Foetal magnetic resonance imaging

Ultrasound is widely used as a routine antenatal screen for foetal abnormalities. It is highly operator-dependent and, occasionally, anatomical relationships are difficult to delineate in the presence of complex and complicated abnormalities. Foetal magnetic resonance imaging (MRI) can play a significant diagnostic and prognostic role in these circumstances.[1] We performed MRI examinations with a 1.5T scanner (Sonata; Siemens, Erlangen, Germany) using a body coil. The imaging sequence included a breath-hold single-shot true fast imaging with steady state precession sequence (TR/TE/Nex=1000/66/1, FOV=340-400 mm, matrix=275x400, slice thickness/ gap=3.5 mm/ 0 mm), with the planes oriented to demonstrate the pathology most satisfactorily. In all cases the foetal MRIs were performed within 7 days of the antenatal ultrasound.

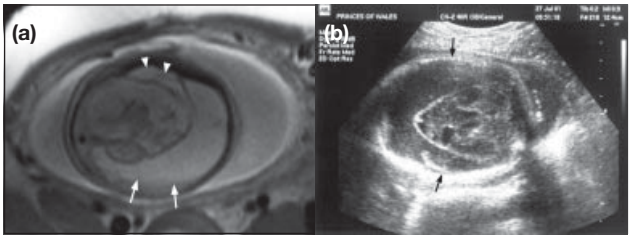

Fig 1. (a) Axial true fast imaging with steady state precession image showing a large right (arrows) and small left subdural haematoma (arrow heads) with fluid-fluid level. The foetal brain was underdeveloped and displaced to the left. (b) Transverse ultrasonographic section of the foetal brain showing bilateral subdural haematomas (arrows)

Case series

Case 1

A routine ultrasound done at 28 weeks' gestation revealed a foetal intracranial haemorrhage. The exact location of the haemorrhage was uncertain and it was difficult to assess foetal brain development. An MRI showed extensive subdural haematomas in both cerebral hemispheres and an underdeveloped foetal brain (Fig 1). As up to 90% of parenchymal and subdural haematomas are associated with severe neurological impairment, foetal or neonatal death, the prognosis was grave.[2] The baby died soon after delivery.

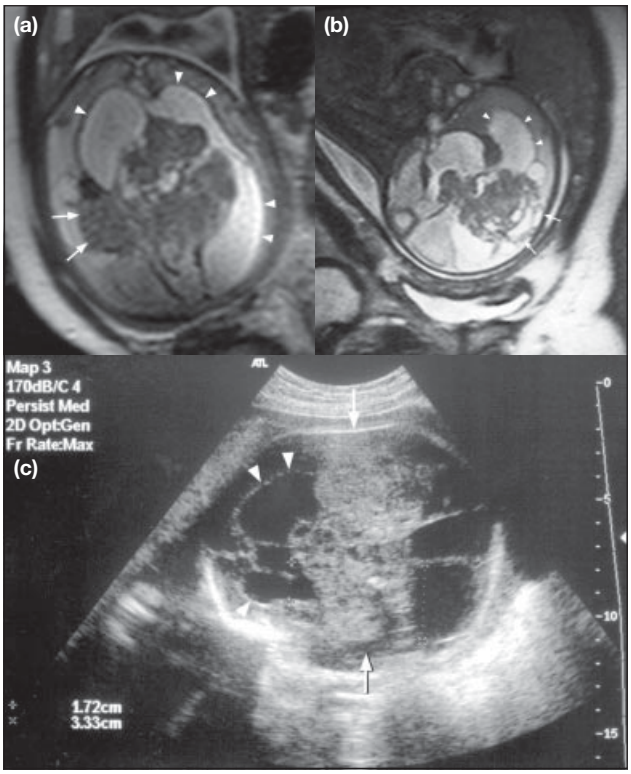

Fig 2. (a) Axial true fast imaging with steady state precession (FISP) image showing a large heterogeneous mass (arrows) centred on the supratentorial region and causing a severe obstructive hydrocephalus (arrow heads). The foetal brain was underdeveloped. (b) Sagittal true FISP image of the same foetal brain showing the large supratentorial tumour (arrows) and obstructive hydrocephalus (arrow heads). (c) Transverse ultrasonography section of foetal brain showing a large heterogeneous mass (arrow) in midline causes obstructive hydrocephalus (arrow heads)

Case 2

A 34-year-old woman had an antenatal ultrasound performed at 29 weeks' gestation that showed a large heterogeneous intracranial lesion causing significant obstructive hydrocephalus in the foetus. The exact nature and origin of the lesion was difficult to determine. An MRI performed 2 days after the antenatal ultrasound showed a large heterogeneous supratentorial mass centred on the pineal region causing an obstructive hydrocephalus (Fig 2). The mass showed multiple cystic components, suggestive of a teratoma.[3] The baby was delivered by elective caesarean section at 30 weeks' gestation and early surgery attempted. Unfortunately, the baby died 1 week after birth. The autopsy confirmed that the mass was an immature intracranial teratoma.

