Diffuse Non-obstructive Bowel Dilatation *in utero*: Report of a Case with a Unique Presentation

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Thus far, few reports have described the rare, non-obstructive type of fetal diffuse bowel dilatation. We describe such a case in the fetus of a 31-year-old Pakistani pregnant woman, gravida 3, para 2. A series of ultrasonographic examinations in the third trimester showed a "honeycomb" appearance of fetal diffuse dilated bowel loops, a mildly enlarged stomach, and mild polyhydramnios. Magnetic resonance imaging further revealed fluid-filled dilated bowel loops extending to the colon and rectum. The male neonate was born at 36 weeks and had marked abdominal distension but did not show signs of mechanical bowel obstruction. He passed a profuse amount of liquid with meconium at 4 h of life. Thereafter, his distended abdomen and bowel dilatation subsided, and he became asymptomatic within a week of life. Taken together with previous case reports, among infants who show the "honeycomb" sign *in utero*, there definitely exists a subset with a favorable outcome and an unknown etiology. This case alerts physicians who are responsible for perinatal care to the fact that careful assessment is required for a newborn when the "honeycomb" sign is observed via fetal imaging. Without evidence of mechanical bowel obstruction, alternative etiologies should be sought to avoid unnecessary laparotomy.

Key words: the honeycomb sign, diffuse non-obstructive bowel dilatation, polyhydramnios

INTRODUCTION

Many conditions can cause bowel dilatation *in utero*. The most common etiology is mechanical obstruction such as intestinal atresia and volvulus. Published data on non-obstructive dilatation of the fetal bowels, particularly the diffuse type, are scarce, compared to those on obstructive bowel dilatation [1]. Typical ultrasound images of fetuses with the diffuse type shows bowel loops with a structure that resemble a honeycomb. The "honeycomb" sign has been observed in several diseases with diffuse non-obstructive bowel dilatation, including rare congenital diarrheas, mild variants of congenital intestinal pseudo-obstruction, and Bartter syndrome [1–14]. In contrast, several authors have pointed out that the dilatation is not usually diffuse or generalized with mechanical obstructive lesions [2, 6].

Here, we report a case in which the "honeycomb" sign was observed *in utero*. The subsequent clinical course described here is unique in that abdominal distention and generalized bowel dilatation remarkably diminished after the passage of the first meconium with a copious amount of clear fluid at 4 h after birth.

CASE REPORT

A 31-year-old Pakistani woman, gravida 3, para 2, was referred to our hospital at 28 weeks of gestation for the evaluation of multiple dilated bowel loops. Her present pregnancy had been uneventful until then. Her past and family histories were not contributory. Fetal ultrasonography revealed a singleton gestation in a vertex presentation with a biparietal diameter of 75.8 mm (+0.7 standard deviation [SD]), a femur length of 55.4 mm (+1.0 SD), and an abdominal circumference of 28.0 cm (+2.7 SD). The estimated fetal weight was 1,764 g (+2.3 SD). Diffuse dilated bowel loops resembling a honeycomb structure and a slightly enlarged stomach were noted (Fig. 1). There was no fetal ascites or intra-abdominal calcification. No other structural abnormalities were found, and the amount of amniotic fluid was within the normal range, with an amniotic fluid index of 13.8 cm. These findings were confirmed by fetal magnetic resonance imaging (MRI), which also demonstrated the presence of fluid-filled dilated bowel loops extending to the colon and rectum (Fig. 2). Follow-up ultrasonographic examination revealed an increasing amount of amniotic fluid. At 35 weeks, the patient had progressed and showed mild polyhydramnios with an amniotic fluid index of 26 cm. At 36 weeks, she experienced preterm premature rupture of the membranes, and an emergency cesarean section was performed because of her previous cesarean section. A male infant weighing 2,650 g was delivered with Apgar scores of 8 and 9, at 1 and 5 min, respectively. The amniotic fluid was clear and not meconium-stained. The neonate had a markedly distended abdomen and was admitted to the neonatal intensive care unit. Ultrasonography showed multiple dilated bowel loops and a stomach filled with fluid, which required transient placement of a nasogastric tube. An

