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Neonatal outcomes associated with intestinal abnormalities diagnosed by fetal ultrasound

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Abstract

Purpose—Intestinal abnormalities are sometimes seen during antenatal testing, however the postnatal importance of these findings has not been well established. We evaluated whether abnormal intestinal appearance on fetal ultrasound (US) was ultimately related to neonatal outcome.

Methods—Fetal US exams from 2003–2006 were evaluated. Hyperechogenic bowel was defined as having the echogenicity comparable to bone, and dilated bowel was identified based on the sonographer's assessment. Persistence or resolution of US findings on subsequent US exams and eventual outcomes were assessed. Cases were categorized as hyperechogenic or dilated, and then sub-grouped based on whether or not the US finding resolved.

Results—Sixty-eight fetuses had either hyperechogenic (n=48) or dilated bowel (n=20) on antenatal US. In 56 cases, complete data were available for analysis. Of 44 liveborn infants, 11 (25.0%) had an abdominal abnormality and 33 (75.0%) were normal at birth. Compared to those with dilated bowel, fetuses with hyperechogenic bowel had a higher rate of prenatal demise (20.8% vs 10%) but a lower rate of abnormality at birth (10.3% vs 53.3%). Hyperechogenic bowel resolved on subsequent US more frequently than dilated bowel (65.5% vs 20.0%). In both groups, all fetuses with sonographic resolution were normal at birth. Three of 9 fetuses (33.3%) that had persistently hyperechogenic bowel were born with an abnormality and all were found to have meconium peritonitis or meconium ileus. In the 12 cases where dilated bowel did not resolve, 8 (66.7%) were eventually born with an abnormality, most commonly intestinal atresia.

Conclusions—Hyperechogenic and dilated bowel are associated with a significant rate of fetal demise. Hyperechogenicity is more common than dilation and is more likely to be transient. Dilated bowel is more often associated with neonatal abnormality than hyperechogenic bowel. Persistence of fetal ultrasound findings predicts a higher likelihood of abnormality in the neonate.

Introduction

Improvements in antenatal ultrasound (US) have resulted in more frequent detection of many conditions affecting the unborn fetus. While the gastrointestinal tract is not easily examined in detail during these antenatal examinations, the presence of hyperechogenic (HB) or dilated bowel (DB) can be ascertained sonographically. The long-term significance of these antenatal findings remains unclear. Some authors suggest that HB may be a normal finding in some cases (1), while others have shown that there is a significantly increased risk

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of adverse outcome (2–5). Similarly, the antenatal US finding of dilated bowel has also been questioned in terms of its ability to reliably predict postnatal outcome (6). The current study was undertaken to assess the frequency of postnatal abnormalities in children who were noted to have abnormal intestinal findings on antenatal US. We hypothesized that a majority of children who were suspected of having a congenital intestinal abnormality would actually have a normal outcome.

Methods

Results of fetal ultrasound examinations performed between 2003 and 2006 were obtained from the records of The Center for Prenatal Pediatrics at Columbia University Medical Center. These records were reviewed for mention of intestinal abnormalities and fetuses that were noted to have either HB or DB were studied in detail. HB was defined as having sonographic echogenicity similar to bone while the presence of DB was determined based on measurements and qualitative assessment by the sonographer. Cases where DB was suspected to represent duodenal atresia were purposefully omitted. Persistence or resolution of abnormal sonographic findings over time and postnatal diagnoses were tracked. This study was reviewed and approved by the Institutional Review Board of Columbia University (Protocol #IRB-AAAB9498).

Results

Sixty-eight fetuses were identified as having either HB (Figure 1) or DB (Figure 2). Outcomes of these pregnancies are shown in Table 1. Fetuses were divided into two groups based on the results of prenatal ultrasound, one group with HB (n= 48) and one group with DB (n=20). In these 68 fetuses, the prenatal sonographic diagnosis was made at a mean of 22.8 weeks gestation and, on average, birth (n=44) occurred at 35 weeks gestation. Twelve of these 68 pregnant mothers were lost to follow-up or did not seek further care at our center, leaving 56 fetuses that had follow-up with us. An additional 12 (17.6%) suffered prenatal demise during the course of the pregnancy, resulting in 44 liveborn fetuses for postnatal evaluation. Eleven (25.0%) of these 44 were found to have abdominal pathology and 33 (75.0%) were normal after birth.

When considering only the fetuses with HB (n=48), the mean gestational age at diagnosis was 20.3 weeks and, on average, these babies were born (n=29) at 34.1 weeks gestation. The rate of prenatal demise was greater than 20%. Of those fetuses that survived to delivery, 26 of 29 (89.7%) were deemed normal at birth while 3 (10.3%) were diagnosed with abnormalities (Table 1).

Of the fetuses determined to have DB (n=20), the sonographic diagnosis was made, on average, at 29.3 weeks gestation and delivery (n=15) occurred at a mean of 37.1 weeks. Only 2 (10.0%) of these fetuses suffered prenatal demise. Eight (53.3%) of the 15 fetuses that survived to delivery were subsequently found to have abdominal pathology (Table 1).

