Prenatal MRI Findings of Mesoblastic Nephroma: a case report

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We here present the antenatal magnetic resonance imaging (MRI) findings of mesoblastic nephroma in a fetus. A profitable design using single-shot fast spin echo (SSFSE) MRI sequence was applied for recognition of the abdominal mass with renal origin in the mobile fetus. SSFSE could significantly shorten the scanning time, therefore we got satisfactory images without fetal sedation. The image findings and differential diagnosis are also discussed. Although unusual huge size as in this case, congenital mesoblastic nephroma (CMN) could be considered when encountering a solid fetal renal tumor.

Key words: Kidney; Magnetic resonance (MR); Mesoblastic nephroma

Determining the nature of a tumor of the fetus is important, and is helpful for deciding to continue or terminate pregnancy and subsequent treatment considerations. The prognosis of congenital mesoblastic nephroma (CMN) is excellent after complete surgical resection, and neither adjuvant chemotherapy nor irradiation therapy is necessary. It also has no tendency to metastasis. To our knowledge, it is almost reported with antenatal ultrasound or postnatal MRI, and only two cases with prenatal MRI are found [1-5]. Computed tomography (CT) is less commonly employed due to radiation hazard. Although MRI is proved superior to ultrasound in certifying the renal origin and demonstrating the imaging characteristics, the major difficulty in ordinary MRI sequence is the intrauterine fetal movement. Hence, our experience in single-shot fast spin echo (SSFSE) MRI is reported in this article.

CASE REPORT

A 19-year-old female, gravida 1, para 0, with 23 weeks pregnancy, was admitted because a fetal abdominal mass was found by prenatal ultrasound examination at local clinic. Sonography at the twentieth week of pregnancy disclosed congenital fetal abnormality presenting as a left abdominal mass, measuring 5 cm in size, associated with scalp edema and polyhydramnios. The family history, laboratory and genetic studies were all unremarkable. At 23 weeks 5 days’ gestation, MRI examination obtained on 1.5-T magnet (Signa; GE Medical Systems, Milwaukee, WI) was performed on the intrauterine fetus. At first, in the axial (TR/TE, 4800/81.4 ms) and coronal (5217.39/77.76) T2-weighted fast spin echo (FSE) sequences, serious motion artifact due to fetal movement was noted. Following single-shot fast spin echo (SSFSE) sequences in three directions according to the fetal position identified in the pilot scan were performed. The parameters of these SSFSE were 33485/99.9; 26 x 26 mm field of view (FOV); 384 × 192 matrix; 0.50 number of excitations (NEX) in axial section, 18938/
Follow-up ultrasound examination at 25 weeks of gestation showed that the tumor had enlarged to $6.6 \times 5.0 \times 5.8$ cm. Unfortunately, premature rupture of membrane and subsequent preterm labor happened (GA 25 weeks). Fetal distress was noted after naturally spontaneous delivery. The Apgar scores were 2 at 1 minute and 1 at 5 minutes. The condition deteriorated despite resuscitation, and the male newborn died in several minutes. There were marked abdominal distention and mild scalp edema of the newborn. Grossly, no other associated abnormality was identified. On autopsy, a firm left renal mass, $7 \times 5.5 \times 5.5$ cm in size and 108 gm in weight was found. The cut surface exhibited light tan, homogenous, hard, and

Figure 1. a. Axial section of FSE T2WI (TR/TE: 4800/81.4 ms, total scanning time: 2'15") shows a well-defined left renal mass (M), normal right kidney (R), the liver (L), and the gall bladder (arrow). b. SSFSE (TR/TE: 33485/99.9 ms) within only 33 seconds could eliminate the effect of the uncontrolled fetal movement and clearly present the left renal mass (M), the normal right kidney (R), the liver (L), the gallbladder (arrow), and the spine (arrowhead).

Figure 2. Sagittal section of SSFSE T2WI (TR/TE: 18938/96 ms) shows a huge intermediate signal intensity mass (M) in the left kidney (K).

Figure 3. Oblique coronal section of SSFSE T2WI (TR/TE: 25731/96.4 ms) shows an intermediate signal intensity mass (M) in the left abdomen, displacing the normal left renal parenchyma (K) upwards, and normal right kidney (R).
whirl-like appearance, without necrosis or hemorrhage. Microscopic examination revealed a congenital mesoblastic nephroma, composed of fascicular proliferation of spindle-shaped cells with remaining renal glomeruli and tubuli. Immunohistochemically, these tumor cells were positive for vimentin, smooth muscle actin, but not cytokeratin. The final diagnosis was mesoblastic nephroma (Fig. 4, 5).

**DISCUSSION**

Abdominal masses in neonates and children are most frequently of renal origin [6, 7]. Pediatric renal masses can be divided into two categories, either cystic or solid. The differential diagnosis for solitary renal mass in infants includes mesoblastic nephroma, Wilms’ tumor, neuroblastoma, multilocular cystic nephroma, infantile polycystic kidney disease, and renal vein thrombosis [6], while in older children, renal cell carcinoma, renal lymphoma & leukemia, and angiomyolipoma should also be considered.

