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Can we select fetuses with intra-abdominal calcification for delivery in neonatal surgical centres?

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Abstract

Background: Prenatal ultrasound (US) diagnosis of fetal intra-abdominal calcification (iAC) is frequently caused by an in utero perforation causing meconium peritonitis. Our ability to predict which fetuses will require postnatal surgery is limited. The aim of our study is to correlate iAC and associated US findings with postnatal outcome.

Methods: A single centre retrospective review of all cases of fetal iAC diagnosed between 2004 and 2010 was performed. Maternal demographics, fetal US findings, and outcomes (need for surgery and mortality) were collected. Descriptive and comparative statistical analyses were performed.

Results: Twenty-three cases of iAC were identified. There were no cases of fetal demise or postnatal deaths. Three liveborns (13%) required abdominal surgery at a median of 2 days (0–3) for intestinal atresia. US findings of iAC and dilated bowel with ($p=0.008$) or without ($p=0.005$) polyhydramnios predicted a need for postnatal surgery as did the combination of iAC, polyhydramnios, and ascites ($p=0.008$). Conversely, iAC alone or associated with oligohydramnios, polyhydramnios, ascites, or growth restriction did not predict need for postnatal surgery.

Conclusion: The majority of fetuses with iAC on prenatal US do not require surgery. Associated US findings (bowel dilation) can be used to select fetuses for delivery in neonatal surgical centres.

1. Background

With advances in prenatal ultrasound (US) technology, the accuracy and frequency of detection of fetal abnormalities have increased. While diagnosis of certain fetal conditions reasonably predicts the need for postnatal treatment, there may be conditions that are asymptomatic and require no specific intervention. An example of a US finding of variable cause and significance is that of fetal intra-abdominal calcification (iAC) which appears as echogenic lesions with acoustic shadowing (Fig. 1). Fetal iAC can be found in a variety of abdominal organs [1]. The etiology is variable and includes but is not limited to congenital viral infection, vascular thrombosis, tumor [1–5],

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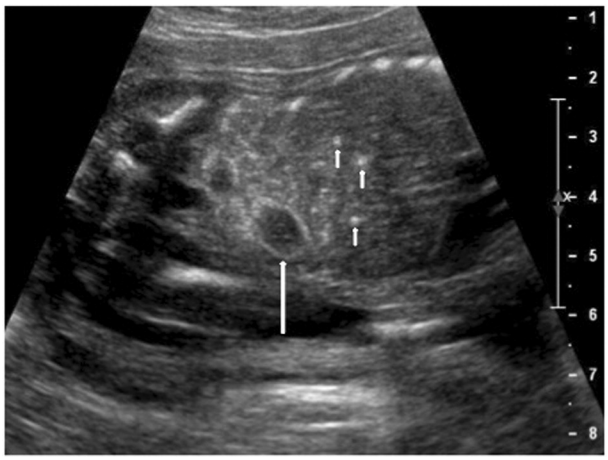

Fig. 1 Ultrasound of a 32-year-old G_2A_1 mother at 29 weeks and 3 days gestational age. Dilated bowel (long arrow) and peritoneal intra-abdominal calcifications (short arrows) are visualized.

or fetal intestinal perforation resulting in meconium peritonitis (MP) [6–8]. Importantly, iAC must be distinguished from "echogenic bowel" which has a separate differential (including fetal aneuploidy, viral infection, cystic fibrosis (CF), or in the majority represents a non-significant finding) [9–11].

Among the various causes of iAC, the one of greatest interest to pediatric surgeons is MP, which is estimated to occur in 1/35,000 births and is thought to arise from an in utero bowel perforation resulting in a sterile chemical peritonitis [10,12]. The causes of bowel perforation include CF (complicated meconium ileus), malrotation, volvulus, and intestinal atresia among others [1,2]. Equally variable is the newborn's postnatal outcome, which ranges from an asymptomatic course to an urgent need for surgical intervention [6,13–15]. Postnatal MP has been associated with mortality rates ranging from 40% to 62% [2,16,17]. There would be considerable benefit in being able to predict which fetuses with iAC due to MP were likely to require postnatal surgery, since this could influence decisions regarding delivery at a facility capable of providing neonatal surgery.

Few studies have attempted to correlate US findings in presumed fetal MP and the need for postnatal surgery [8,18–23]. This study aims to elicit the neonatal outcomes associated with a fetal diagnosis of abdominal non-solid organ, non-intraluminal, non-vascular calcification(s) to help guide perinatal decision-making regarding the location of delivery based on likelihood of need for postnatal surgery.

2. Methods

A retrospective review of cases of fetal iAC diagnosed by our institution's Fetal Diagnostic Center (FDC) between January 2004 and December 2010 was conducted. With institutional review board (IRB) approval, the fetal US database was interrogated with the search terms: "calcification", "abdominal calcification" and "meconium peritonitis". Strict inclusion criteria were used: only cases with intra-abdominal or peritoneal calcification not involving solid viscera, vascular or biliary structures. Cases of isolated "echogenic bowel" were excluded. In addition to the presence of "isolated" iAC, abstracted US datafields included the presence/absence of ascites, dilated bowel, polyhydramnios (amniotic fluid index (AFI) > 97.5% for gestational age (GA)), oligohydramnios (AFI < 2.5% for GA) and intrauterine growth restriction (IUGR; abdominal circumference < 10% for GA).

After fetuses with iAC on prenatal US were identified, the corresponding maternal and neonatal charts were retrieved. Demographic data were collected as well as the birth outcomes attributable to the initial hospitalization, including need for neonatal intensive care unit (NICU) admission, need for surgery, need for mechanical ventilation, days of total parenteral nutrition (TPN), and length of hospital stay (LOS). Outborn babies were tracked using a provincial perinatal database, and their birth hospital outcomes were abstracted from their hospital of birth. Patients were followed until discharge from their birth hospital.

A descriptive analysis was performed. Data are presented as medians (range) and means (standard error). The strength of association of predictive variables with outcomes was explored using the Student's t-test for continuous variables, and the chi square test for dichotomous variables. Only univariate analysis was performed, due to small group numbers. P-values < 0.05 were considered significant.

3. Results

Twenty-three fetuses with US findings of iAC were identified. The median age at prenatal diagnosis of iAC was 21.3 (range 18.1–32.7), and the mean number of antenatal ultrasounds performed per fetus was 3.96 (±.696). In addition to the finding of iAC, prenatal US recorded the following features: polyhydramnios (n = 2), oligohydramnios (n = 1), IUGR (n = 4), ascites (n = 5) and dilated bowel (n = 7). Eleven mothers (48%) underwent diagnostic amniocentesis for karyotype and all were normal. Ten couples underwent parental CF screening; in all couples, at least one parent screened negative for the CF gene. Five mothers were referred to a pediatric surgeon for antenatal consultation. There were no stillbirths or terminations.

Despite a prenatal diagnosis of iAC at our center, only 9 (39%) cases were inborn, with the rest born at centers without the capacity for neonatal surgery (none of whom subsequently required surgery). Fifteen babies (65%) were born by spontaneous vaginal delivery (SVD). All 23 infants were liveborn, 16 (70%) were male, and the mean gestational age and birth weight were 37 weeks (±1.2 weeks) and 2878 (±356 g), respectively. Eight babies were born prematurely at a median gestational age of 35 weeks (range 27–36). All babies survived, with a mean LOS of 14 (±12 days).