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Sonographic Features of Midgut Volvulus in Neonatal Intestinal Malrotation: Two Case Reports

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Abstract **Case Report**

Midgut malrotation is a rare congenital anomaly that predisposes to life-threatening complications such as midgut volvulus, especially in neonates. This condition results from incomplete rotation of the primitive intestinal loop, leading to a narrow mesenteric root and a high risk of bowel torsion. We report two cases of term neonates who presented with bilious vomiting in the absence of abdominal distension. In both cases, abdominal radiographs were inconclusive, but ultrasound with color Doppler revealed the characteristic "whirlpool sign" of twisted mesenteric vessels and an abnormal orientation of the superior mesenteric vein and artery, confirming midgut volvulus on a common mesentery. Prompt surgical intervention was performed, preventing ischemic complications. These cases underscore the crucial role of ultrasound as a non-invasive, readily accessible tool for early diagnosis. Recognizing these sonographic features is essential for timely management, as delayed diagnosis can lead to bowel necrosis, resection, and increased morbidity.

Keywords : Midgut volvulus, Intestinal malrotation, Neonate, Ultrasound diagnosis, Whirlpool sign.

INTRODUCTION

Midgut malrotation, also known as a common mesentery, arises from incomplete rotation of the primitive intestinal loop during embryonic development.[1] Although this congenital anomaly affects only 0.2% to 0.5% of the population and may remain asymptomatic, it carries a persistent risk of acute complications, particularly in early infancy.[2]

Among these complications, midgut volvulus represents a true surgical emergency. It occurs when the small intestine twists around the superior mesenteric artery, causing proximal bowel obstruction and potentially compromising blood flow. [3] Neonates and young infants typically present with bilious vomiting and abdominal distension. Without rapid diagnosis and intervention, volvulus can progress to bowel ischemia, necrosis, and even death. [4]

While volvulus can manifest at any age, approximately 75% of cases present within the first month of life, most frequently during the first week. Early recognition is therefore crucial. [5] Ultrasonography—a noninvasive, readily available imaging modality—has gained prominence for its ability to detect characteristic signs such as the ''whirlpool sign'' of twisted mesenteric vessels, thus enabling prompt surgical management.

Through the presentation of two neonatal cases, this article illustrates the pivotal role of ultrasound in the early and accurate diagnosis of midgut volvulus associated with intestinal malrotation.

PATIENTS AND METHODS

Observations:

Case 1

Baby M. a 2-day-old male neonate, born at term via vaginal delivery after an uneventful and well-monitored pregnancy, presented with bilious vomiting and a flat abdomen. The clinical context was afebrile, with preserved general condition. On physical examination, the neonate appeared pink, spontaneously active, with no signs of dehydration or malnutrition. The abdomen was soft, flat, non-tender, with no palpable masses, and hernial orifices were free.

Blood tests revealed leukocytosis at 24,750/mm³ and hemoglobin at 16.6 g/dL.

Plain abdominal radiography (ASP) showed no air-fluid levels. (Figure 1)

Figure 1: Plain abdominal radiograph (ASP) showing a normal appearance with no air-fluid levels

Ultrasound with color Doppler examination revealed a pseudo-mass in the epigastric region with a whirlpool appearance (Whirlpool sign) persisting on color Doppler, indicative of mesenteric vessel rotation. The superior mesenteric vein (SMV) was visualized to the right of the superior mesenteric artery (SMA), consistent with malrotation. No peritoneal effusion was noted, but proximal intestinal loop distension was observed upstream of the torsion. (Figure 2)

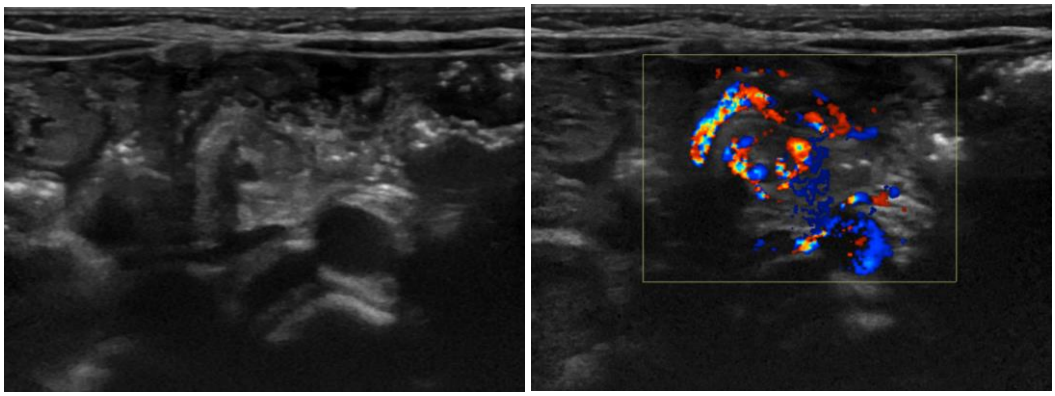

Figure 2: (a) B-mode ultrasound showing a pseudo-mass with a whirlpool appearance in the epigastric region. (b) Color Doppler image confirming the whirlpool sign, with the superior mesenteric vein (SMV) located to the right of the superior mesenteric artery (SMA), suggestive of intestinal malrotation with mesenteric vessel rotation.