Congenital mesoblastic nephroma (CMN; also known as: fetal renal hamartoma, leiomyomatous hamartoma, Bolande’s tumor) is the most common fetal and neonatal renal neoplasm [1, 2, 4, 6, 7]. It is usually unifocal and unilateral. The prepartum history of CMN may be associated with polyhydramnios, prematurity, and dystocia [1, 6]. On pathologic examination, mesoblastic nephroma usually shows circumscribed but not encapsulated large firm solid tumor and consists of variable cellular growth of spindle cells. It rarely undergoes hemorrhage or necrosis, but cystic variant may occur [8].

Mesoblastic nephroma is almost exclusively diagnosed within the first 6 months of life, while in Wilms’ tumor, the peak incidence is 30 months to 3 years of age, and is rarely seen before the age of 2 years [6, 8]. Associated anomalies of CMN may involve the genitourinary and gastrointestinal system, and sometimes include polydactyly and hydrocephalus, but never present with aniridia and hemihypertrophy as seen in Wilms’ tumor. Obstetric complication such as polyhydramnios, premature labor, dystocia, hemorrhage, hypercalcemia can also develop in CMN. Both CMN and Wilms’ tumor are well-defined and solid, but Wilms’ tumor may have hemorrhagic or necrotic components, and appears septated due to its fibrous stroma [6, 7]. Wilms’ tumor tends to displace the vessels rather than encase them in neuroblastoma [6]. Inferior vena cava or right atrium thrombosis may also be seen in Wilms’ tumor, but has never been reported in CMN [7]. Although the age groups, natural courses, pathological appearances and prognoses of CMN and Wilms’ tumor are different, these two neoplasms may have similar imaging features [1, 2], except that calcification can be detected in 10-15% of Wilms’ tumor but is rare in CMN. Definite diagnosis depends only on pathologic examination.

Reviewing the literature, antenatal detection of renal mass is mostly made by ultrasound [1, 2, 3, 9]. On ultrasound, mesoblastic nephroma is reported as a well-circumscribed, solid, homogeneously or heterogeneous hypoechoic mass, occupying the renal fossa, without IVC involvement [1-7]. Occasionally, anechoic areas due to cystic change could also be
seen. CT, though rarely performed due to the risk of radiation, allows identification of the intrarenal tumor with no or mild enhancement, adjacent functioning parenchymal distortion, and pyelocaliectasis [6, 7]. On MRI, CMN appears as a large well-defined renal mass, with low signal intensity in T1WI, similar signal to renal parenchyma in HASTE T2WI, and no caval extension [1, 2, 5]. Cassart et al. suggested fast imaging sequences (half-Fourier acquisition single-shot turbo spin echo, balanced fast field echo) and four-element phased array body coil for improvement of fetal imaging [9]. In our case, sonography showed a clearly-defined hypoechoic mass in the fetal abdomen. With T2-weighted FSE, total scanning time for 16 slices was 2 minutes and 15 seconds. SSFSE MRI (breath holding once per 6 seconds) decreased the acquisition time for 17-20 slices to 19-33 seconds, and minimized artifacts due to fetal motion. Neither sedation nor contrast medium injection was needed. Therefore we demonstrated the characteristic imaging findings, not only renal origin of the intermediate signal intensity mass, but also lack of hemorrhage, calcification, necrosis, cystic change, or IVC invasion. Although early stage of Wilms’ tumor might show similar image appearances, CMN was more favored in our case regarding the age of presentation. Keep pregnant and postpartum nephrectomy could be suggested.

In conclusion, despite being uncommon, CMN should be taken into consideration when evaluating a fetal abdominal mass. This benign lesion typically is a well-margined renal tumor, which appears hypoechoic with associated polyhydramnios on ultrasound examination. SSFSE MRI serves as a useful modality to determine the origin of the lesion and clearly demonstrates other characteristics of the lesion identified in sonography. This could be done without fetal sedation.

REFERENCES

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胎兒先天性中胚葉細胞腎瘤在產前磁振造影之影像表現：病例報告

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本文報告中胚葉細胞腎瘤在產前磁振造影的表現。主要是提出一種有用的磁振造影脈衝序列 SSFSE，可以確定子宮內快速活動的胎兒腎中腫瘤來源自腎臟。SSFSE 的優點在於大幅縮短了掃描的時間，使我們可以在不需麻醉病人的情況下獲取清楚的影像。文中也對其影像表現和鑑別診斷做出討論。對於胎兒腎臟實質的腫瘤，儘管如這病例中不尋常的大小，中胚葉細胞腎瘤應該要列入鑑別診斷中。病理報告確定了此診斷。

關鍵詞：腎臟；磁振造影；中胚葉細胞腎瘤