Pediatr Radiol (2011) 41 (Suppl 1):S83–S84
DOI 10.1007/s00247-011-2049-8

IPR PRESENTATIONS

MRI evaluation of the foetal bowel

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With prenatal ultrasound (US), the foetal stomach is usually visualised from the early second trimester; the small bowel can be identified (small fluid-filled loops) in the second and third trimesters, and the large bowel in the third trimester. The diameter of the colon is easily evaluated and, therefore, microcolon can be diagnosed. Foetal magnetic resonance imaging (MRI) provides much better contrast resolution than prenatal US; in the setting of normal or pathological foetal bowel, good visualization of fluid or meconium-filled intestinal loops may be particularly useful.

Normal MRI patterns of foetal bowel

Meconium is produced from 13 weeks' gestation (WG), and it migrates slowly from the small bowel to the colon and rectum. Due to an increase in anal sphincter pressure, a functional obstruction of the anal canal is observed by 20 WG, resulting in a progressive distal-to-proximal accumulation of meconium. The cause of T1-hyperintensity and T2-hypointensity of meconium is still not entirely elucidated; it has been ascribed to the high content of proteins and minerals. At 20 WG, the rectum appears T1-hyperintense. Its anteroposterior diameter increases with gestational age. The rectal cul-de-sac is usually located at least 10 mm inferior to the bladder neck. The left colon is visible from 24 WG, the transverse and right colon being identified before 31 WG in only half the cases. Before 25 WG, the small bowel exhibits iso- or hypointensity on T1-weighted (T1-W) sequences. From 25 WG, appreciable amounts of ingested amniotic fluid are responsible for T1-hypointensity and T2-hyperintensity within the jejunum. Before 32 WG, T1-hyperintensity in the distal small bowel loops (secondary to accumulation of meconium) is observed in up to 58.7% of foetuses (40% after 32 WG).

Pathological MRI patterns of foetal bowel

Small bowel obstruction MRI may help identify the location of the obstruction. Theoretically, the more distal the obstruction, the higher the signal of the dilated loops on T1-W images, because of accumulation of meconium in distal small bowel loops. However, some observations of proximal occlusion with T1-hyperintense dilated small bowel loops contradict this assumption. The significance of such T1-hyperintensity is still unclear. Evaluation of the intestinal tract distal to the obstruction is not easy, and uncertainty remains when no loops are visible; in these cases, it is difficult to rule out multiple obstructions, bowel necrosis or an "apple-peel" pattern of atresia. Conversely, in distal obstruction, the loops proximal to the obstruction are usually well visualised, which makes it possible to evaluate the approximate amount of normal small bowel.

In foetuses with cystic fibrosis and meconium ileus, the dilated bowel loops may exhibit T1-hyperintensity and intermediate T2 signal intensity. Moreover, pellets of meconium may be visible within distal ileal loops (Fig. 1). Dilated bowel loops may also be associated with a meconium pseudocyst, which usually displays T2-hyperintensity and variable intensity on T1-W images.

Most intestinal duplications can be diagnosed with US and do not require MRI. Very rare cases of midgut malrotation have been reported at foetal MRI.

Disclaimer Dr. Catherine Garel has no financial interests, investigational or off-label uses to disclose.

