Ultrasound Obstet Gynecol 2012; **40**: 370–372
Published online in Wiley Online Library (wileyonlinelibrary.com).

Letters to the Editor

Coronal view as a complementary ultrasound approach for prenatal diagnosis of aberrant right subclavian artery

Aberrant right subclavian artery (ARSA) is associated with chromosomal abnormalities, mainly Down syndrome, and congenital heart disease[1–5]. ARSA is caused by abnormal regression of the primitive right aortic arch between the right subclavian artery and the right common carotid artery. As a result, the aortic arch branches into four arteries instead of three, and the ARSA originates distal to the left subclavian artery at the level of the aortic isthmus. ARSA follows an oblique course behind the trachea and esophagus to reach the right arm.

In 2005, Chaoui *et al.*[2] described the methodology for assessment of fetal ARSA in the transverse three vessels and trachea view, in which the anomalous origin of ARSA, close to the ductus arteriosus, and its retrotracheal course can be visualized (Figures 1a and c). This group subsequently showed how to visualize fetal ARSA in a longitudinal view[6], in which the artery arises as a fourth and distal vessel from the aortic arch; however, in this view the retrotracheal course is not identifiable. As Quarello and Carvalho[7] remarked, although several anatomical variations can manifest as an aortic arch with four vessels in the longitudinal view, in cases in which ARSA originates anteriorly from the aortic arch, visualization of four supra-aortic vessels is not possible.

We illustrate how this vessel can be visualized in the coronal plane. In order to assess ARSA, we obtain a coronal view of the fetal thorax, posterior to the trachea and anterior to the spine, until we are able to see the thoracic descending aorta. Highly sensitive color Doppler with a low velocity range (10–15 cm/s) shows ARSA as a vessel arising from the descending aorta at the level of the aortic isthmus and following an S-shaped course towards the right clavicle and shoulder (Figures 1b and c). This view has the advantage of providing visualization of the origin and course of the anomalous artery in the same plane. This view can also facilitate evaluation in cases in which the origin of ARSA is not in its most common position, such as ARSA originating anteriorly from the aortic arch or very distal to the left subclavian artery. It is important not to confuse ARSA with the azygos vein and its anastomosis with the superior vena cava. In the coronal view, the azygos vein courses parallel to the right side of the aorta, while ARSA arises from the aorta and follows an oblique course to reach the right arm. Pulsed Doppler interrogation is recommended to distinguish ARSA from the azygos vein in this region.

In summary, fetal ARSA can be viewed in the coronal plane using ultrasonography. This approach shows both the anomalous origin of the artery and its S-shaped course to the right shoulder. Although the detection of ARSA is possible in a coronal view, it should be confirmed in the three vessels and trachea view.

