



Accuracy of antenatal ultrasound signs in predicting the risk for bowel atresia in patients with gastroschisis



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ABSTRACT

Objective: Evaluate accuracy of prenatal ultrasound findings in predicting the risk of bowel atresia in patients with gastroschisis.

Methods: A retrospective study was conducted on 18 fetuses with a prenatal diagnosis of gastroschisis treated at University hospital of Saint Etienne France between 2002 and 2012. Ultrasound abnormalities were used to classify them into three groups: no ultrasound abnormality ($n = 4$), oligohydramnios ($n = 9$), intra-abdominal bowel dilatation ≥ 20.5 mm ($n = 5$). Postnatal outcomes were compared between groups. The threshold value of 20.5 mm for the prediction of atresia was determined through the receiver operator characteristics curve.

Results: In the group with oligohydramnios, intra uterine growth restriction were significantly more frequent ($p = 0.015$) and three newborns had serositis including two with secondary complications after the initial surgery. In the group with major intra-abdominal bowel dilatation, all had a narrow defect < 10 mm significantly more than other fetuses ($p = 0.002$). Intra-abdominal bowel dilatation reaching 20.5 mm started at a mean gestational age significantly lower than that of the other fetuses (23.3 versus 29.7 weeks $p = 0.02$). On the five fetuses presented intra-abdominal bowel dilatation ≥ 20.5 mm, four showed atresia and no other newborn has this complication ($p = 0.0016$). The threshold value of 20.5 mm has a sensitivity of 100% and a specificity of 92.9%. The area under the curve was equal to 96.4%.

Conclusion: Intra-abdominal bowel dilatation ≥ 20.5 mm seems to be associated with the risk of postnatal atresia. MRI could help to clarify a complicated or uncertain ultrasound aspect.

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Introduction

Gastroschisis is an anterior abdominal wall defect located to the right of the umbilicus interesting all the thickness with evisceration of the primitive intestinal loop [1]. Its incidence has increased and its pathogenesis is still unclear. Prenatal diagnosis is possible therefore 12 weeks, diagnostic criteria are rather well established: abdominal viscera bathed in the amniotic fluid, absence of covering membrane and defect to the right of normal umbilical cord. Non-isolated forms represent only 10% of gastroschisis. The isolated gastroschisis is not associated with an increased risk of chromosomal abnormality [2]. There are controversies on prognostic criteria, the advantage of

amnio-exchanges, and on the term and mode of delivery. Ultrasound prognostic criteria were the subject of many studies [3–19] often leading to divergent results. Mortality was significantly reduced around 10% thanks to advances in neonatal medical-surgical care. According Molik et al., the gastroschisis can be classified into two categories: those at low risk or simple form and those at high risk or complex form according to the finding at birth atresia, stenosis or intestinal ischemia [20].

Ultrasound does not seem to be enough to define specific prognostic factors. The description with MRI of the digestive anatomy and understanding of the physiology of fetal transit with the study of meconium signal was described in 2002 by Saguintaah et al. [21]. The gradual but systematic externalization of all small bowel and colon appears to be a dynamic phenomenon occurring until the end of the second trimester. This externalization process seems to be stopped in case of small defect size so often accompanying atresia and intra-abdominal bowel dilatation [22].

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The main objective of this study was to evaluate accuracy of prenatal ultrasound findings in predicting the risk of bowel atresia in patients with gastroschisis.

Methods

Study design

This is a retrospective study conducted in University Hospital of Saint Etienne (France) on fetuses with gastroschisis diagnosed between 2002 and 2012. Have been included, patients whose fetus was carrying a gastroschisis monitored at Multidisciplinary Center for Prenatal Diagnosis who gave birth and whose child was hospitalized and operated at the University Hospital of Saint Etienne.

Data collected

The list ($n = 18$) was formed from the Multidisciplinary Center for Prenatal Diagnosis data. Data were retrospectively collected from obstetric medical records, ultrasound reports, Multidisciplinary Center for Prenatal Diagnosis records, surgery reports, and pediatrics file. Fetuses with gastroschisis who experienced in utero fetal death or medical termination of pregnancy were included. Patients were excluded if data collection was incomplete.

Maternal and obstetric data: age, parity, gravidity, gestational age at diagnosis, fetal karyotype and fetal sex, amniotic fluid infusion, lung maturation, term of delivery, mode of delivery and indication, amniotic fluid appearance the at birth.

