Letter to the Editor

Prenatal diagnosis of dural sinus malformation by two-dimensional combined with three-dimensional ultrasound: a case description

Yanzhao Wang[1#^], Zhiheng Yan[1#], Wenjing Guo[1], Gang Wang[1], Tiangang Li[1], Bin Ma[1,2]

[1]Department of Ultrasound Diagnosis, Gansu Provincial Maternity and Child-care Hospital, Lanzhou, China; [2]Ultrasound Medicine Center, Lanzhou University Second Hospital, Lanzhou, China

[#]These authors contributed equally to this work.

Correspondence to: Bin Ma, MD. Department of Ultrasound Diagnosis, Gansu Provincial Maternity and Child-care Hospital, 143 Qilihe North Street, Lanzhou 730050, China. Email: 153873545@qq.com.

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Introduction

Dural sinus malformation (DSM) is a dural arteriovenous shunt. Since cerebral venous drainage is mainly through the dural sinus, the prognosis of patients with DSM is poor; however, some patients have improved or average clinical predictions. Relevant literature (1,2) has reported that lateral DSM can retain normal venous drainage on the contralateral side and is associated with a good prognosis. Conversely, midline DSM has a poor prognosis, is prone to involve sinus confluence, posterior superior sagittal sinus, and transverse sinus, leading to brain injury and poor prognosis of neonates (3,4). The case reported herein presented with midline DSM with thrombosis, but the clinical prognosis was good.

Case presentation

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was provided by the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal. A 24-year-old woman, pregnancy 1 and birth 0, healthy, no history of toxins, drugs, allergies, or radiation exposure, who had undergone regular prenatal examination in other hospitals during pregnancy, presented to our hospital. Her husband was healthy, non-consanguineous, and had no infectious diseases or genetic history. A fetal ultrasound examination at 26 gestational weeks showed a triangular cystic mass in the occipital region of the fetus, with a clear boundary and a range of 29 mm × 27 mm in transverse and coronal views of the cerebellum. The internal sound transmission was poor, showing a "cloudy" shape. A hypoechoic mass of 22 mm × 23 mm was seen within the mass, with a regular contour and slightly enhanced peripheral echo (*Figure 1A*,*1B*). No unmistakable blood flow signal was collected in the mass. The median sagittal plane of the skull showed a widening of the superior sagittal sinus and sinus confluence, with a maximum width of about 21 mm and a hypoechoic mass located at the sinus confluence (*Figure 1C*). Three-dimensional (3D) crystal imaging revealed the sinus confluence's broadening and solid groups (*Figure 1D*). In this case, the fetal heart was not abnormal. Ultrasound suggested that the fetal superior sagittal sinus was widened with abnormal, strange, bizarre

^ ORCID: 0000-0002-5642-7201.

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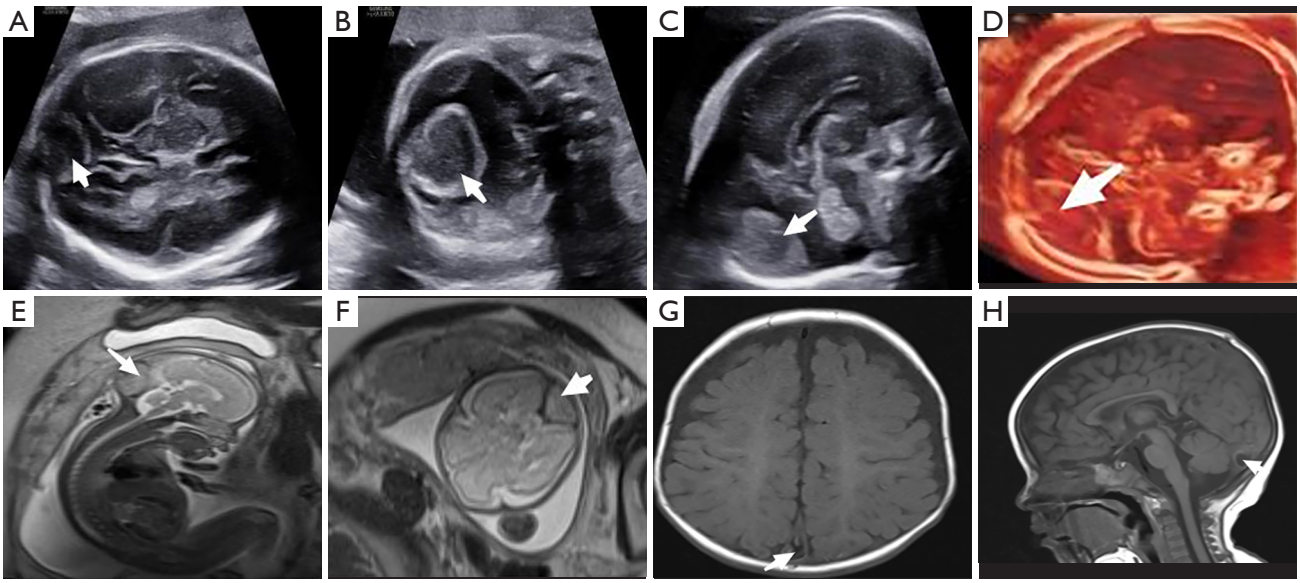

Figure 1 Prenatal ultrasound and prenatal and postnatal MRI images. (A) 2D ultrasound transverse view of the brain shows cystic anechoic at the confluence of the sinus (white arrow). (B) Sagittal view of the skull shows fetal sagittal sinus widening and its internal thrombus (white arrow). (C) Coronal view of the brain shows the thrombus at the confluence of the sinus (white arrow). (D) 3D crystal imaging shows thrombus (white arrow). (E,F) Postnatal MRI T1WI, T2WI images show the superior sagittal sinus and sinus confluence widening, thrombosis (white arrow). (G,H) Reexamination of MRI in July (T1WI, T2WI) localized abnormal signal in sinus confluence area (white arrow). 2D, 2-dimensional; 3D, 3-dimensional; MRI, magnetic resonance imaging; T1W1, T1-weighted imaging; T2WI, T2-weighted imaging.

echo, and DSM with thrombosis was considered.