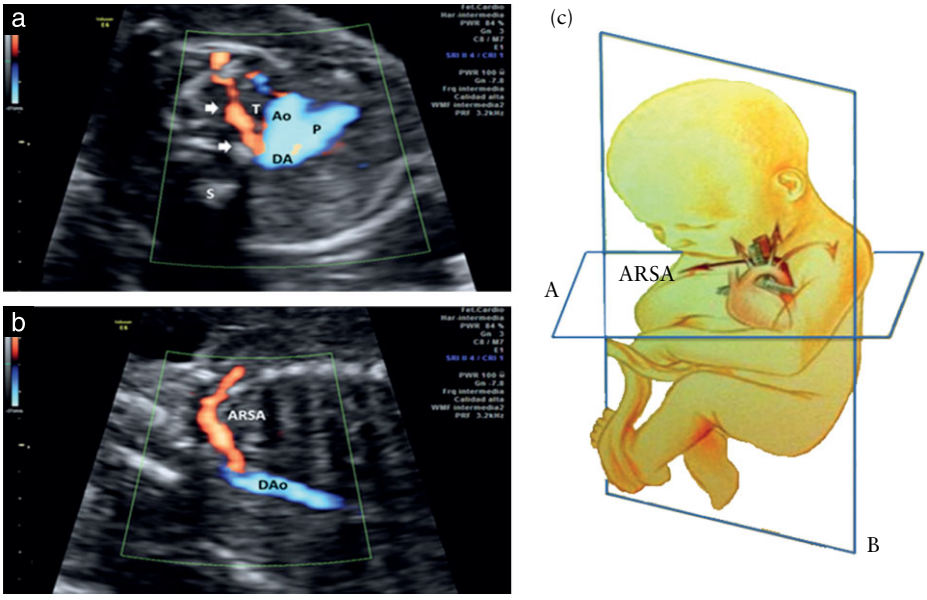

Figure 1 (a,b) Color Doppler ultrasound images of fetal aberrant right subclavian artery (ARSA) at 20 weeks' gestation. (a) Transverse view showing ARSA in the three vessels and trachea plane with its origin at the level of the aortic isthmus and with a retrotracheal course (arrows). (b) Coronal view showing ARSA arising from the aorta with an oblique course towards the right shoulder. (c) Schematic representation of the transverse (A) and coronal (B) planes in a fetus at the level of the ARSA. Ao, aorta; DA, ductus arteriosus; DAo, descending aorta; P, pulmonary artery; S, spine; T, trachea.

J. De León-Luis*, C. Bravo, F. Gámez and L. Ortiz-Quintana
Fetal Medicine Unit, Department of Obstetrics and Gynecology, Hospital General Universitario Gregorio Marañón, Calle O'Donnell, 48. 28009 Madrid, Spain
**Correspondence. (e-mail: jdeleonluis@yahoo.es)*
DOI: 10.1002/uog.11094

Acknowledgments

This work was supported by Fondo de Investigaciones Sanitarias (FIS# PI081712 and BA#09/90011). The authors are grateful to Mr David De León for assistance with graphics and to Mr Thomas O'Boyle for editorial assistance.

References

1. Borenstein M, Minekawa R, Zidere V, Nicolaides KH, Allan LD. Aberrant right subclavian artery at 16 to 23 + 6 weeks of gestation: a marker for chromosomal abnormality. *Ultrasound Obstet Gynecol* 2010; **36**: 548–552.
2. Chaoui R, Heling KS, Sarioglu N, Schwabe M, Dankof A, Bollmann R. Aberrant right subclavian artery as a new cardiac sign in second- and third-trimester fetuses with Down syndrome. *Am J Obstet Gynecol* 2005; **192**: 257–263.
3. Paladini D, Sglavo G, Pastore G, Masucci A, D'Armiento MR, Nappi C. Aberrant right subclavian artery: incidence and correlation with other markers of Down syndrome in second-trimester fetuses. *Ultrasound Obstet Gynecol* 2012; **39**: 191–195.
4. Willruth AM, Dwinger N, Ritgen J, Stressig R, Geipel A, Gembruch U, Berg C. Fetal Aberrant Right Subclavian Artery (ARSA) – a Potential New Soft Marker in the Genetic Scan? *Ultraschall Med* 2011; DOI 10.1055/s-0029-1245935.
5. Zapata H, Edwards JE, Titus JL. Aberrant right subclavian artery with left aortic arch: associated cardiac anomalies. *Pediatr Cardiol* 1993; **14**: 159–161.
6. Chaoui R, Rake A, Heling KS. Aortic arch with four vessels: aberrant right subclavian artery. *Ultrasound Obstet Gynecol* 2008; **31**: 115–117.
7. Quarello E, Carvalho JS. Prenatal diagnosis of an aberrant right subclavian artery: four vessels arising from the aortic arch? *Ultrasound Obstet Gynecol* 2009; **33**: 492–493; author reply 493–494.

Effect of arterioarterial anastomosis on early-onset umbilical artery flow abnormality in a monochorionic–diamniotic twin

Absent or reversed end-diastolic velocity (A/REDV) in the umbilical artery (UA) waveform, representing increased downstream resistance, is associated with fetal deterioration[1]. In monochorionic–diamniotic (MCDA) twins, retrograde transmission of pressure changes from an arterioarterial anastomosis (AAA) sometimes leads to a characteristic intermittent fluctuating A/REDV in the UA waveform. These transmitted patterns, as previously reported[2,3], are usually only present in discordant or selective intrauterine growth-restricted (IUGR) twins and tend to be associated with a worse pregnancy outcome. We report here a case with this characteristic UA waveform detected from as early as 22 weeks' gestation in a pregnancy that resulted in two appropriately grown infants.