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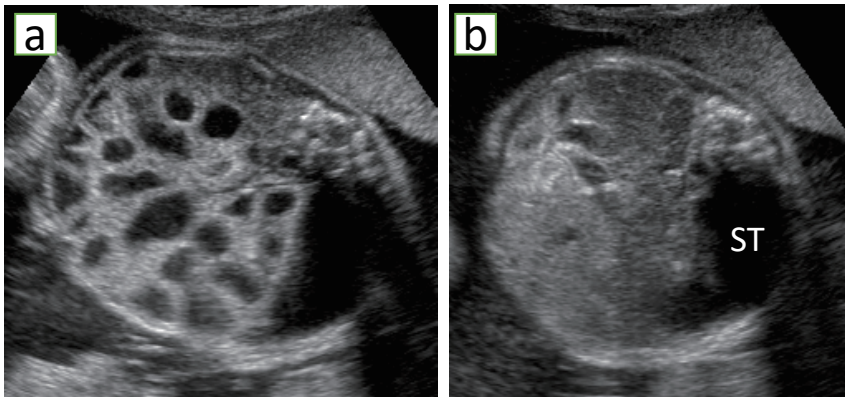

Fig. 1 Ultrasonographic images at 29 weeks of gestation: (a) Diffuse dilated bowel loops resembling the structure of a honeycomb or beehive (the "honeycomb" sign) and (b) a slightly enlarged stomach (ST).

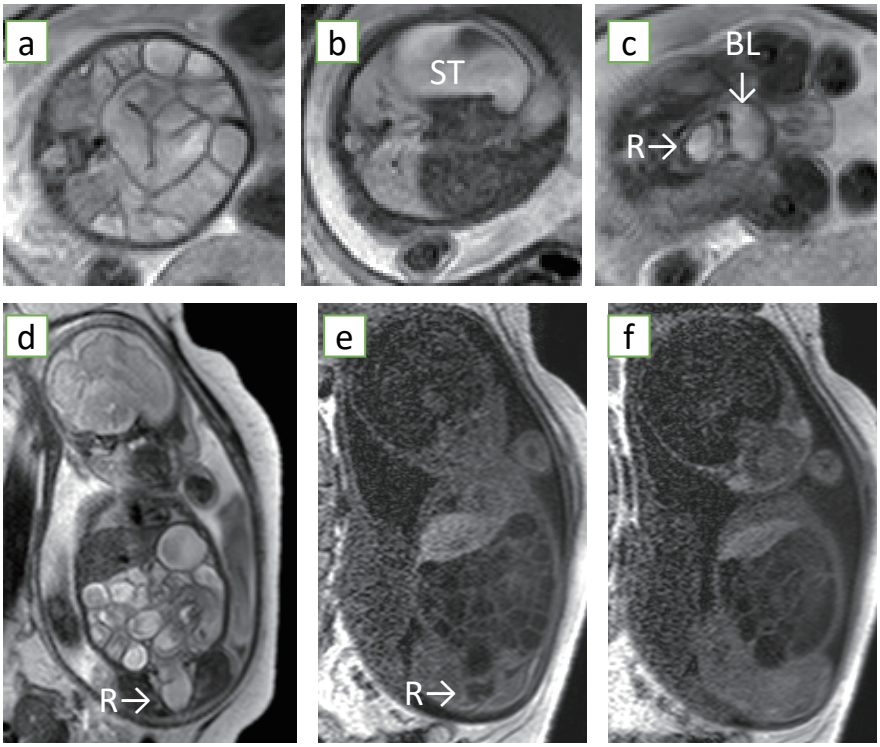

Fig. 2 Fetal magnetic resonance imaging at 29 weeks: (a) T2-weighted axial image showing fluid-filled diffuse dilated bowel loops; (b) T2-weighted axial image showing a slightly enlarged stomach (ST); (c) T2-weighted axial image at the fetal pelvis level demonstrating the bladder (BL) and fluid-filled rectum (R); (d) T2-weighted coronal image showing fluid-filled diffuse dilated bowel loops extending to the rectum (R); and (e and f) T1-weighted coronal images showing a lack of the physiological hypersignal, which is usually seen in the distal colon and rectum (R) and is associated with presence of the meconium content, indicating that the bowel is mostly filled with fluid.