Further magnetic resonance imaging (MRI) in our hospital showed that the abnormal signals in the midline confluence area of the occipital top of the fetus were consistent with the shape of the sagittal sinus (*Figure 1E*), the axis was triangular, the boundary was clear, the edge was toward the brain line, and the range was about 25 mm × 24 mm. T1-weighted imaging (T1WI) revealed an equal and slightly higher signal, T2-weighted imaging (T2WI) revealed a somewhat higher and lower sign, and diffusion-weighted imaging (DWI) showed a high movement (*Figure 1F*).

DSM with thrombosis should be considered in fetuses with abnormal sinus confluence areas. After prenatal consultation, the patient and her family decided to carry on observation, and a later reexamination showed that the mass was significantly smaller than before. A male infant weighing 3,052 g was born by natural vaginal delivery at 38 gestational weeks. Clinicians should remain aware of the possibility of dural sinus dysplasia with thrombotic sequelae (dural sinus dysplasia with thrombosis sequelae refers to the remnant of fetal DSM with thrombosis, which has not been completely absorbed over time) (*Figure 1G,1H*).

Discussion

DSM is a rare disease, usually seen in infants and fetuses. According to Lasjaunias' classification, this malformation belongs to the dural arteriovenous shunt, divided into the infantile and adult types. The exact cause and mechanism of DSM are still unclear. Dural arteriovenous shunt volume is small, and shunt velocity is low; spontaneous thrombosis is not uncommon, and although thrombosis is common in infants, fetal thrombosis is rare; thrombosis can lead to severe nervous system venous hypertension, secondary venous infarction, and intracranial hemorrhage. According to the location of onset, DSM is divided into midline DSM and lateral DSM. As cerebral venous drainage is mainly through the dural sinus, the prognosis of patients with DSM is poor, but some patients have improved or average clinical prognosis.

The patient had DSM with thrombosis in the midline and was followed up at birth. The imaging diagnosis of DSM mainly depends on prenatal ultrasound. The classification of DSM is helpful to the judgment of clinical prognosis, and accurate diagnosis is the key to treatment.

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3D crystal imaging can more intuitively evaluate DSM's boundary shape and size and the relationship with surrounding tissues and skulls to achieve a more accurate diagnosis. In this case, 2-dimensional (2D) and 3D crystal imaging was used to diagnose DSM in the midline DSM. The patient was followed up from diagnosis to birth, and the postnatal MRI showed a good prognosis. DSM is mainly found by prenatal ultrasound, which is primarily manifested in the cross-section of the brain; a triangular or irregular shape cystic mass near the confluence of the skull sinuses can be seen, and small punctate flows can be seen within it. In this case, thrombosis was manifested as a hyperechoic mass in the capsule, primarily round or round. Color Doppler ultrasound showed no blood flow signal in the lesion, and the blood flow signal of the superior sagittal sinus and transverse sinus was interrupted at the edge of the tumor. The 3D crystal imaging showed an irregular mass at sinus confluence with a clear boundary and internal structure. In this case, ultrasound detected thrombosis in the second trimester of pregnancy, and there was no other structural malformation in the single brain. In the third trimester of pregnancy, the mass was smaller than before, and the thrombus was dissolved. The spontaneous dissolution of the thrombus was related to the regulation of blood flow.

The patient was prenatally diagnosed with DSM and thrombosis. Fetal thrombosis is rare, and the prognosis was poor. However, the patient's family insisted on continuing with the pregnancy and follow-up; a head MRI further confirmed the thrombosis after birth. DSM with thrombosis should be differentiated from Galen's vein aneurysm, intracranial posterior fossa tumor, and arachnoid cyst: (I) Galen's vein aneurysm: located in the anterior-posterior fossa, the color Doppler is helpful to distinguish Galen's vein aneurysm from other masses, and the high-speed turbulent flow signal in the cystic structure is shown; (II) intracranial posterior fossa tumors: blood flow signals are often present in the tumors; and (III) arachnoid cyst: mainly manifested as anechoic mass with thin wall and no blood flow, similar to the echo of cerebrospinal fluid (5).

In this case, 2D images combined with 3D crystal imaging were used to diagnose lifeline midline DSM with thrombosis, and the follow-up prognosis was good. In conclusion, prenatal ultrasound is the primary imaging tool for fetal DSMs. In contrast to MRI, prenatal ultrasound can detect fetal brain abnormalities early in pregnancy. 3D ultrasound imaging can show the external outline and internal structure more intuitively and clearly. It can distinguish between brain tissue and bone structure, which can help to confirm the diagnosis. Regular follow-up, ultrasound monitoring of mass changes, and preliminary prediction of fetal prognosis are recommended.

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Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://qims.amegroups.com/article/view/10.21037/qims-23-860/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was provided by the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

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