CASE REPORT

Ultrasound “Whirlpool Sign” for Midgut Volvulus

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Midgut volvulus is a cause of acute abdomen in neonates and infants. It results when the normal embryologic sequence of bowel development and fixation is interrupted. Until now, the diagnosis of this condition has relied on upper gastrointestinal barium studies. We describe a case of midgut volvulus diagnosed on ultrasound after observing the “whirlpool sign.” This sign corresponds to a clockwise wrapping of the superior mesenteric vein and the mesentery around the superior mesenteric artery. Using ultrasound as an investigation modality when suspecting midgut volvulus in neonates and infants is also emphasized.

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Case Report

A 12-day-old male neonate born of full-term normal delivery was brought presenting with complaints of bilious vomiting and abdominal distention since Day 5 of birth. His general condition was fair with mild tachycardia. The abdominal examination revealed fullness in the epigastrium.

Plain X-ray showed gas-filled, mildly dilated stomach and duodenal cap. The plain X-ray suggested high intestinal obstruction, and abdominal ultrasound was done.

Abdominal ultrasound using high-resolution, linear 7- to 10-MHz probe (logiq 5 Expert; GE, Milwaukee, WI, USA) revealed a swirled pattern of small bowel loops in the mid-abdomen (Fig. 1). On color Doppler ultrasound, the superior mesenteric vein was seen swirling with the small bowel loops with centrally placed superior mesenteric artery (Fig. 2). This appearance of “whirlpool” suggested midgut volvulus. Barium study confirmed the aforementioned findings.

The barium study revealed dilated stomach and first portion of the duodenum. The duodenojejunal flexure was situated to the right of the spine with swirling of the proximal, collapsed jejunal loops in corkscrew pattern (Fig. 3).

Diagnosis of midgut volvulus was made, and the baby was operated. Perioperative findings included location of the duodenojejunal flexure to the right of the spine along with small bowel volvulus. Fixation of the bowel loops was done along with excision of a few bands. The recovery of the baby was rapid with disappearance of the symptoms.

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Intestinal malrotation is a major diagnostic challenge in the new-born period. The principal complication of malrotation is midgut volvulus, which can be a life-threatening condition requiring immediate surgical intervention [1].

Malrotation of the intestine results when the normal embryologic sequence of bowel development and fixation is interrupted. The malrotated bowel is prone to torsion, resulting in midgut volvulus [2].

The failure of normal rotation and mesenteric attachment of the midgut during embryologic development leaves the bowel from duodenojejunal junction to the mid-transverse colon attached to the posterior abdominal wall by narrow pedicle containing superior mesenteric vessels. This anomaly predisposes to torsion of this free-swinging long segment of gut [3]. Midgut volvulus is most likely to occur in neonates and young infants and is associated with vomiting, abdominal distention, and occasionally bloody stools.

Millar et al [4] reviewed 137 cases of malrotation and midgut volvulus seen over a 28-year period to emphasize the patterns of clinical presentation. Although 62% presented as neonates, 20% were older than 1 year. Vomiting was the symptom of paramount importance in 97% but was not initially bile stained in 20%. Sixteen percent had diarrhea as a major symptom. Abdominal pain occurred in 96% of patients older than 1 year. Clinical signs were not apparent in most cases until gut infarction had occurred [4].

Until recently, the diagnosis of midgut malrotation and volvulus had necessitated the performance of contrast material—enhanced upper gastrointestinal series to demonstrate the abnormal position of duodenojejunal junction, the caecum, or both. There are, however some limitations to the diagnostic accuracy of these studies, especially for enabling the detection of midgut volvulus [5].

The observed findings on barium upper gastrointestinal studies include the following [3]: (1) a dilated, fluid-filled duodenum; (2) a proximal small bowel obstruction; (3) a “corkscrew” pattern (proximal jejunum spiraling downward in right or mid-upper abdomen in midgut volvulus, which is rare.)

**Fig. 1.** Transverse sonogram showing “whirl”-like pattern of small bowel loops in mid-abdomen.

**Fig. 2.** Color Doppler ultrasound showing “whirlpool sign,” clockwise rotation of superior mesenteric vein, and small bowel around centrally placed superior mesenteric artery. Arrow, superior mesenteric vein; arrowhead, superior mesenteric artery.

**Fig. 3.** Upper gastrointestinal barium study showing dilated stomach and proximal duodenum along with swirled proximal jejunal loops. Arrow, dilated duodenum; arrowhead, jejunal loops. Note the abnormal location of the ligament of treitz to the right side of spine.
Ultrasound is rapidly evolving investigation modality for the diagnosis of gastrointestinal disorders in infants and children. Sonographic and color Doppler features of small bowel volvulus secondary to malrotation of the midgut are well described. The classic sign described is the “whirlpool sign.” This sign corresponds to a clockwise wrapping of the superior mesenteric vein (SMV) and the mesentery around the superior mesenteric artery (SMA). The “whirlpool sign” directly indicates the anatomic alteration caused by midgut volvulus. In midgut volvulus, not only the bowel but also the mesenteric vessels are twisted. The SMV and tributaries wrap around the SMA as a result of the volvulus. The “whirlpool sign” represents this characteristic pattern of the SMV and mesentery around the SMA in 15 of the 18 patients with midgut volvulus, and it was best seen using color Doppler ultrasound.

Shimanuki et al [8] evaluated the clockwise “whirlpool sign” by color Doppler ultrasound in diagnosing midgut volvulus. In 13 patients with surgically confirmed midgut volvulus, color Doppler ultrasound showed clockwise “whirlpool sign” in 12 patients and no “whirlpool sign” in one patient. The sensitivity, specificity, and positive predictive value of clockwise “whirlpool sign” for midgut volvulus were 92%, 100%, and 100%, respectively [8].

Ultrasound is especially suitable for evaluating pediatric abdomen; also, it does not involve radiation and can be performed at bedside without special preparation. “Whirlpool sign,” considering the literature review, is diagnostic of midgut volvulus. Using this sign for diagnosing midgut volvulus in appropriate clinical circumstances can expedite the surgical management of these patients and reduce the delay by avoiding upper gastrointestinal barium studies.

References