Letter to the Editor

Prenatal diagnosis of the ventricular septal aneurysm using HDlive flow with spatiotemporal image correlation

Bin Ma[1,2#], Yanzhao Wang[2#], Qiong Lan[2], Dengcai Zhang[3], Tiangang Li[2], Fang Nie[1]

[1]Ultrasound Medicine Center, Lanzhou University Second Hospital, Lanzhou, China; [2]Ultrasound Medicine Center, Gansu Provincial Maternity and Child-care Hospital, Lanzhou, China; [3]Department of Pathology, Gansu Provincial Maternity and Child-care Hospital, Lanzhou, China

[#]These authors contributed equally to this work.

Correspondence to: Fang Nie, MD. Ultrasound Medicine Center, Lanzhou University Second Hospital, No. 82 Cuiyingmen, Chengguan District, Lanzhou 730050, China. Email: ery_nief@lzu.edu.cn.

Submitted Jan 24, 2024. Accepted for publication Jul 17, 2024. Published online Aug 19, 2024.
doi: 10.21037/qims-24-145
View this article at: https://dx.doi.org/10.21037/qims-24-145

Introduction

A 19-year-old pregnant woman at 24 weeks of gestation showed ventricular septal aneurysm (VSA), right heart enlargement, and massive tricuspid valve regurgitation on prenatal fetal echocardiography. Labor was induced in our hospital, and fetal autopsy and pathology confirmed an aneurysm in the middle of the ventricular septum and the apex of the heart. A VSA is a rare cardiac malformation, and prenatal diagnosis is crucial for eugenics and childbearing. The ventricular septum is the wall that separates the left and right ventricles. It is composed of the infundibular part, the perimembranous part, and the muscular part. Defects or aneurysms can occur in any position, namely, ventricular septal defect (VSD) and VSA. A pressure difference between the left and right ventricles causes the ventricular septum to protrude into the ventricle on the opposite side. VSA and VSD are occasionally discovered during routine examination; their clinical manifestations are usually asymptomatic, yet they rarely occur in isolation, more often accompanied by other congenital heart malformations. Isolated VSA is typically asymptomatic and does not require surgical intervention, which is necessary for other congenital heart diseases or VSD complications.

Case presentation

A 19-year-old woman underwent a prenatal ultrasound examination which resulted in a diagnosis of VSA at 24 weeks of gestation. A 2-dimensional (2D) 4-chamber ultrasound revealed a large VSA bulging from the body of the right ventricle into the left ventricle during early systole and from the body of the left ventricle into the right ventricle during end-systole. The remainder of the cardiac anatomy was otherwise ordinary (*Figure 1A,1B*). The 2D color Doppler ultrasound showed a bidirectional flow across the bulges (*Figure 1C*). A subsequent 4-dimensional (4D) color Doppler ultrasound with spatiotemporal image correlation (STIC) showed the blood mass filling an aneurysm (*Figure 1D*). The pregnant patient choose amniocentesis for further examination; the karyotype analysis indicated trisomy 21, and a decision was made to terminate the pregnancy. The existence of an aneurysm was confirmed after fetal autopsy and confirmed by pathology (*Figure 1E,1F*).

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committees and with the Helsinki Declaration (as revised in 2013). The study was approved by the Medical Ethics Committee of Gansu Provincial Maternity and Child-care Hospital under the approval number (2023) GSFY[65]. Written informed consent was provided by the patient for publication of this article and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