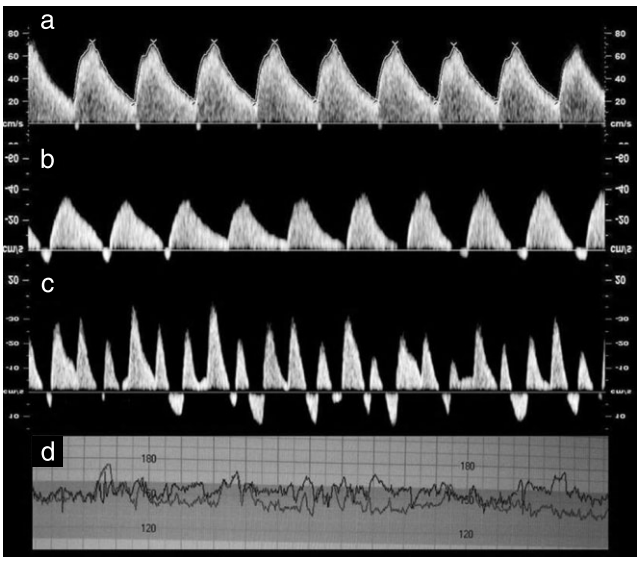

Figure 1 (a,b) Pulsed Doppler at 22 weeks' gestation showed differences in the umbilical artery waveforms of the twins: positive end-diastolic velocity in the larger twin (a) and intermittent fluctuating absent or reversed end-diastolic velocity (A/REDV) in the smaller twin (b). (c,d) Intermittent fluctuating A/REDV had become more frequent at 32 weeks' gestation (c); however, non-stress test showed reassuring fetal heart beat tracing in both twins (d).

A healthy 33-year-old woman, gravida 2 para 0, was referred to our hospital at 22 weeks' gestation with a spontaneously conceived MCDA twin pregnancy. Pulsed Doppler revealed positive UA end-diastolic velocity in the larger twin (Figure 1a) but intermittent A/REDV in the smaller one (Figure 1b). Twin–twin transfusion syndrome (TTTS) was excluded given the evidence of adequate amniotic pockets and visible bladder in both twins. Increased frequency of fluctuating UA-A/REDV in the smaller twin was noted during serial follow-up (Figure 1c). However, non-stress test showed reassuring fetal heart beat tracing in both twins (Figure 1d). In addition, a large AAA with a net flow mostly towards the smaller twin resulting from unequal placental sharing was clearly identified at 32 weeks' gestation (Figure 2a). The magnitude of the intertwin blood exchange allowed the larger twin to support proper growth of the smaller one without fetal growth restriction. The woman delivered at 34 weeks' gestation due to preterm uterine contractions. The larger twin was a 2046-g (50th percentile) girl with Apgar scores of 8 and 9 at 1 and 5 min, respectively, while the smaller twin was a 1726-g (10–25th percentile) girl with Apgar scores of 6 and 9, respectively (growth difference: 15.6%). The presence of intertwin transfusion was evident from the discordance in hemoglobin concentration (15.8 g/dL *vs* 18.8 g/dL). Placental examination confirmed monochorionicity with

