

Severe tortuous intra-abdominal segment of isolated single umbilical artery by three-dimensional high-definition flow imaging

J.C. Han¹, M. Hornick², H.S. Ko³, X. Yang¹, Y.H. He¹

¹ Department of Ultrasound, Beijing Anzhen Hospital, Capital Medical University;
Beijing Key Laboratory of Maternal-Fetus Medicine in Fetal Heart Disease, Beijing (People's Republic of China)

² Department of Surgery, Hospital of the University of Pennsylvania, Philadelphia, PA (USA)

³ Department of Obstetrics and Gynecology, College of Medicine, Catholic University, Seoul (Korea)

Summary

The authors report a tortuous intra-abdominal segment of isolated single umbilical artery (SUA) that proved to be an omega-shaped variant by three-dimensional high-definition-flow (3D-HD-flow) imaging. A 28-year-old woman was referred to the present center for detailed fetal echocardiography examination after finding SUA during routine two-dimensional ultrasound examination at 24⁺³ weeks' gestation. 3D-HD-flow demonstrated a severely tortuous and dilated intra-abdominal segment of SUA mimicking omega-shaped variant. Postnatal abdominal ultrasound and cardiac examination were unremarkable. This case suggests that the omega-shaped variant of SUA is probably a normal variant when unassociated with other structural anomalies. When a locally dilated umbilical artery is detected during routine 2D ultrasound, the authors recommend using 3D color Doppler imaging to more precisely determine the course of the umbilical artery.

Key words: Fetus; Ultrasound; Single umbilical artery; Three-dimensional imaging; High-definition flow.

Introduction

Three-dimensional (3D) imaging in conjunction with high-definition flow (HD-flow) can be used to complement two-dimensional (2D) ultrasound examination in prenatal diagnosis [1]. The authors observed a tortuous intra-abdominal segment of isolated single umbilical artery (SUA) that proved to be an omega-shaped variant by 3D-HD-flow.

Case Report

A 28-year-old woman was referred to the present center for detailed fetal echocardiography examination after finding SUA during routine 2D ultrasound examination at 24⁺³ weeks' gestation. No additional abnormalities were detected. Nuchal translucency was 1.6 mm and screening for Town syndrome was low risk at 12⁺² weeks' gestation. There were no abnormal findings on fetal echocardiography. However, using HD-flow imaging in conjunction with 2D ultrasound, the authors found a tortuous intra-abdominal segment of left SUA (Figures 1A-B). 3D imaging with HD-flow demonstrated a severely tortuous and dilated intra-abdominal segment of SUA mimicking omega-shaped variant (Figure 1C). Ultimately this fetus was delivered vaginally at 39⁺² weeks' gestation. Physical examination at time of delivery was normal. Apgar score at one and five minutes was 8 and 9, respectively. Birth weight was 3,200 grams. Postnatal abdominal ultrasound and cardiac examination were unremarkable.

Discussion

The incidence of SUA varies from 0.08% to 1.9% [2] and 33% of fetuses with SUA have additional structural anomalies [3], and 10% of cases are associated with aneuploidy [4, 5]. In a large series, the incidence of chromosomal anomalies associated with SUA was 0% in the isolated SUA group, 3.7% in those with one additional defect, and 50.7% in those with multiple defects [3]. In a meta-analysis, there was no evidence that fetuses with isolated SUA have an increased risk for aneuploidy [4].

The present case demonstrated an isolated SUA with a dilated and tortuous intra-abdominal segment, likely an omega-shaped variant. Shen *et al.* [6, 7], who first reported an omega-shaped SUA and considered this variant to be more common in patients with a SUA than in those with two umbilical arteries.

The present authors postulate two potential explanations for the dilated omega-shaped segment in this case. From a hemodynamic standpoint, turbulent flow within the omega-shaped segment may lead to local dilation of the involved vessel, despite normal flow velocity. Additionally, just as single umbilical artery is a developmental defect, congenital abnormalities could result in local vascular dysplasia in the artery and predispose to vessel dilation.

