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Prenatal Ultrasound Diagnosis and Multidisciplinary Management of Small Bowel Atresia: A Case Report and Literature Review

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Abstract **Case Report**

Small bowel atresia is a rare congenital malformation of the digestive tract characterized by a complete loss of intestinal continuity. It is a leading cause of neonatal bowel obstruction, with an estimated incidence of approximately 1 in 3,000 to 5,000 live births. Prenatal diagnosis relies on ultrasonographic findings, typically from the late second trimester onwards. Key indicators include dilated intestinal loops and, in some instances, polyhydramnios (notably in proximal obstructions). Optimal management necessitates close multidisciplinary collaboration between obstetricians, sonographers, neonatologists, and pediatric surgeons. This synergy ensures tailored delivery planning and prompt surgical intervention. Clinical priorities include screening for associated life-threatening anomalies, preventing preterm birth, and ensuring immediate postnatal surgical care. Surgical exploration is essential to determine the atresia type, its location (jejunal or ileal), whether it is solitary or multiple, and the length of the affected segment. These parameters are critical for selecting the appropriate surgical technique and determining the long-term functional prognosis. We report a clinical case of small bowel atresia diagnosed prenatally, highlighting the pivotal role of prenatal ultrasound screening and multidisciplinary care in improving outcomes for this rare condition.

Keywords: congenital abnormalities, multidisciplinary management, neonatal bowel obstruction, prenatal diagnosis, small bowel atresia, "triple bubble sign".

INTRODUCTION

Intestinal atresia is a rare congenital malformation and a primary cause of early neonatal bowel obstruction. Its incidence is estimated to be between 1 in 3,000 and 1 in 5,000 live births, affecting both sexes equally with no significant ethnic predominance [1]. Although the exact etiology remains debated, the prevailing theory suggests an in utero vascular ischemic accident leading to aseptic necrosis of the intestinal segment and its subsequent resorption [2].

Recent advancements in prenatal imaging now facilitate in utero diagnosis starting from the second trimester. Cardinal ultrasonographic signs include dilated intestinal loops (diameter greater than 7 mm) and hyperperistalsis, often associated with polyhydramnios in proximal forms [3]. This early detection allows for strategic delivery planning, which significantly enhances immediate postnatal multidisciplinary management.

While the definitive treatment remains surgical, the overall prognosis for this condition has substantially improved due to simultaneous progress in neonatal intensive care and parenteral nutrition. Survival rates now exceed 90%, although the long-term prognosis depends closely on the length of the residual segment and the risk of short bowel syndrome [4].

CASE PRESENTATION

Patient History and Clinical Findings:

A 27-year-old woman (gravida 3, para 3) with two previous uncomplicated vaginal deliveries and no significant medical history presented to the obstetric emergency department in early labor. The pregnancy was at term but had not received regular prenatal care. Upon admission, the patient was conscious and hemodynamically stable. Clinical examination revealed a fundal height of 30 cm, regular fetal heart tones, and uterine contractions (2 per 10 minutes) with associated cervical changes.

Diagnostic Assessment:

The patient was hospitalized for an urgent biological workup and obstetric ultrasonography. The ultrasound revealed a viable singleton fetus in cephalic presentation with an estimated fetal weight of 3,300 g. A significant finding was a large, echogenic, and heterogeneous fetal abdominal mass measuring 8 x 6 cm. The mass contained fluid and showed no vascularization on Doppler imaging, though minute internal punctate echoes were noted. The placenta was antero-fundal. Notably, there was no evidence of polyhydramnios, other associated malformations, or abnormal vascular Doppler indices (Figure 1).

