on barium studies of the gastrointestinal tract [5, 6] and even on a plain radiograph of the abdomen [7]. The shape may be bulbous, elongated or tear-drop. The thickened wall of the inverted diverticulum characterisically surrounds echogenic fat (Figs. 3, 4) but may contain only echo-free fluid (Fig. 1)

The echogenic central fat may have a tear-drop or bulbous shape and should be differentiated from the fat of the mesentery that is drawn into the intussusception itself and which usually has a crescentic or semilunar shape in transverse section [8].

Careful sonographic technique in children with abdominal pain and in those suspected of having an intussusception may enable one to recognise the presence of an inverted Meckel diverticulum acting as the lead point of an intussusception. This study documents the sonographic findings in children with an intussuscepted inverted Meckel diverticulum (Fig. 1–5). The features illustrated in four of our patients appear to be quite specific and should be easy to define (Figs. 1–4). More experience with inverted Meckel diverticulum as a lead point is required to establish how accurately this lesion can be identified with sonography and how specific the sign is.

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