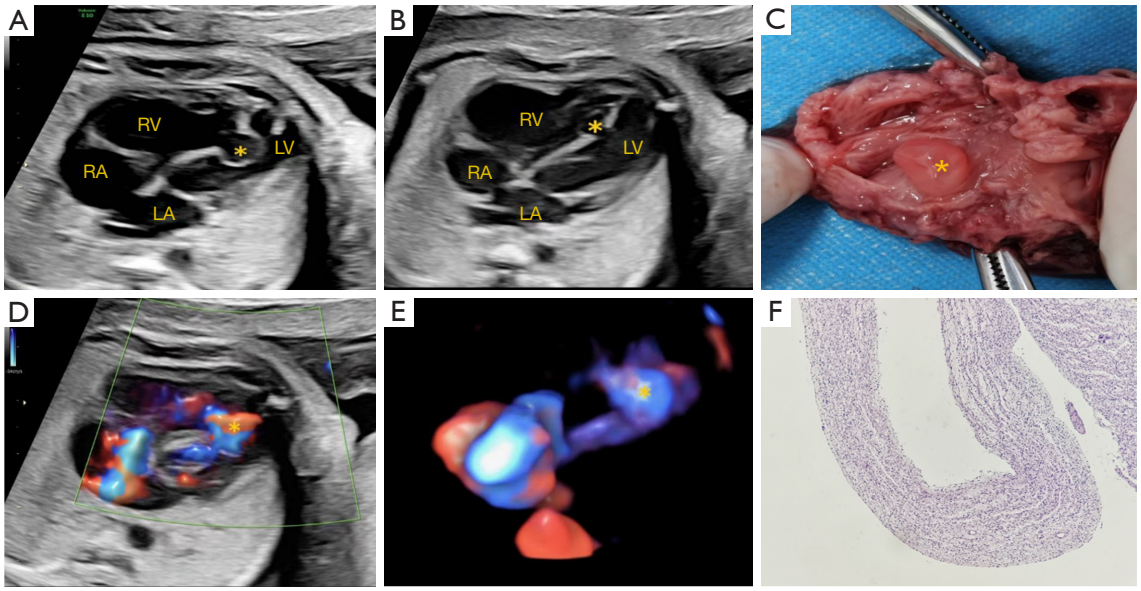

Figure 1 Prenatal image of VSA. (A) Early systole: aneurysm bulges from the body of the right ventricle into the left ventricle. (B) Late systole: the aneurysm bulges towards the right ventricle. (C) Color Doppler demonstrating the aneurysm. (D) The imaging of aneurysm with STIC. (E) Autopsy specimen. (F) Pathological manifestations of aneurysms (hematoxylin and eosin stain, 100×). The asterisk (*) indicates the VSA. RA, right atrium; RV, right ventricle; LA, left atrium; LV, left ventricle; VSA, ventricular septal aneurysm; STIC, spatiotemporal image correlation.

Discussion

A VSA is a rare heart defect in the ventricular septum's muscular or membranous part. Muscular septal aneurysm is usually isolated and has a good prognosis (1). Other heart abnormalities often accompany membranous septal aneurysms, leading to severe complications that may require surgery. Membranous VSAs are usually uncomplicated [usually right ventricular outflow tract (RVOT) obstruction] but may also be complicated by arrhythmia, thromboembolism, and even subaortic stenosis, which may require surgical correction. VSAs are most commonly associated with the transposition of the great arteries. Muscular VSAs are associated with hypoplasia of the aortic arch and severe hydrocephalus, which leads to pregnancy termination (2). This case was diagnosed with muscular VSA, which ultimately resulted in termination of the pregnancy via labor induction due to further diagnosis of chromosomal abnormalities (with the written informed consent of the patients before this article was prepared for publication).

The ultrasound features of VSA: 2D images showed that the ventricular septum was continuous, and a sac-like structure was convex into the right ventricle. HDlive blood flow showed that the heart cycle had vortex like changes, and no septal blood bundle was seen. STIC imaging showed a convex, aneurysm-like blood flow into the right ventricle. Congenital aneurysms of the interventricular septum are rare. The cause may have been a genetic defect in mesenchymal cell migration from the atrioventricular canal (3,4). However, most infants with congenital septal aneurysms are asymptomatic. Therefore, if VSA is found before delivery, pregnant women should be encouraged to undergo amniocentesis. If the karyotype is abnormal, the pregnancy needs to be terminated; if the karyotype is expected, the gestation and regular postpartum follow-up after delivery can be continued. The development of membranous VSA may be associated with a delayed partial or complete closure of the VSD (*Table 1*).