Case 3

An antenatal ultrasound done at 28 weeks' gestation showed a mixed cystic and solid tumour in the foetal left neck. The presumptive diagnosis was a teratoma. An MRI showed a cystic lesion with internal septation over the left side of the neck, extending to the left parapharyngeal space (Fig 3). No solid component could be identified. The features were characteristic of a cystic hygroma rather than a teratoma.[4] The diagnosis was confirmed by resection of the lesion after the baby was delivered at full term.

Case 4

A pregnant woman had a relatively normal ultrasound at 16 weeks' gestation but the foetal left thorax was poorly

visualised due to an unfavourable foetal lie. A follow-up ultrasound at 24 weeks showed a large mass in the thorax. The exact origin of the lesion was uncertain. An MRI showed a large homogeneous soft tissue mass occupying almost the entire left lung (Fig 4). The lesion was closely related to the heart. The spine was unremarkable. The presumptive diagnosis was a lung sarcoma closely abutting the heart border or a rhabdomyoma arising from the heart. At autopsy the lesion was found to be a rhabdomyoma.

Discussion

To reduce motion artefact related to breathing and foetal movement, foetal MRI images are acquired with breath-holding sequences. It is difficult to obtain diagnostic-quality images if the patient cannot hold her breath for more than 10 seconds or if the foetus keeps moving during scanning. Antenatal ultrasound definitely has its role in screening for congenital abnormalities. It allows high-resolution real-time assessment of foetal movement and cardiac motion, which is not achievable with current MRI techniques. However, ultrasound has difficulty determining the origin and nature of some abnormalities, especially when the abnormality is large and extensive and the normal anatomy is markedly distorted. A foetal MRI will then play an important role in establishing the diagnosis. Parents will be better informed about the prognosis and antenatal intervention, if appropriate, can be carried out accordingly. The recent development of three-dimensional (3D) and four-dimensional (4D) ultrasonic imaging, allows assessment of foetal abnormalities in different planes. However, the resolution of reformatted images is often less optimal than the source images. Both 3D and 4D scanning have limitations when there is rapid foetal movement, an unfavourable foetal lie, and an advanced gestational age with little liquor amnii serving as the acoustic window. Therefore, the role of foetal MRI cannot be totally replaced by 3D and 4D ultrasound imaging.

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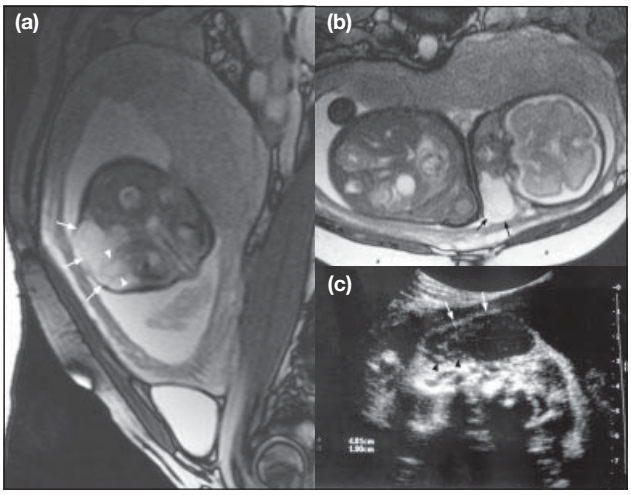

Fig 3. (a) Axial true fast imaging with steady state precession (FISP) image showing a cystic structure (arrows) with internal septation (arrow heads) representing a hygroma located in the left foetal neck. (b) Coronal true FISP image of the foetal neck confirming the presence of the cystic hygroma (arrows) in the left foetal neck. (c) Ultrasonography of the same foetus showing the cystic mass (arrows) with internal echoes (arrow heads) in the left foetal neck

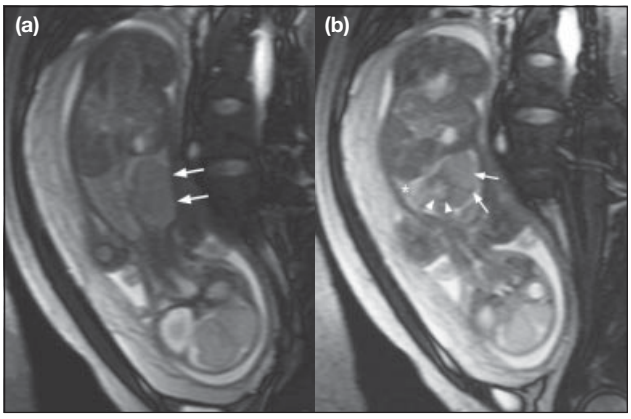

Fig 4. (a) Coronal true fast imaging with steady state precession (FISP) image showing a large homogeneous extra-cardiac soft tissue mass (arrows) occupying the entire left lung and causing a significant contralateral mediastinal shift. Autopsy revealed an intra-thoracic rhabdomyoma. (b) Coronal true FISP image showing the relationship of the tumour (arrows) to the foetal heart (arrow heads) and right lung (asterisk)

References

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