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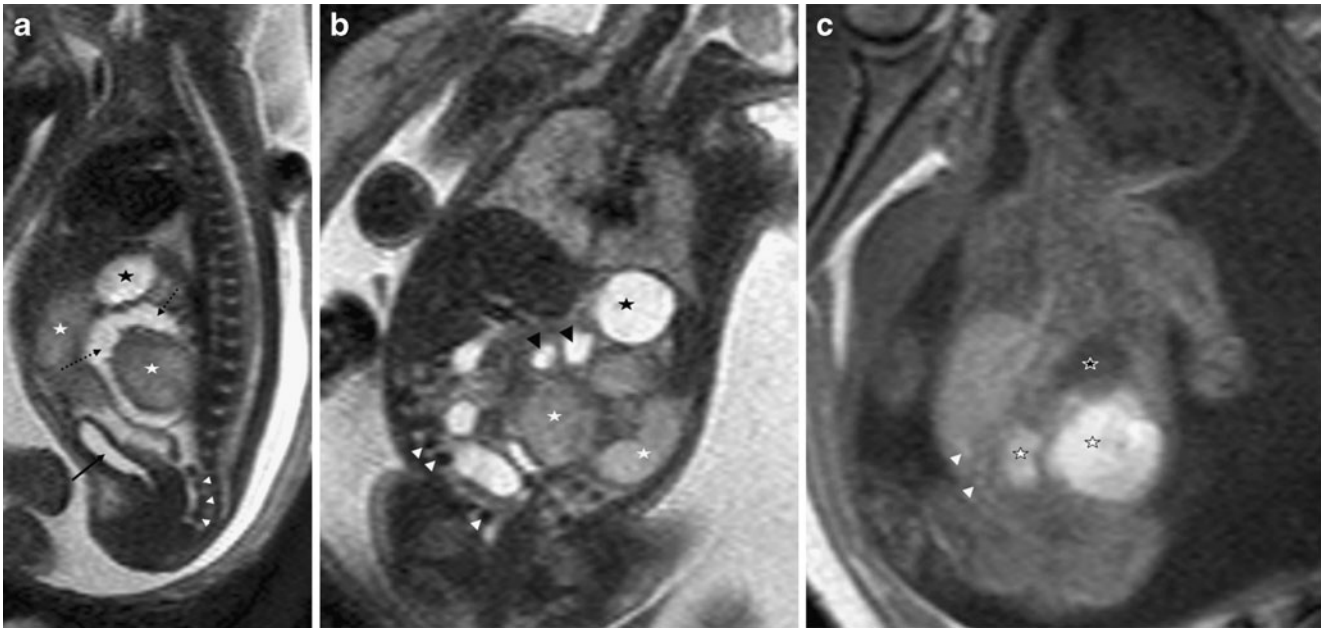

Fig. 1 Cystic fibrosis and meconium ileus at 29 weeks' gestation. **a** T2-weighted midsagittal section: the stomach (*black star*) and the bladder (*black arrow*) are hyperintense. The dilated ileal loops (*white stars*) display intermediate signal intensity, and one is surrounded by peritoneal fluid (*dotted arrows*). Hypointense pellets of meconium are visible within the rectum (*white arrowheads*). **b** T2-weighted coronal section: the stomach (*black star*) and the proximal small bowel loops (*black arrowheads*) are hyperintense. The dilated ileal loops (*white stars*) display intermediate signal intensity. Hypointense pellets of meconium are visible within distal small bowel loops (*white arrowheads*). **c** T1-weighted coronal section: the stomach (*black star*) is hypointense. Dilated distal small bowel loops (*white stars*) and pellets of meconium in the distal ileum (*white arrowheads*) are hyperintense

Abnormal colon Evaluation of colonic size and content is easy at MRI. Therefore, it may be helpful to perform foetal MRI when microcolon is suspected in the setting of megacystis microcolon intestinal hypoperistalsis syndrome. MRI is also useful in cases of congenital diarrhoea, showing diffuse bowel loop dilatation and absent T1-hyperintensity in the colon and rectum.

Abnormal rectum In cases of abnormal communication between the (genito-)urinary and intestinal tracts, the normal T1-hyperintensity of the rectum disappears, which may be suggestive of rectourethral fistula in high anorectal malformation. When a cloacal malformation is suspected (variable association of dilated bowel loops, pelvic mass, urogenital anomalies, ascites), foetal MRI can show an abnormal signal in the rectum (T1-hypo- and T2-hyperintensity) and can depict abnormal anatomy of the pelvic structures (Fig. 2).

Visualisation of the rectum with MRI is also useful in the setting of midline pelvic masses that may be isolated (sacrococcygeal teratoma) or associated with dysraphism (Currarino triad).

In conclusion, foetal MRI provides good visualisation of fluid- or meconium-filled intestinal loops. It is indicated in the setting of small bowel obstruction, when anorectal malformation, cloacal malformation or microcolon is suspected, or when a midline pelvic mass is seen on US.

Fig. 2 Cloacal malformation at 33 weeks' gestation; T2-weighted midsagittal section. The bladder (*black star*) and the dilated vagina (*white arrow*) show normal hyperintensity. The rectum (*black arrow*) should be hypointense, but is hyperintense due to abnormal communication with the genitourinary tract