We specifically tracked the results of serial sonograms to assess whether the sonographic abnormality resolved or persisted. These data are shown in Table 2. When we examined the entire group of fetuses that were born alive, 22 of 44 (50.0%) had eventual sonographic resolution of the abnormality that had been detected antenatally. Sonographic resolution was universally associated with normal outcome. In 21 of 44 fetuses (47.7%), however, the ultrasound findings persisted until delivery. Fifty-two percent of these were eventually shown to have abnormality after birth.

Sonographic findings persisted in 12 of 15 (80.0%) fetuses with DB while only 9 of 29 (31.0%) fetuses with HB had persistently abnormal sonography. Sixty-seven percent of

fetuses with persistently DB were found to have pathology after postnatal evaluation, while only 33.3% of fetuses with HB eventually were found to have an abnormality.

Postnatal diagnoses were tracked and are shown in Table 3. Three newborns with prenatally diagnosed HB were found to be abnormal after birth. Two were determined to have meconium peritonitis requiring laparotomy and one was diagnosed with meconium ileus. None of these children required massive bowel resection or developed short bowel syndrome (SBS). Eight newborns with DB were found to have abnormalities after birth. Six were found to have jejunal atresia, 1 had gastroschisis with dilated intraabdominal bowel, and 1 had a left congenital diaphragmatic hernia with DB. Three of the six newborns with jejunal atresia developed SBS. One child had concomitant liver disease and died after failed liver transplantation, one child with 15 cm of remaining bowel underwent unsuccessful small bowel transplantation and remains on parenteral nutrition, and one child underwent intensive intestinal rehabilitation and is now off parenteral nutrition at age 4.

Discussion

Reliable antenatal diagnosis of intestinal abnormalities remains difficult to achieve. Variability in sonographic equipment, techniques, and interpretation may be partially responsible for this difficulty in obtaining exact diagnoses. This study attempts to elucidate what aspects, if any, may aid in predicting which children with abnormal antenatal US will be born with an intestinal abnormality.

In this study population, the finding of HB was more than twice as common as DB. Whether more cases of HB are incidental as compared to DB cannot be ascertained from this study. When taking the entire cohort into consideration, the incidence of postnatal abnormality was 25.0%. Few other studies have assessed the incidence of postnatal abnormality in fetuses found to have HB and DB. Muller, et al. reported a prenatal demise rate of 26% and found that 112 of 135 (83%) of newborns with HB were determined to be normal after birth (5). Nine (7%) of the children in Muller's study required surgery for gastrointestinal anomalies. These findings are similar to the results of the current study with respect to the rate of prenatal demise and the high incidence of normal birth in children with HB. Another study by Ghose, et al reported similar results with 82% of the fetuses with isolated HB in their study having normal outcome (7).

In our study, fetuses with DB had a 53% incidence of abnormality after birth. Most previous reports involve the retrospective study of prenatal ultrasounds of children who were already known to have surgical findings such as intestinal atresia or meconium peritonitis (8–10). These postsurgical studies conclude that DB on antenatal ultrasound is accurate in predicting intestinal abnormalities postnatally. Our findings are similar to those of Borsellino, et al., who reviewed the accuracy of antenatal US in determining the presence of any thoracic or abdominal abnormality (6). In their 17 fetuses with DB, only 10 (59%) eventually were determined to have an intestinal abnormality (6).

Many fetuses are evaluated on multiple occasions. For this reason, we sought to assess the frequency and effects of sonographic resolution on eventual postnatal outcome. Overall, 50% of fetuses had resolution of the abnormality seen on antenatal US. Those with HB were more than 3 times as likely to have resolution as those with DB. Since half of 44 liveborn fetuses in our study had resolution of sonographic abnormalities, it appears that HB and DB should be followed for resolution. Additionally, this study shows that resolution of the abnormality is reassuring since no fetus with a resolved abnormality was eventually found to have an abnormality at birth.

Both HB and DB have been associated with congenital intestinal disorders such as intestinal atresia, meconium peritonitis, and meconium ileus (5, 10). In the current series, all three diagnoses were seen. Meconium peritonitis and meconium ileus were associated with HB and intestinal atresia featured prominently in the DB group. Long term outcomes were excellent in the 3 children with HB with no instances of significant intestinal loss or SBS. Conversely, 3 of 8 children from the group who had DB and an abnormality at birth developed significant postnatal complications associated with SBS. This is similar to the findings of Casaccia, et al, who found a 43% incidence of SBS in 44 children with congenital intestinal anomalies (11).

In conclusion, antenatal sonographic findings of HB are more common than DB but more often resolve and are less frequently associated with eventual abnormality. When serial antenatal sonograms show resolution of HB or DB, a good outcome appears to be predictable. These data can be used during antenatal consultations with families when HB or DB is identified during prenatal sonography.