initial plain roentgenogram revealed a relative paucity of intestinal gas in a distended abdomen (Fig. 3a). At 4 hours after birth, the neonate passed a small amount of meconium and a copious amount of clear liquid after rectal stimulation. The meconium appeared normal; it was greenish black in color and not too viscid. Immediately after the passage of the bowel content, his body weight decreased to 2,334 g, and abdominal distention and generalized bowel dilatation remarkably diminished. Plain abdominal radiography on day 1 (Fig. 3b) showed multiple dilated bowel loops with air visible in the rectum, indicating that the diagnosis of gastrointestinal tract obstruction was less likely to be correct and confirming the fetal MRI results. Although daily enema with glycerin was required to facilitate defecation for approximately a week, his distended abdomen and bowel dilatation further subsided even after the initiation of milk intake on day 2. He became asymptomatic within a week after birth. During his stay in the neonatal intensive care unit, the infant experienced no vomiting or diarrhea, his respiratory status remained stable with normal blood gas levels without any episodes of apnea, and his laboratory data constantly revealed no signs of abnormalities, including electrolyte imbalance and inflammation. No signs of inguinal hernia were noted. The neonatal mass

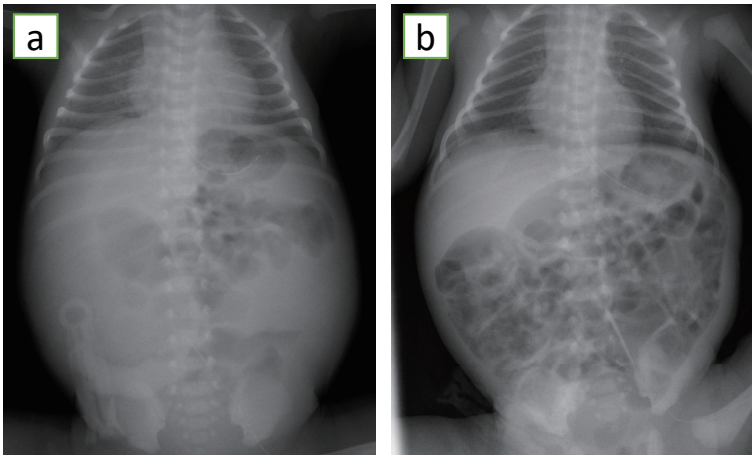

Fig. 3 Plain X-ray images: (a) On day 0, relative paucity of intestinal gas in a distended abdomen was noted; and (b) on day 1, multiple dilated bowel loops with air visible in the rectum were noted.

screening was normal, which screened out congenital hypothyroidism, congenital adrenal hyperplasia, and inborn errors of metabolism [15]. On day 14, the infant was discharged in good health with a body weight of 2,364 g.

DISCUSSION

In this case, diffuse fluid-filled dilatation of bowel loops, resembling a honeycomb structure, and mild polyhydramnios were identified through third-trimester fetal ultrasound and MRI. Within the first few hours of life, the neonate passed a profuse amount of liquid along with the first meconium. His abdominal distention and bowel dilatation subsequently subsided, and he became asymptomatic within a week of life. The clinical course described here is a unique presentation of diffuse, non-obstructive bowel dilatation.

Although ultrasonography is the first-line examination for bowel dilatation in the fetus, several authors report that MRI is advantageous over ultrasonography because meconium and fluid in the colon and rectum can be visualized more easily and clearly [16]. In the present case, MRI detection of the fluid-filled colon and rectum was helpful in ruling out intestinal obstruction.