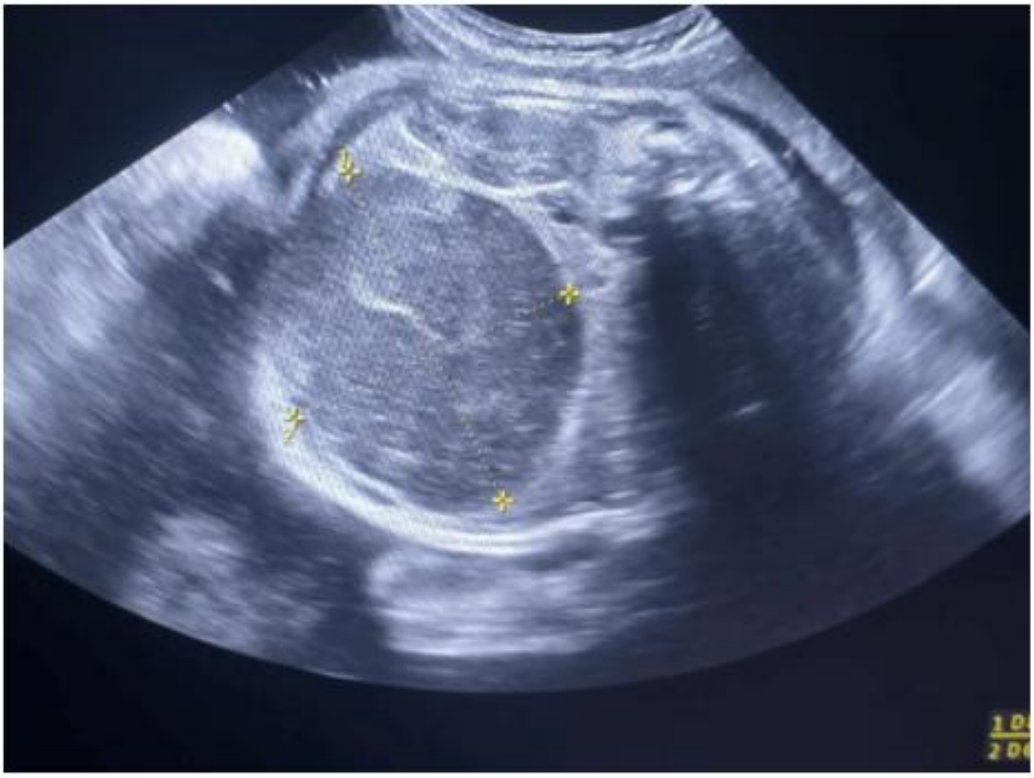

FIGURE 1: Antenatal ultrasonography showing small bowel atresia.

Prenatal ultrasound image demonstrating fetal intestinal atresia.

Neonatal Outcome:

The patient underwent an uneventful vaginal delivery. The neonate was a reactive, eutrophic male with no dysmorphic features. While vital signs and anthropometric measurements were within normal limits, physical examination revealed abdominal distension with a soft mass in the right hypochondrium and visible collateral venous circulation. The anus and genitalia were normally positioned. Although primitive reflexes were present, a weakened suck reflex was noted. No meconium was passed within the first hours of life.

Postnatal Imaging:

An abdominal X-ray (plain film) demonstrated the "triple bubble sign," indicating dilation of the stomach, duodenum, and proximal jejunum, with a complete absence of distal gas shadows (Figure *2*). An emergency abdominal ultrasound identified a well-circumscribed cystic formation in the right hypochondrium (78 x 60 mm) with irregular borders and echogenic content. The mass appeared to be continuous with a slightly dilated digestive structure, raising suspicion of an alimentary tract duplication.

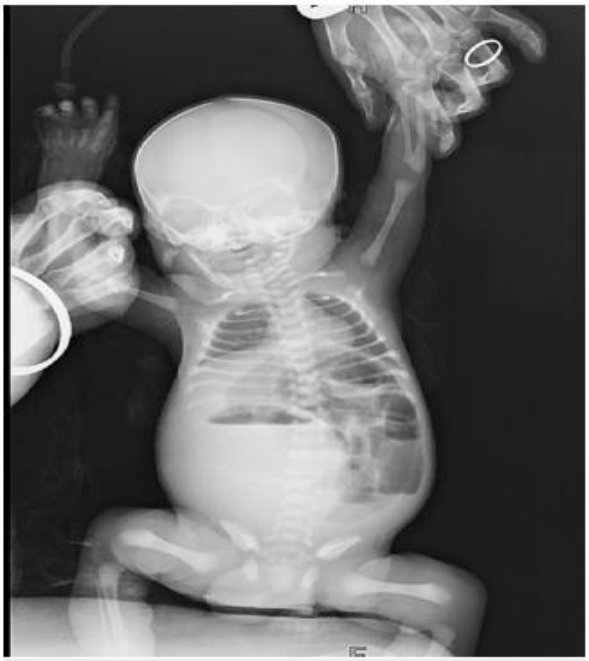

FIGURE 2: Postnatal plain abdominal X-ray revealing the "triple bubble sign."

Surgical Management:

Following multidisciplinary stabilization, the neonate underwent exploratory laparotomy on the second day of life. Surgical exploration revealed small bowel atresia located 5 cm from the ileocecal junction. The proximal segment was severely dilated, forming a mass adherent to both the abdominal wall and adjacent intestinal loops. Furthermore, three seromuscular lacerations were identified at 50 cm, 60 cm, and 90 cm from the first jejunal loop (Figure 3). After gentle adhesiolysis, a tapering enteroplasty of the proximal segment was performed, followed by a primary end-to-end anastomosis. Intestinal patency was confirmed distally.