The prognosis of membranous and muscular VSAs is excellent when not complicated with other intracardiac malformations. Although rare, VSA is usually found through echocardiography, which can also determine whether it is combined with other malformations. Prenatal fetal heart examination, as a fetal heart screening imaging method, can accurately identify heart-related malformations; STIC can be more stereoscopic, intuitively display vascular

Table 1 Key points of differentiation between ventricular septal aneurysm and ventricular septal diverticulum

Feature	Disease	
	VSA	Ventricular septal diverticulum
Form	Width of base	Narrow base
Ventricular wall relationship	Local bulge	Defect
Relationship of movement	Synchronous	Dyssynchrony, or disorder
Histologic layers	Disorganized or absent myocardium with fibrosis	All 3 layers present

VSA, ventricular septal aneurysm.

conformation, and enable an early accurate diagnosis (5). Prenatal fetal cardiac examination can be an essential imaging method for diagnosing VSAs. The distinction between ventricular septal and Valsalva aneurysms is crucial (6). VSA is often mistaken for an aneurysm of the right sinus of Valsalva aneurysm on echocardiography and is usually detected incidentally before surgery for aortic valve disease; Valsalva aneurysms are rare and most often occur in the right coronary artery or non-coronary sinus; they may be congenital or acquired through infection, trauma, or degenerative disease. They are usually associated with other cardiac abnormalities, particularly VSDs and aortic valve dysfunction (7,8).

Conclusions

The membranous septal aneurysm is a rare condition almost always found incidentally on echocardiography and can be mistaken for an aneurysm of the right Valsalva sinus. However, in some cases, it can cause arrhythmias or hemodynamic complications, such as RVOT obstruction, VSD, and valvular insufficiency. Accurate diagnosis is essential for treatment. Therefore, prenatal fetal cardiac examination is the preferred screening method for fetal congenital heart disease, which can dynamically observe the intracardiac structure and hemodynamic changes in real-time. Combined with STIC, the spatial conformation of the heart structure can be displayed more stereoscopically, and the fetal heart can be evaluated more accurately. Multimodal imaging enables more accurate diagnosis, further providing more critical information for clinical practice.

Limitations

Due to the lack of prognosis and postnatal imaging data, the evaluation of prognostic effects is insufficient.

Acknowledgments

Funding: None.

Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://qims.amegroups.com/article/view/10.21037/qims-24-145/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 committees and with the Helsinki Declaration (as revised in 2013). The study was approved by the Medical Ethics Committee of Gansu Provincial Maternity and Child-care Hospital under the approval number (2023) GSFY[65]. Written informed consent was provided by the patient for publication of this article and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

References

1. Pipitone S, Sperandeo V, Mongiovi M, Roberto G, Centineo G. Prenatal diagnosis of ventricular aneurysm: a report of two cases and a review. Prenat Diagn 2002;22:131-6.
2. Cavalla F, Cipriani A. Congenital left ventricular aneurysm of interventricular septum: prenatal diagnosis and long-term management. Cardiol Young 2022;32:2036-7.
3. Nguyen TP, Srivastava S, Ko HH, Lai WW. Congenital muscular ventricular septal aneurysm: report of four cases and review of the literature. Pediatr Cardiol 2008;29:40-4.
4. Sherman SJ, Leenhouts KH, Utter GO, Litaker M, Lawson P. Prenatal diagnosis of left ventricular aneurysm in the late second trimester: a case report. Ultrasound Obstet Gynecol 1996;7:456-7.
5. Carr M, Kearney DL, Eidem BW. Congenital aneurysm of the muscular interventricular septum. J Am Soc Echocardiogr 2008;21:1282.e1-6.
6. Assaf A, Berry R, Mantha Y, Zughaib M, Saba S. Isolated Ventricular Septal Aneurysm: A Differential Diagnosis for a Right Sinus of Valsalva Aneurysm. Am J Case Rep 2021;22:e930930.
7. Pastor A, Rey M, Farré J. Sinus of valsalva aneurysm. Rev Esp Cardiol 2011;64:150.
8. Ott DA. Aneurysm of the sinus of valsalva. Semin Thorac Cardiovasc Surg Pediatr Card Surg Annu 2006;165-76.

Cite this article as: Ma B, Wang Y, Lan Q, Zhang D, Li T, Nie F. Prenatal diagnosis of the ventricular septal aneurysm using HDlive flow with spatiotemporal image correlation. Quant Imaging Med Surg 2024;14(12):9841-9844. doi: 10.21037/qims-24-145