Ultrasound data: growth from fetal biometrics and estimated fetal weight, amniotic fluid and date of occurrence of oligohydramnios, maximum intra-abdominal and extra-abdominal bowel dilatation diameter (mm) and gestational age at diagnostic, maximum thickness of the bowel wall, hyperechoic bowel, wall defect size, presence of gastrointestinal peristalsis, presence of a Doppler flow in the superior mesenteric artery, hernia or dilatation of the stomach.

Pediatric data: gestational age at birth, birth weight, Apgar, pH and lactate in cord, appearance of bowel and complications, technique and time to surgical treatment, number of surgeries, delay to the recovery of spontaneous transit, duration of total parenteral nutrition, and time to full enteral feeding, digestive and non-digestive complications after the first surgery, length of hospital stay in neonatal resuscitation and in total (intensive care or neonatology), evolution and survival.

Ultrasound abnormalities were defined from the literature: intra-abdominal and extra-abdominal bowel dilatation, hernia or dilatation of the stomach, bowel wall thickening, hyperechoic bowel, absence of peristalsis, mesenteric vascularization decreased, oligohydramnios, narrow wall defect lower or equal to 10 mm and intrauterine growth retardation. Fetuses were classified into three groups based on ultrasound findings

- Group 1: no oligohydramnios, intra-abdominal bowel dilatation of less than 20.5 mm,
- Group 2: presence of persistent oligohydramnios despite amniotic fluid infusions and intra-abdominal bowel dilatation of less than 20.5 mm,
- Group 3: presence of intra-abdominal bowel dilatation ≥ 20.5 mm with or without oligohydramnios.

Statistical analysis

The different analyzes were performed using XISTAT[®]. Normality distribution of all quantitative variables was subject to statistical analysis. Comparisons of means or medians for which the assumption of variable distribution normality was retained

were performed using a Student T test. For others, the comparisons were made using a Mann–Whitney test for independent groups. For qualitative analysis, the numbers are small, the Fisher exact test was used. A p value of less than 0.05 was considered statistically significant.

The threshold value of intra-abdominal bowel dilatation for the prediction of atresia was determined through the receiver operator characteristics (ROC) curve, calculating the area under the curve with 95% confidence intervals (95% CI).

Results

20 children underwent surgery for gastroschisis between 2002 and 2012. Two patients were excluded: one patient was not monitored by ultrasound on the center and a patient whose record has not been found. 18 patients whose fetus with gastroschisis followed by the multidisciplinary prenatal diagnosis center of St Etienne, who gave birth at the Hospital of St Etienne and whose child was hospitalized and operated at the Hospital of St Etienne have been included in this period.

Demographic and obstetric characteristics are summarized in Table 1. 17 children were born alive and one medical termination of pregnancy was performed. For this patient, the diagnosis was made at 12.2 weeks. A 17.0 weeks, there was a decrease in the volume of bowel loops externalized with a hyperechoic appearance and the beginning of intra-abdominal bowel dilatation. At 24.5 weeks, a disappearance of externalized bowel was observed with disappearance of the defect of the anterior abdominal wall associated with intra-abdominal bowel dilatation. Intra-abdominal bowel had a

Table 1

Demographic and obstetric characteristics. Data are reported as mean \pm SD, median (interquartile range) and frequencies.

Characteristics	Values
Maternal age (years)	25.2 \pm 3.4 25 (18–29)
Parity	
Multiparity	2 (11.1%)
Primiparity	16 (88.9%)
Gestational age at diagnosis	15.7 \pm 4.8 13.8 (12.1–32)
Between 12.0 and 14.0 weeks	10 (55.6%)
Between 14.1 and 18.0 weeks	5 (27.8%)
>20.0 weeks	3 (16.6%)
Number of antenatal ultrasound	9.9 \pm 2.7 9.5 (6; 14)
Lung maturation	
Yes	17 (94.4%)
No	1 (5.6%)
Gestational age	29.3 \pm 2.05 29.1 (26.2; 34.2)
Gestational age at delivery	33.8 \pm 2.3 34.4 (28.2; 36.2)
Reason for induction of labor or cesarean delivery	
Pediatric care	9 (50%)
Spontaneous labor	2 (11.1%)
Abnormal fetal heart rate	3 (16.7%)
Premature rupture of membranes	3 (16.7%)
Pregnancy medical interruption	1 (5.5%)
Mode of delivery	
Vaginal	2 (11.1%)
Cesarean section	16 (88.9%)
Amniotic fluid at delivery	
Clear	12 (66.7%)
Tinted	3 (16.7%)
Meconial	2 (11.1%)
Absent	1 (5.5%)

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