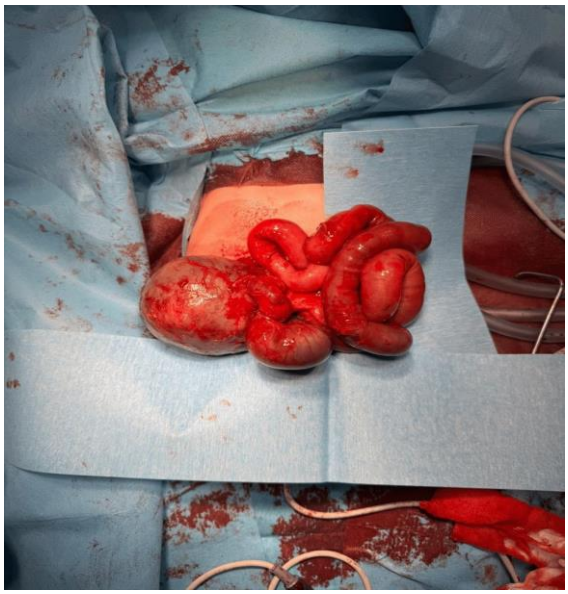

FIGURE 3: Intraoperative view showing small bowel atresia

Follow-up:

The postoperative course was uneventful. Following clinical and biological improvement, the neonate was discharged with a scheduled follow-up at the pediatric surgery department one month later.

DISCUSSION

Pathogenesis and Classification

Small bowel atresia (SBA) is a rare malformation with an estimated incidence between 1 in 3,000 and 1 in 5,000 live births [5]. It accounts for approximately one-third of all cases of neonatal

intestinal obstruction. Unlike many congenital anomalies, SBA is generally considered a developmental accident rather than a primary embryopathy. The leading theory suggests an in utero vascular catastrophe resulting in segmental ischemia within the superior mesenteric artery territory. This ischemic event may be primary (thrombotic) or mechanical, often following complications such as volvulus, intussusception, or gastroschisis during the return of the midgut to the abdominal cavity. Furthermore, the frequent observation of meconium peritonitis is typically attributed to the perforation of the necrotic segment [6].

Clinical presentation often involves bilious vomiting, abdominal distension, and failure to pass meconium, particularly in complete ileal atresia. While SBA is not frequently linked to chromosomal abnormalities, it is associated with cystic fibrosis in up to 30% of cases, especially in distal forms [7]. Anatomically, atresias can occur throughout the small intestine and are classified according to the Louw and Barnard system into four types:

Type I: Intraluminal membrane or web. Type II: Ends separated by a fibrous cord.
Type IIIa: Complete gap with a V-shaped mesenteric defect. Type IIIb: "Apple-peel" atresia.
Type IV: Multiple atresias [8].

Diagnostic Imaging: Antenatal and Postnatal

Prenatal diagnosis relies primarily on ultrasonography, typically performed during the late second or third trimester. Ultrasound remains the first-line examination, particularly effective in neonates due to the thinness of the abdominal wall [9]. Findings often include a significant disparity in intestinal caliber. The degree of dilation varies by location: proximal (jejunal) obstructions typically show larger loops (averaging 30 mm) compared to distal obstructions (averaging 24 mm) [10]. Doppler imaging (color and power) is essential for assessing hemodynamic shifts and potential ischemia.

While ultrasound may reveal gastric distension or signs of in utero perforation, polyhydramnios is a hallmark sign, especially in proximal atresia. Recently, fetal MRI has emerged as a superior modality for detailing the nature and exact location of the obstruction. T2-weighted MRI and 3D reconstructions provide specific signals for intestinal content, confirming proximal dilation and suspicion of jejunal atresia with higher precision than ultrasound [11].

Postnatally, a plain abdominal X-ray (AXR) typically demonstrates dilated loops with air-fluid levels that are wider than they are tall, alongside an absence of distal colonic gas. Intra-abdominal calcifications on AXR are pathognomonic for meconium peritonitis following perforation. A systematic screening for associated cardiovascular, digestive, and urogenital malformations, including renal and cardiac ultrasound, is mandatory [12].

Management and Prognostic Factors

Surgical intervention is the definitive treatment, preceded by stabilization including nasogastric decompression, fluid and electrolyte correction, and broad-spectrum antibiotics. The surgical strategy is dictated by the atresia type:

Simple resection and primary anastomosis (Types I-II).
Wider resection with anastomosis (Type IIIa).
Complex procedures for "apple-peel" (Type IIIb) or multiple atresias (Type IV) [13].

Due to advancements in neonatal surgery and parenteral nutrition, survival rates now exceed 90% in specialized centers [8]. The long-term prognosis depends on the residual bowel length, the atresia type, and associated anomalies. Intestinal loss and prolonged dependence on artificial nutrition remain the primary drivers of morbidity and mortality [14]. While antenatal diagnosis may not directly increase survival, it optimizes perinatal coordination, reduces complications related to delayed care, and allows for immediate fasting to prevent postnatal vomiting [9]. Ultimately, multidisciplinary collaboration between obstetricians and pediatric surgeons is the cornerstone of successful management.

CONCLUSIONS

Intestinal atresia, whether isolated or associated with other malformations, has historically been a postnatal diagnosis. However, it is now readily detectable via routine antenatal ultrasonography during the second and third trimesters. This early detection facilitates prompt etiologic assessment, strategic delivery planning, and optimized surgical management. Such a coordinated multidisciplinary approach is essential to improving clinical outcomes and the long-term prognosis of affected neonates.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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DISCLOSURES

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