






Doppler Evaluation of Umbilical Arteries for Fetal Distress Assessment: Discrepant Results Can Be Obtained from Both Arteries

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ABSTRACT Umbilical artery Doppler evaluation is very important in diagnosing intrauterine fetal distress. During a Doppler assessment of umbilical arteries, occasionally one of the arteries shows normal indices while the other exhibits abnormal values at the exam session. Here, we are presenting a case with one umbilical artery exhibiting normal and the other umbilical artery exhibiting abnormal Doppler indices initially, who later had a cesarean delivery at 29 weeks of gestation due to abnormal umbilical artery Doppler indices and fetal distress. After delivery, the assessment of the umbilical cord revealed two arteries and one vein; one of the arteries was macroscopically nodular, the other was normal in appearance. Also, a pathological examination of the umbilical cord revealed that the diameter of one umbilical artery was smaller than the other. We aimed to discuss the divergent results in both umbilical arteries by means of Doppler values and the histological findings.

Keywords: Umbilical artery Doppler; fetal distress; umbilical artery diameter

The umbilical artery is the vessel that has been studied the most ever since Doppler technology was first introduced into the field of obstetrics.¹ Today, umbilical artery Doppler assessment is routinely used in the management of certain types of high-risk pregnancies. Fetuses with intrauterine growth retardation and those affected by preeclampsia, increased the pulsatility index and the resistive index can be seen during the Doppler assessment of umbilical arteries due to decreased end-diastolic flow.²

The umbilical artery is the longest vessel structure in a fetus and Doppler blood flow rate patterns change along the umbilical cord.³ Obtained waveforms are different near the placental insertion site compared with the fetal site.⁴ Studies have published

reference values for sectional measurements at the placental site, and longitudinal measurements at the fetal site.^{3,5} Even though Doppler indices are found to show higher values close to the fetus, these differences are clinically insignificant in normal pregnancies and waveforms do not need to be assessed at the same level along the cord. However, these umbilical artery blood flow pattern changes become more prominent in fetuses with growth retardation.⁶

Here we present a case with normal Doppler indices in one of the umbilical arteries but increased S/D in the other artery, which progressed to absent end-diastolic flow in later gestational weeks, resulting in cesarean delivery at the 29th gestational week due to fetal distress.

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CASE REPORT

A thirty-three year old, G3P1011 woman at her 26th week of gestation was referred to the Obstetrics Clinic of Adnan Menderes University Faculty of Medicine. Informed consent was obtained for the publication of the case. Her history was significant in terms of a previous cesarean delivery at term, a normal first trimester combined test result, 100 mg daily salicylic acid (Coraspin 100 mg, Bayer Turkish Chemicals Industry, İstanbul, Turkey) usage for diastolic notches on bilateral uterine arteries observed at her 20th week scan, and an abnormal 100 g oral glucose test result leading to a gestational diabetes diagnosis with a referral to the endocrinology clinic. Insulin treatment was started for high blood glucose levels besides a low carbohydrate diet and exercise. A Doppler ultrasound study at her 25th week of gestation revealed normal umbilical artery indices but bilateral notches and increased resistance in uterine arteries. A repeat umbilical Doppler ultrasound evaluation performed fifteen days later revealed an increased S/D ratio (3.46) in one of the umbilical arteries and normal S/D in the other umbilical artery. One week later, the S/D ratio was 3.63 in one of the umbilical arteries while 3.12 in the other. In addition, the pulsatility index of the middle cerebral artery was 1.28 and the S/D ratio was 3.67. A course of betamethasone (12 mg IM, daily for 48 hours; Celestone Chronodose, Schering-Eczacıbaşı, Lüleburgaz, Turkey) was administered for fetal lung maturity. On the patient's follow-up exam in three days, absent end-diastolic flow was found in one of the umbilical arteries (S/D ratio 7.67) and a 3.45 S/D ratio on the other (Figure 1). Three days later, due to fetal distress findings on the non-stress test and decreased fetal movements, a cesarean delivery was performed. A 1,100 g female baby was born with the respective Apgar scores of 7 and 8 at the 1st and 5th minutes. The newborn was monitored in an incubator for 42 days in the neonatal intensive care unit. After the operation, a macroscopic evaluation of the placenta revealed that one of the two umbilical arteries was nodular in appearance with interrupted blood flow (Figure 2). Moreover, a pathological light microscopic examination of the umbilical cord revealed that the diameter of

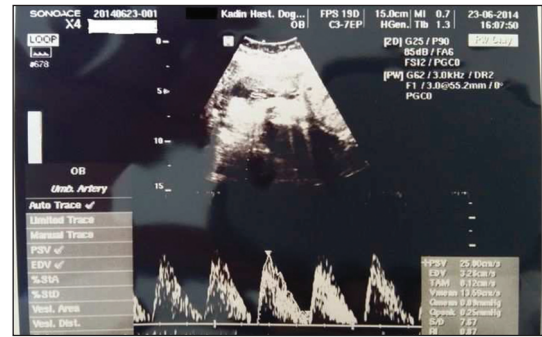


FIGURE 1: Absent end-diastolic flow on one of the umbilical arteries.