The etiology of this case is unclear. However, it could be in the spectrum of a certain type of non-obstructive disorder that presents with diffuse dilated bowel loops (the "honeycomb" sign) on fetal ultrasound and MRI. The "honeycomb" sign has been demonstrated in congenital chloride diarrhea (CCD) and other diarrheas, mild variants of congenital intestinal pseudo-obstruction, and Bartter syndrome [1–7, 9–14]. Among these, CCD is the most commonly reported [2–6, 8–13]. CCD is an extremely rare autosomal recessive disorder (OMIM #214700) that causes severe watery diarrhea due to a defect in the absorption of chloride in exchange for HCO_3 in the ileum and colon. The disorder is due to a variety of mutations in the SLC26A3 gene. Typically, patients with CCD present with refractory watery diarrhea soon after birth. The mainstay of treatment involves replenishment of lost electrocytes and water, and CCD can be lethal if untreated. Images of fetuses with other rare congenital diarrheas, including microvillous inclusion disease and congenital sodium diarrhea, can also show the "honeycomb" sign [1, 8, 9]. The infant in the present study did not fit the clinical picture of these congenital diarrheas. Most of pediatric patients with chronic intestinal pseudo-obstruction (CIPO), a potentially lethal disease, experience clinical onset before 1 year of age. The severity of CIPO ranges broadly between a mild, self-limiting form and a life-threatening, severe disease. Shen *et al*. reported two cases of transient, mild variants of CIPO in members of one family, both of which showed polyhydramnios and the "honeycomb" sign at 30 weeks of gestation [7]. Both infants underwent conservative medical management and were discharged within a month, in a good condition of health. Thus, it is possible that our case was one of the mildest forms of CIPO, although our patient lacked a family history.

Alternatively, the present case may be an atypical variant of meconium plug syndrome (MPS). MPS is a benign cause of neonatal bowel obstruction that typically presents with abdominal distension, emesis, and delayed passage of meconium during the first 24 to 48 hours of life [17–19]. In MPS, transient large bowel obstruction is relieved by the passage of meconium plugs, which frequently occurs after rectal stimulation [18, 20]. We observed a similar phenomenon in our case. In a typical case with MPS, abdominal distension develops after birth [17–19]. Therefore, a major flaw of this hypothesis is that the abdominal distention due to fluid-filled bowel dilatation occurred *in utero* in our case and not after birth. In addition, infants with MPS usually have multiple meconium plugs in the distal colon and rectum [21]. However, in our case, prenatal T1-weighted MRI at 29 weeks did not detect hypersignals associated with meconium content.

Previous studies have shown that 13–38% of patients with MPS have Hirschsprung disease [19]. Patients with a persistent abnormal stooling pattern usually undergo rectal biopsy to rule out Hirschsprung disease [17]. In the present case, rectal biopsy was not performed because of the rapid disappearance of the symptoms. Hence, it is possible that this case is a mild variant of Hirschsprung disease.

A recent 14-year retrospective study by Katz *et al*. reported 7 cases of diffuse types of non-obstructive bowel dilatation from a total of 378 cases with fetal

bowel anomalies [1]. One patient had congenital diarrhea (microvillous inclusion disease) and died of sepsis. In the remaining 6 cases, no apparent etiology was identified, and the overall prognosis was good. Of note, 2 term infants were breast-fed and hospitalized for only 2 days. Taken together, among infants who show diffuse dilated bowel loops *in utero*, there exists a subset of infants whose prognosis is generally good, but the etiology is still unknown. An accumulation of data for such cases and further studies are needed to unravel the pathogenesis.

In conclusion, the present case highlights the importance of the "honeycomb" sign in the prenatal diagnosis of non-obstructive diffuse bowel dilatation and the need for careful assessment of newborns showing the "honeycomb" sign. Without evidence of bowel obstruction, alternative etiologies should be considered to avoid unnecessary laparotomy.

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