Based on these findings, the diagnosis of midgut volvulus on a common mesentery was made. The neonate was promptly referred for surgical exploration. (Figure 3)

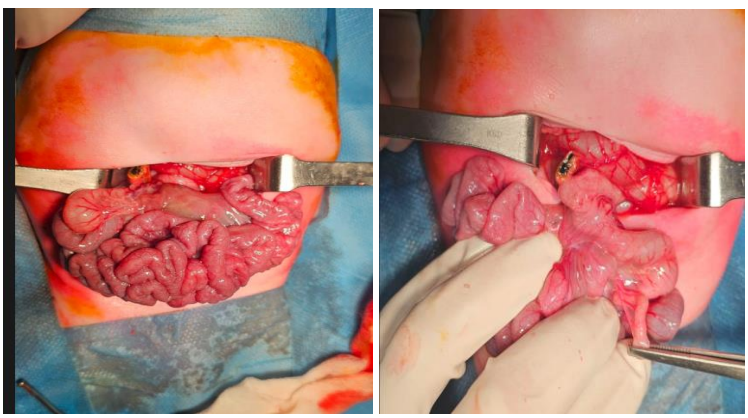

Figure 3: Intraoperative images taken during surgical exploration

Case 2

Baby A. r male neonate born at term from a twin pregnancy, weighing 2500 g, was admitted on day 2 of hospitalization in Agadir for evaluation of bilious vomiting since birth. There was no reported cessation of stool or gas passage. The patient had already been started on triple antibiotic therapy (metronidazole, gentamicin, and ceftriaxone) for 2 days prior to transfer.

On examination, the neonate was pink but mildly lethargic, with spontaneous movements and present primitive reflexes. The skin showed signs of dehydration. The abdomen was flat, soft, and non-tender, with no palpable masses and free hernial orifices.

Blood work revealed a white blood cell count of 9,200/mm³, hemoglobin at 15.6 g/dL, and CRP at 5 mg/L.

Plain abdominal radiography showed no air-fluid levels. (Figure 4)

Figure 4: Plain abdominal radiograph (ASP) showing a normal appearance with no air-fluid levels

Ultrasound with color Doppler findings were identical to those of the first case, demonstrating a Whirlpool sign with clockwise rotation of mesenteric vessels and SMV positioned to the right of the SMA, confirming the diagnosis of volvulus on a common mesentery. There was no peritoneal effusion, and the bowel loops were distended upstream. (Figure 5)

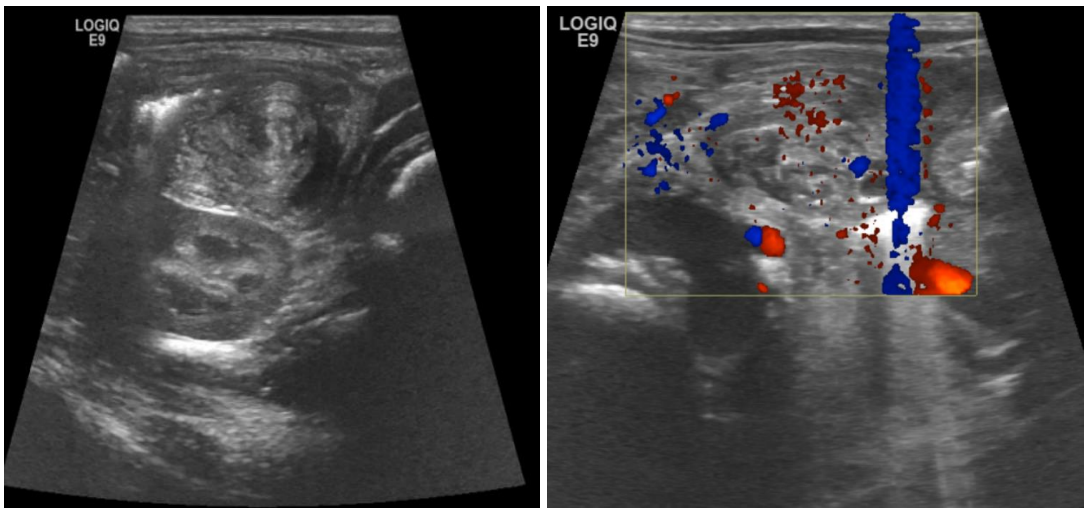

Figure 5 :(a) B-mode ultrasound showing a pseudo-mass with a whirlpool appearance in the epigastric region. (b) Color Doppler image confirming the whirlpool sign, with the superior mesenteric vein (SMV) located to the right of the superior mesenteric artery (SMA), suggestive of intestinal malrotation with mesenteric vessel rotation.