FIGURE 2: One of the two umbilical arteries was nodular in appearance with interrupted blood flow.

one of the umbilical arteries was smaller than the other. (243x99 μm vs 531x281 μm) (Figure 3).

DISCUSSION

Here, we presented a case with two umbilical arteries where the Doppler waveforms observed were significantly different from each other. To the best of our knowledge in the literature, there is only one study regarding Doppler measurements in both umbilical arteries. In eighty patients with gestational ages between 20 and 40 weeks, Predanic et al. evaluated both umbilical arteries in each case by measuring at the same transverse section level and found these to have different S/D ratios.⁷ This difference was more prominent in the early gestational weeks and tended to decrease with advancing gestational age. The researchers speculated that Hyrtl anastomosis was causing this condition. The anastomosis is found on the placental side of the umbilical cord, helping to balance blood flow and pressure between the two um-

bilical arteries.⁸ They therefore suggested that a difference in Doppler indices between two umbilical arteries in the same patient at advanced gestational ages could be an early sign of fetal hypoxia and fetal distress.

To be able to obtain Doppler measurements of each of two umbilical arteries, they first need to be discerned. It is relatively easier to do this on the intra-abdominal segment of the cord than on the rest.⁷ It is known that the diameters of the umbilical cord and artery change as they get closer to the placental insertion site due to increased bifurcations. Therefore it is difficult to discern each of the umbilical arteries by their diameters and knowledge about accurate measurement techniques for these coiled and pulsatile vessels is limited.⁹

The umbilical coiling index may be another approach to differentiate two umbilical arteries; this is calculated as one divided by the distance between sequential coils in centimeters.^{1,10} In a study where the distance between two coils on the umbilical artery was measured and the coiling index calculated, it was speculated that this approach required experience and for this reason results could be subjective.¹¹

Umbilical arteries can be examined histopathologically in an attempt to differentiate between the two. In the literature, there are studies using scanning electron microscopy and corrosion techniques to investigate placental vascular morphology and three-



FIGURE 3: The light microscopic examination of umbilical cord revealed that the diameter of one of the umbilical arteries was smaller than the other (243x99 μm vs 531x281 μm) (H&E,x100).

dimensional microscopic/morphologic remodeling.¹² In their study, Baykal et al. examined the placentas of pregnant women with intrauterine growth retardation and found thinner, more branched and tortuous umbilical arteries.¹³ In our case, the pathological electron microscopic examination of the umbilical cord revealed that the diameter of one of the umbilical arteries was smaller than the other.

In conclusion, abnormal Doppler findings on one of the two umbilical arteries were found in this case, supporting an early sign of fetal distress in accordance with the literature. The important point was the ability to differentiate the two umbilical arteries from each other during the Doppler evaluation. According to available data, it seems like measuring both arteries separately in the same window is more accurate; however, the value of measuring the diameters of each artery and/or using the umbilical artery coiling index to differentiate the two arteries from each other is not clear. It is evident that we need better planned, adequately powered randomized clinical trials, conducted with a multidisciplinary approach, encompassing detailed pathological and radiological assessments, to enable the clarification of the uncertainties of this topic.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: Selda Demircan Sezer; **Design:** Selda Demircan Sezer, Sümevra Nergiz Avcioğlu; **Control/Supervision:** Hasan Yüksel, Sündüz Özlem Altinkaya; **Data Collection and/or Processing:** Hasan Yüksel, Sündüz Özlem Altinkaya; **Analysis and/or Interpretation:** Selda Demircan Sezer, Sümevra Nergiz Avcioğlu; **Literature Review:** Sümevra Nergiz Avcioğlu; **Writing the Article:** Selda Demircan Sezer, Sümevra Nergiz Avcioğlu; **Critical Review:** Hasan Yüksel, Sündüz Özlem Altinkaya, Emre Zafer.

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