The present case suggests that the omega-shaped variant

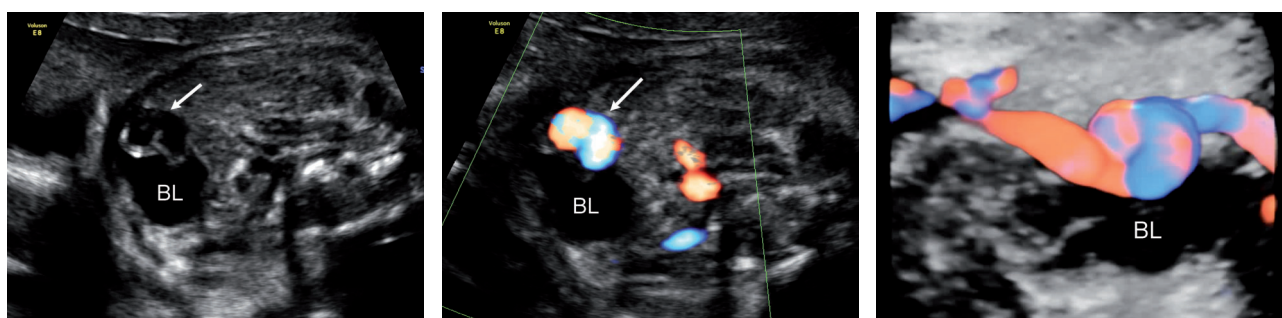


Figure 1. — Tortuous intra-abdominal segment of isolated single umbilical artery. A) Axial section of left SUA on two-dimensional ultrasound. U-shape of SUA is found along left side of bladder (arrow). BL: bladder. B) Two-dimensional high-definition flow imaging of left SUA. Opposite flow direction is found in the U-shape of SUA (arrow). BL: bladder. C) Three-dimensional high-definition flow imaging of left SUA. The dilated and tortuous SUA (omega sign) is noted. BL: bladder.

of SUA is probably a normal variant when unassociated with other structural anomalies [1]. 3D-HD-Flow can be used to complement 2D ultrasound for optimizing visualization of the abnormal intra-abdominal SUA. When a locally dilated umbilical artery is detected during routine 2D ultrasound, the authors recommend using 3D color Doppler imaging to more precisely determine the course of the umbilical artery.

References

- [1] Rodriguez N., Angarita A.M., Casasbuenas A., Sarmiento A.: "Three-dimensional high-definition flow imaging in prenatal diagnosis of a true umbilical cord knot". *Ultrasound Obstet Gynecol.*, 2012, 39, 245.
- [2] Tasha I., Brook R., Frasure H., Lazebnik N.: "Prenatal detection of cardiac anomalies in fetuses with single umbilical artery: Diagnostic accuracy comparison of maternal-fetal-medicine and pediatric cardiologist". *J. Pregnancy*, 2014, 2014, 265421.
- [3] Dagklis T., Defigueiredo D., Staboulidou I., Casagrandi D., Nicolaides K.H.: "Isolated single umbilical artery and fetal karyotype". *Ultrasound Obstet. Gynecol.*, 2010, 36, 291.
- [4] Voskamp B.J., Fleurke-Rozema H., Oude-Rengerink K., Snijders R.J., Bilardo C.M., Mol B.W., Pajkrt E.: "Relationship of isolated single umbilical artery to fetal growth, aneuploidy and perinatal mortality: Systematic review and meta-analysis". *Ultrasound Obstet. Gynecol.*, 2013, 42, 622.
- [5] Granese R., Coco C., Jeanty P.: "The value of single umbilical artery in the prediction of fetal aneuploidy: Findings in 12,672 pregnant women". *Ultrasound Q.*, 2007, 23, 117.
- [6] Shen O., Rabinowitz R., Yagel S., Avnet H.: "Omega-shaped anomaly of the umbilical artery: Association with chromosome 18q deletion". *J. Ultrasound. Med.*, 2011, 30, 581.
- [7] Shen O., Rabinowitz R., Malinger G., Mazaki E., Tsafirir A.: "Omega-shaped variant of the umbilical artery: Prenatal diagnosis and outcome". *J. Ultrasound. Med.*, 2013, 32, 541.

Corresponding Author:
Y.H. HE, M.D.
Department of Ultrasound
Beijing Anzhen Hospital
No.2, Anzhenli, Chaoyang District
Beijing 100029 (China)
e-mail: heyihuaecho@hotmail.com