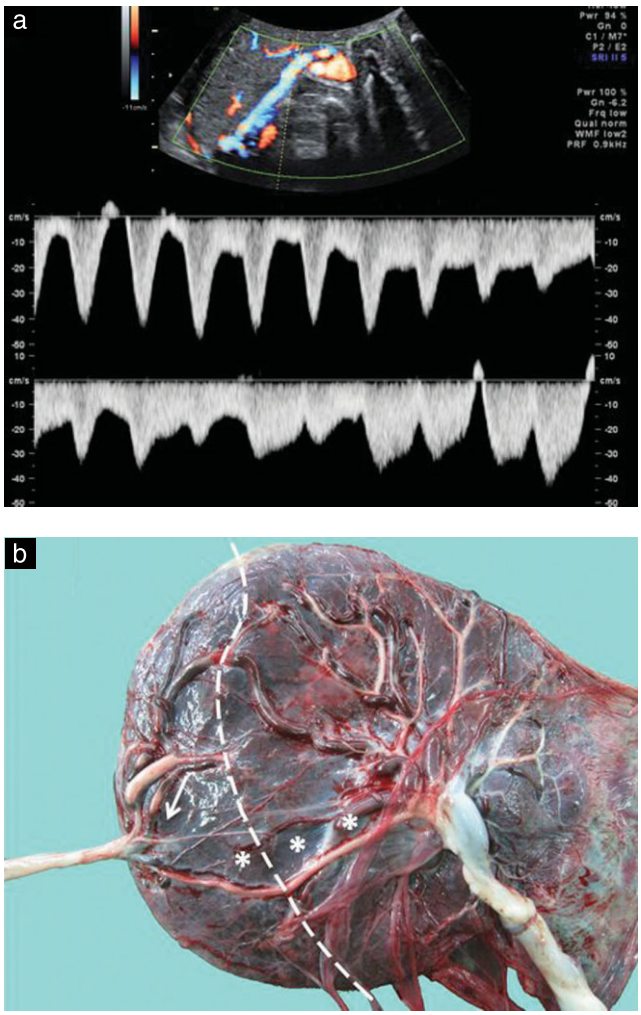

Figure 2 (a) Doppler of the large arterioarterial anastomosis (AAA) with net flow mostly towards the smaller twin was clearly identified at 32 weeks' gestation, showing the pressure difference resulting from unequal placental sharing. (b) Placenta of the monochorionic–diamniotic twins showing the three characteristic findings: (1) unequal placental sharing (indicated by dashed line: left side of placenta belongs to smaller twin and right side to larger twin); (2) marginal cord insertion of smaller twin (arrow); and (3) a large arterioarterial anastomosis (*), identified by milk injection.

unequal placental sharing and one superficial, large AAA, as demonstrated by milk injection (Figure 2b). However, placental arteriovenous anastomoses could not be identified. Transcranial ultrasound examination of both twins was normal and the further neonatal course was uneventful.

The AAA waveform is the sum of two amniotic UA waveforms that fluctuate in and out of synchronicity due to the difference in placental sharing. The bidirectional nature of the AAA waveform enables two protective roles: (1) prevention of development of TTTS by compensating the circulatory imbalance[4]; and (2) avoidance of discordance of ductus venosus (DV) and UA Doppler parameters[5]. The size of an AAA also has serious clinical implications. Small AAA may not be sufficient to prevent IUGR from developing in the smaller twin, but too large an AAA may give rise to twin anemia–polycythemia sequence[6,7]. One should be cautious in the early diagnosis of chronic A/REDV in MCDA twins. Early delivery increases preterm morbidity and mortality. Other indices of fetal wellbeing, such as amniotic fluid volume, DV flow, middle cerebral artery pulsatility index and nonstress test, should be used as guidance for management planning.

T. H. Lin†, C. H. Lin†, J. C. Shih†, Y. N. Su‡, E. T. Wu† and C. N. Lee*†
†*Obstetrics and Gynecology, National Taiwan University Hospital, Taipei, Taiwan*; ‡*Medical Genetics, National Taiwan University Hospital, Taipei, Taiwan*
**Correspondence.*
(e-mail: leecn@ntu.edu.tw)
DOI: 10.1002/uog.11111

References

1. Kingdom J, Huppertz B, Seaward G, Kaufmann P. Development of the placental villous tree and its consequences for fetal growth. *Eur J Obstet Gynecol Reprod Biol* 2000; **92**: 35–43.
2. Wee LY, Taylor MJ, Vanderheyden T, Talbert D, Fisk NM. Transmitted arterio-arterial anastomosis waveforms causing cyclically intermittent absent/reversed end-diastolic umbilical artery flow in monochorionic twins. *Placenta* 2003; **24**: 772–778.
3. Gratacós E, Lewi L, Muñoz B, Acosta-Rojas R, Hernandez-Andrade E, Martinez JM, Carreras E, Deprest J. A classification system for selective intrauterine growth restriction in monochorionic pregnancies according to umbilical artery Doppler flow in the smaller twin. *Ultrasound Obstet Gynecol* 2007; **30**: 28–34.
4. van Meir H, Slaghekke F, Lopriore E, van Wijngaarden WJ. Arterio-arterial anastomoses do not prevent the development of twin anemia-polycythemia sequence. *Placenta* 2010; **31**: 163–165.
5. Baschat AA, Harman CR. Discordance of arterial and venous flow velocity waveforms in severe placenta-based fetal growth restriction. *Ultrasound Obstet Gynecol* 2011; **37**: 369–370.
6. Lewi L, Cannie M, Blickstein I, Jani J, Huber A, Hecher K, Dymarkowski S, Gratacos E, Lewi P, Deprest J. Placental sharing, birthweight discordance, and vascular anastomoses in monochorionic diamniotic twin placentas. *Am J Obstet Gynecol* 2007; **197**: 587.e581–e588.
7. Suzuki S. Twin anemia-polycythemia sequence with placental arterio-arterial anastomoses. *Placenta* 2010; **31**: 652.