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References

1. Fakhry J, Reiser M, Shapiro LR, Schechter A, Pait LP, Glennon A. Increased echogenicity in the lower fetal abdomen: a common normal variant in the second trimester. *J Ultrasound Med.* 1986; 5(9):489–492. [PubMed: 3531541]
2. Hill LM, Fries J, Hecker J, Grzybek P. Second-trimester echogenic small bowel: an increased risk for adverse perinatal outcome. *Prenat Diagn.* 1994; 14(9):845–850. [PubMed: 7845892]
3. Bromley B, Doubilet P, Frigoletto FD Jr, Krauss C, Estroff JA, Benacerraf BR. Is fetal hyperechoic bowel on second-trimester sonogram an indication for amniocentesis? *Obstet Gynecol.* 1994; 85(5 Pt 1):647–651. [PubMed: 8164918]
4. Simon-Bouy B, Muller F. French Collaborative Group. Hyperechogenic fetal bowel and Down syndrome. Results of a French collaborative study based on 680 prospective cases. *Prenat Diagn.* 2002; 22(3):189–192. [PubMed: 11920891]
5. Muller F, Dommergues M, Aubry MC, Simon-Bouy B, Gautier E, Oury JF, Narcy F. Hyperechogenic fetal bowel: an ultrasonographic marker for adverse fetal and neonatal outcome. *Am J Obstet Gynecol.* 1995; 173(2):508–513. [PubMed: 7645628]
6. Borsellino A, Zaccara A, Nahom A, Trucchi A, Aite L, Giorlandino C, Bagolan P. False-positive rate in prenatal diagnosis of surgical anomalies. *J Pediatr Surg.* 2006; 41(4):826–829. [PubMed: 16567202]
7. Ghose I, Mason GC, Martinez D, Harrison KL, Evans JA, Ferriman EL, Stringer MD. Hyperechogenic fetal bowel: a prospective analysis of sixty consecutive cases. *BJOG.* 2000; 107(3): 426–429. [PubMed: 10740343]
8. Wax JR, Hamilton T, Cartin A, Dudley J, Pinette MG, Blackstone J. Congenital jejunal and ileal atresia: natural prenatal sonographic history and association with neonatal outcome. *J Ultrasound Med.* 2006; 25(3):337–342. [PubMed: 16495494]
9. Iacobelli BD, Zaccara A, Spiridakis I, et al. Prenatal counselling of small bowel atresia: watch the fluid! *Prenat Diagn.* 2006; 26(3):214–217. [PubMed: 16470577]
10. Shyu MK, Shih JC, Lee CN, Hwa HL, Chow SN, Hsieh FJ. Correlation of prenatal ultrasound and postnatal outcome in meconium peritonitis. *Fetal Diagn Ther.* 2003; 18(4):255–261. [PubMed: 12835586]
11. Casaccia G, Trucchi A, Spiridakis I, et al. Congenital intestinal anomalies, neonatal short bowel syndrome, and prenatal/neonatal counseling. *J Pediatr Surg.* 2006; 41(4):804–807. [PubMed: 16567197]

Figure 1.
Fetus with hyperechogenic bowel appearing as a bright area in the lower abdomen (right of screen)

Figure 2.
Fetus with prominently dilated bowel in the abdominal cavity

Table 1

Characteristics of Fetuses and Neonates with Hyperechogenic and Dilated Bowel

	All	Hyperechogenic	Dilated
Total cases (N)	68	48	20
Mean GA @ diagnosis (weeks)	22.8	20.3	29.3
Lost to follow-up (% of total)	12 (17.6)	9 (18.8)	3 (15.0)
Prenatal demise (% of total)	12 (17.6)	10 (20.8)	2 (10.0)
Born Alive (% of total)	44 (64.7)	29 (60.4)	15 (75.0)
Mean GA @ birth (weeks)	35.0	34.1	37.1
Normal at Birth (% of live births)	33 (75.0)	26 (89.7)	7 (46.7)
Abnormal at Birth (% of live births)	11 (25.0)	3 (10.3)	8 (53.3)

Table 2

Effect of Persistence or Resolution of Abnormal Prenatal Ultrasound Findings in 44 Liveborn Fetuses

	All	Echogenic	Dilated
Number Born Alive	44	29	15
Number Resolved (% Abnormal at Birth)	22 (0)	19 (0)	3 (0)
Number Persisted (% Abnormal at Birth)	21* (52.4)	9* (33.3)	12 (66.7)

* One child did not have follow-up U/S after initial diagnosis prior to birth

Table 3

Postnatal Diagnoses Associated with Intestinal Abnormalities on Prenatal Ultrasound

Echogenic Bowel (N)	Dilated Bowel (N)
Meconium Peritonitis (2)	Jejunal Atresia (6)
Meconium Ileus (1)	Gastroschisis (1)
	Congenital Diaphragmatic Hernia (1)