Hyperechogenic fetal bowel

Most structural fetal abnormalities and many 'soft markers' detectable by prenatal ultrasound scanning have been progressively defined in recent years. Hyperechogenicity of the fetal bowel, first described a decade ago, remains poorly understood with no clear definition or guidelines for clinical management. This has important consequences for parents, obstetricians, radiologists, neonatologists and paediatric surgeons.

Definition
Fetal small bowel becomes progressively more visible by ultrasound scan during the second trimester as relatively 'bright' meconium accumulates within its lumen from about 16 weeks' gestation. Hyperechogenicity has been defined by most authors as bowel of similar or greater echogenicity than surrounding bone, but others have relied on comparisons with fetal liver or lung. These subjective assessments are prone to significant interobserver variation but attempts to introduce objective measures have been difficult.

Prevalence
Hyperechogenic fetal bowel is present in 0-6% to 1-4% of all second trimester fetuses and is detectable at the time of routine antenatal ultrasound scanning. It is readily distinguishable from the more florid features of meconium peritonitis such as fetal ascites, intra-abdominal calcification, and intestinal dilatation. Hyperechogenicity as an isolated finding before 20 weeks' gestation is usually transient, disappearing on serial scans during the next few weeks. Resolution is associated with normal bowel function in most infants. Persistently hyperechogenic small bowel in the third trimester is more likely to reflect underlying pathology even though a normal outcome is still possible.

The few reports of isolated hyperechogenic colonic meconium arising in the third trimester have not been associated with underlying pathology.

Outcome
Combining data from five large North American studies of second trimester fetuses with hyperechogenic bowel, shows that in almost 60% of the 230 cases no abnormalities were found after birth. Among the remainder, however, there was an abnormally high incidence of karyotype abnormalities, intra-uterine growth retardation, and perinatal death.

The incidence of aneuploidy varied from 3 to 27%, with Down's syndrome accounting for the majority, and other trisomies and sex chromosome abnormalities such as Turner's syndrome for most of the others. In some, hyperechogenic bowel was the only detectable sonographic abnormality, which supports an argument for karyotyping these fetuses. In a retrospective study Nyberg et al found hyperechogenic bowel in 7% of second trimester fetuses with Down's syndrome and in over half it was an isolated finding.

Nevertheless, hyperechogenic bowel is neither very sensitive nor specific as a marker of trisomy 21 in the second trimester fetuses.

Intrauterine growth retardation was evident in around 15% of fetuses with hyperechogenic bowel, even after excluding those with karyotype anomalies. Moreover, this group of patients contributed to the 10% of cases in whom perinatal death was recorded. This is a complex area with probable links between hyperechogenic bowel, uteroplacental insufficiency, prematurity and functional neonatal intestinal obstruction. Blott et al described eight premature, growth retarded infants with hyperechogenic bowel, absent umbilical artery end diastolic flow velocities, and neonatal intestinal obstruction due to meconium.

These observations have been subsequently confirmed by a prospective case control study in which enteral feeding was also shown to be significantly delayed in the surviving infants.

Other rarer associations with hyperechogenic fetal bowel have been reported: mechanical intestinal obstruction due to imperforate anus, intestinal atresia, or volvulus; congenital cytomegalovirus infection; maternal systemic lupus erythematosus; and maternal infection with bloodstained amniotic fluid which would have been swallowed by the fetus. Hyperechogenic bowel can also be a marker of meconium ileus attributable to cystic fibrosis (CF), but its sensitivity and specificity in this context are uncertain.

In prospective evaluations of pregnancies at risk for CF, hyperechogenic bowel has been documented in up to 60% of affected fetuses. However, several studies of second trimester fetuses with hyperechogenic bowel have not identified a single infant with CF. Lack of formal testing and relatively short follow up periods may account for this but hyperechogenic bowel by itself is probably only a weak marker of CF. The presence of hyperechogenic bowel before 20 weeks of gestation
may in fact be misleading and false positive results have been reported.\(^2\) When combined with bowel dilatation, the finding is probably much more suggestive of meconium ileus.\(^2\)\(^3\)\(^\#\)

Given this spectrum of associated pathologies, it is not surprising that perinatal death is linked to hyperechogenic bowel in the fetus. The risk of an adverse fetal outcome seems to be greater the more echogenic the bowel and is highest when the density is comparable with bone.\(^5\)\(^6\)\(^7\)\(^10\)

Mechanism

The development of hyperechogenic bowel may be attributable to hypoperistalsis and/or decreased fluid content of the meconium.\(^2\)\(^4\) This could explain its occurrence in fetuses with karyotype abnormalities where no gross bowel pathology has been identified\(^5\)\(^4\) and in mechanical proximal bowel obstruction or CF. Resolution of hyperechogenicity in the normal fetus parallels the increase in swallowed amniotic fluid in later pregnancy. The link between hyperechogenic fetal bowel and placental dysfunction is complex but has been suggested that chronic intrauterine gut ischaemia is responsible for both the hyperechogenicity and impaired neonatal function.\(^5\)\(^7\)\(^8\)

Management

What practical steps are necessary in the second trimester fetus with hyperechogenic bowel? A detailed parental history is clearly important because of the links with karyotype anomalies, intrauterine infection, and CF. The sonographic fetal survey must be complete to exclude associated structural problems and features such as intestinal dilatation and fetal ascites. Serial ultrasound assessments can detect resolution of the hyperechogenicity and can be used to monitor fetal growth and placental function. More invasive investigations such as parental carrier testing for CF and fetal karyotyping are probably justified, but more detailed studies are necessary before we can be certain of the risk benefit ratio and so that high risk subgroups can be defined.

Infants with a history of persistently hyperechogenic bowel and particularly those with growth retardation and/or documented abnormalities of umbilical artery blood flow are at risk of functional neonatal intestinal obstruction. A greater demand for parenteral nutrition should be anticipated in such cases and rectal washouts or water soluble contrast enemas may be necessary to release meconium plugging and to exclude mechanical obstruction. A sweat test should be performed subsequently.

The future

A reproducible definition of hyperechogenic bowel is urgently needed so that large, controlled, prospective studies with standardised equipment settings and methods of collection can replace the largely retrospective data currently available. This would permit accurate estimates of incidence/prevalence and reliable data on various adverse outcomes. A more objective measure of fetal bowel echogenicity is required before this can be achieved.

A recently published multicentre French study of 182 cases of hyperechogenic fetal bowel is completely consistent with the pooled North American data in terms of the incidence and spectrum of associated pathologies.\(^2\) The small group of fetuses with intrauterine infection also included, however, two cases of toxoplasmosis.

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