Dural Sinus Malformation Imaging in the Fetus: Based on 4 Cases and Literature Review

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Background: This study aims to describe the imaging characteristic of dural sinus malformation in 4 fetuses with different locations. *Materials and Methods:* We report a series of 4 fetuses with dural sinus malformation in Hubei Maternal and Children's Hospital from July 2013 to February 2016. All the mothers undertook the prenatal magnetic resonance (MRI) imaging because of the intracranial space-occupying lesions discovered by prenatal ultrasound. *Results:* Two of the 4 cases demonstrated typical MRI of dural sinus malformation with thrombosis in the vicinity of torcular herophili (also known as sinus confluence), whereas the other 2 cases showed lesions in the superior sagittal sinus and transverse sinus separately. Three pregnancies were terminated, whereas the other one was delivered in the local hospital. *Conclusions:* Sonographer should realize the sign of dural sinus malformation. Atypical location of the dural sinus malformation, such as superior sagittal sinus and transverse sinus, should be paid special attention to. Further, prenatal MRI is necessary to identify the lesion. **Key Words:** Dural sinus malformation—fetus—MRI—ultrasound—complication—fetal pathology.

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Dural sinus malformation is a rather rare entity which usually can be encountered in fetuses and infants. According to the Lasjaunias's classification, this malformation belongs to the dural arteriovenous shunts and can be divided into infantile and adult types.[1] To our knowledge, only around 50 cases of dural sinus malformation had been reported in the literature,[2-24] and atypical case that involves superior sagittal sinus could only be seen in the Emamian et al study.[25] The cause and prognosis of the dural sinus malformation in the fetuses is still limited. Obstetric ultrasound is used for screening fetal brain abnormalities, and magnetic resonance imaging (MRI) is used as a complementary examination to assess the diagnosis and provide more details. Most reported cases involved the torcular herophili with variable extension to the adjacent dural sinuses. As the venous drainage of the brain mainly goes through dural sinus, poor outcomes were expected in cases with dural sinus malformation,[1] yet some demonstrated improvement or normal clinical outcomes.[2,3,26]

The purpose of our study is to present several different imaging patterns of dural sinus malformation

through a series of 4 cases. With the increasing knowledge of dural sinus malformation, it is important to recognize the imaging characteristic of this entity for proper diagnosis.

Materials and Methods

This is a retrospective study of imaging findings in 4 fetuses with dural sinus malformation, based on ultrasound and MRI. The protocol for this retrospective study was approved by the ethics committee of our hospital. The written informed consent should be obtained from all the mothers, including these 4 cases, before the MRI examination in our hospital. Initial ultrasound examinations were performed in our hospital (tertiary referral center) as part of routine screening. The signs that were studied using ultrasound included the location, size, echogenicity and relationship to the torcular of the mass, the condition of ventricles and brain parenchyma, and blood flows within and around the mass.

All the fetal MRI was performed within 48 hours after the prenatal ultrasound. Non–contrast-enhanced and nonsedation MRI was performed with Siemens Magnetom Espree 1.5 T unit (Siemens Medical Systems, Erlangen, Germany) using phased-array surface coil. The mothers were placed in the supine or lateral decubitus position. All the prenatal MRI included T2-weighted half-Fourier acquisition single-shot turbo spin echo (HASTE) sequences (repetition time [TR]: 1200 milliseconds; echo time [TE]: 143 milliseconds; slice thickness: 4 mm; field-of-view [FOV]: 260 × 260 mm; matrix: 256 × 256; acquisition time [TA]: 19 seconds) in the 3 orthogonal planes (axial, coronal, and sagittal). In all cases but one (fetus 3), axial fast low angle shot (FLASH) T1-weighted gradient echo (GRE) breath-hold sequences (TR: 2000 milliseconds; TE: 3.19 milliseconds; slice thickness: 5.5 mm; flip angle: 15°; FOV: 250 × 250 mm; matrix: 256 × 256; TA: 26 seconds) and axial diffusion-weighted imaging (DWI) sequence (TR: 4000 milliseconds; TE: 114 milliseconds; slice thickness: 3 mm; FOV: 400 × 400 mm; matrix: 192 × 192; TA: 28 seconds; b-factor: 0 and 700 s/mm^2) were obtained. The duration of the MRI examination was less than 30 minutes.

The images were reviewed by 2 experienced radiologists in consensus, who were aware of the ultrasound reports in all cases. The prenatal MRI was focused on signal intensities, location, size, extent of the mass, and the anomalies of the brain parenchyma and ventricles.

Results

The clinical and imaging findings of the 4 cases are presented in Table 1.

Case 1

Prenatal ultrasound performed in our hospital at 26 + 3 gestational weeks demonstrated an isoechoic solid mass in the posterior fossa without blood flow. Fetal MRI performed in our hospital at 26 + 3 gestational weeks delineated a mass in the torcular herophili, which was iso- to hyperintense on T1 and iso- to hypointense on T2 with extension into the posterior one third of the superior sagittal sinus. In the mass, an eccentric focal area, which was hyperintense on T1, hypointense on T2, and hyperintense on DWI (b = 0, 700), could be seen. Mild space-occupying effect on the cerebellum and fourth ventricle could be observed as well, whereas the rest of the brain was normal (Fig 1). The baby was delivered in a local hospital, and the diagnosis was confirmed by postnatal ultrasound.

Case 2

Prenatal ultrasound performed in our hospital at 24 + 5 gestational weeks described an anechoic area in posterior fossa with hyperechoic mass, but no blood flow was observed. As the conclusive diagnosis could not be made, the mother undertook the fetal MRI. The fetal MRI performed in our hospital at 25 gestational weeks delineated a mass in the torcular herophili, which was iso- to hyperintense on T1, iso- to hypointense on T2, and hypointense on DWI with eccentric focal area of hyperintense on T1, hypointense on T2, and hyperintense on DWI (b = 0, 700). The mass extended into the posterior one third of the superior sagittal sinus. Mild space-occupying effect on the cerebellum and fourth ventricle could be observed, whereas the rest of the brain was normal (Fig 2). The imaging presentation was similar to case 1. The pregnancy was terminated at 28 gestational weeks. No autopsy was obtained because of cephalotomy.

Case 3

Prenatal ultrasound performed in our hospital at 32 + 2 gestational weeks described an anechoic area superior to right cerebellum without blood flow. Prenatal MRI performed in our hospital at 32 + 4 gestational weeks delineated a mass in right transverse sinus and torcular herophili. The mass was iso- to hyperintense on T1, iso- to hypointense on T2 with eccentric focal area of hyperintense on T1, hypointense on T2, and hypointense on DWI (b = 0, 700). Besides, the right hemisphere was smaller, its cortical was smoother than the left cortical with a cortical dysplasia appearance, and the signal of white matter in right hemisphere was lower than the left. Enlarged right temporal horn and right supracerebellar cistern cyst could be observed as well (Fig 3). The pregnancy was terminated in 34 gestational weeks. No autopsy was obtained because of cephalotomy.