The patient was taken to the operating room for surgical management. (Figure 6)

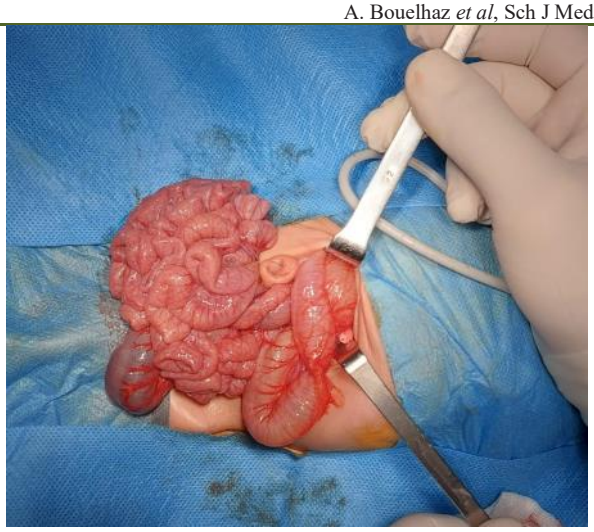

Figure 6: Intraoperative images taken during surgical exploration

DISCUSSION

Midgut volvulus on a common mesentery is a rare but life-threatening surgical emergency, typically occurring in neonates. It results from an anomaly in the embryologic rotation of the midgut. Normally, between the 5th and 12th weeks of gestation, the primitive intestinal loop undergoes a 270° counterclockwise rotation around the axis of the superior mesenteric artery (SMA). Failure of this process results in intestinal malrotation, where the small bowel is situated on the right and the colon on the left, often with a narrowed mesenteric root. [1,4] This abnormal anatomy predisposes to volvulus, particularly in early life.

Clinically, neonates with midgut volvulus usually present with bilious vomiting, a hallmark of proximal intestinal obstruction. The abdomen is often soft and flat. In severe cases, the progression to bowel ischemia may be heralded by signs of hemodynamic instability or gastrointestinal bleeding, indicating possible necrosis. [7]

Radiographic imaging is critical in diagnosis, although plain abdominal radiographs (ASP) can be normal in up to one-third of cases. When abnormal, ASP may show signs of duodenal obstruction such as the double bubble sign with diminished gas distally. [8] However, these findings are not specific and may also be present in conditions like duodenal atresia or duodenal web.

Ultrasound with color Doppler has become a key tool in the non-invasive diagnosis of midgut volvulus. The most characteristic sign is the whirlpool sign, representing clockwise twisting of the mesenteric vessels around the SMA. [6] Inversion of the SMA and SMV relationship—where the SMV lies to the left instead of its normal right position—is another reliable sonographic marker of malrotation. [9] Additional ultrasound findings may include duodenal dilation, bowel wall thickening, fluid-filled loops, and absence of the SMV or truncated SMA in advanced volvulus. [10]

Upper gastrointestinal (UGI) contrast studies remain the gold standard in differentiating malrotation with or without volvulus. Findings such as a right-sided duodenojejunal junction, corkscrew appearance of the bowel, and beaking at the point of obstruction confirm the diagnosis. [11] However, this examination should not delay surgical management when volvulus is clinically suspected.

Computed tomography (CT) and MRI are more commonly used in older children or atypical cases. On CT, the whirlpool sign, abnormal bowel configuration, and inverted SMA/SMV relationship may be seen, along with signs of obstruction or ischemia. These modalities, however, are less practical in neonates. [3]

The differential diagnosis of neonatal bilious vomiting includes duodenal atresia, duodenal web, annular pancreas, pyloric stenosis, intestinal atresia, meconium ileus, and duplication cysts. [12] Differentiating midgut volvulus is crucial, as it requires urgent surgery. Ultrasound, especially when combined with UGI contrast studies, is essential for accurate diagnosis and rapid management.[13]

The definitive treatment is emergent laparotomy. The standard procedure involves de-torsion of the volvulus, division of Ladd's bands, and widening of the mesenteric base.[14] If bowel viability is uncertain, a second-look surgery may be performed. Resection is necessary in cases of necrosis. Importantly, even after surgery, the bowel is not returned to its normal anatomical position; the small bowel remains on the right and the colon on the left. [15]

Prognosis depends on the promptness of diagnosis and the presence or absence of ischemic complications. If treated early, outcomes are excellent. However, delayed diagnosis can lead to irreversible

bowel damage, requiring extensive resection and associated with increased morbidity and mortality. Long-term complications include adhesive small bowel obstruction, reported in up to 10% of cases. [16]

CONCLUSION

In conclusion, midgut volvulus on a common mesentery requires high clinical suspicion, especially in neonates with bilious vomiting. Ultrasound with Doppler plays a central role in early detection by demonstrating key features such as the whirlpool sign and abnormal SMA/SMV orientation. Prompt surgical intervention remains the cornerstone of management to prevent devastating complications.

Conflicts of Interest: The authors declare no conflicts of interest.

Contributions of the Authors: All authors contributed to the conduct of this work. They have read and approved the final version of the manuscript.

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