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Single umbilical artery: Prevalence and clinical significance in prenatal sonography

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Abstract

Objective: To estimate the prevalence of single umbilical artery (SUA) in an Iranian population and to determine the absent side and its association with malformations. **Methods:** We prospectively studied 3240 singleton pregnancies of 14 to 30 weeks of gestational age with USG. The absent side, pregnancy data, and the perinatal outcome were reviewed. **Results:** SUA occurred in 1.1% of pregnancies. The artery was absent on the left side in 27 (71.1%). Nine of those with SUA had malformations (24%) and there were three deaths. The average stage of pregnancy at which SUA was diagnosed was at 27 weeks and 2 days. 20 fetuses were male. **Conclusion:** The prevalence of SUA and associated anomalies in our population seems to be similar to that reported in other countries. Absence of the left artery was more common. Evaluating cord vessels at the 20th week of pregnancy is valuable and fetuses with an isolated SUA will benefit from a more detailed assessment and USG monitoring.

Key words: Congenital malformation; prenatal diagnosis; single umbilical artery; ultrasound.

The correct monitoring of both low- and high-risk pregnancies includes USG scans as part of normal practice. Routine USG in early pregnancy appears to provide a better outcome, enabling the perinatal mortality rate to be lowered.[1] However, the benefits for other substantive outcomes are less clear.

The absence of one umbilical artery, defined as a single umbilical artery (SUA), is found in 0.2–1.9% of deliveries.[2,3] A number of studies have reported that the presence of SUA may be related to a variety of congenital anomalies of the major organ systems as well as to chromosomal defects, aneuploidy, preterm delivery, and low birth weight. Incidence estimates from various populations (which may suffer from selection biases) range from 0.2–0.87%, with an associated anomaly rate reported to be as high as 67%.[4–6]

With the advent of color Doppler USG, umbilical arteries can be imaged in the amniotic cavity and in the fetal pelvis as they course around the bladder. Detection of SUA by USG is a potentially useful marker for suspecting an anomalous fetus. Routine USG does not include evaluation of the number of cord vessels. We believe that the investigation of perinatal results in fetuses diagnosed with SUA, during a routine USG study, would be of interest.

The aims of our study were to estimate the incidence of SUA in the Iranian population, the location of the SUA, the clinical significance of SUA in our population, and to examine if a possible correlation exists between SUA and its location and the occurrence of other congenital malformations and the eventual outcome.

Materials and Methods

In this prospective study, we studied all pregnant women (3240 singleton pregnancies) referred for a second trimester USG scan to our department. All studies were performed by the same radiologist.

USG was performed using a 3.5 MHz convex transducer, (EUB-525 Hitachi, Japan). SUA was suspected when only two vessels (one artery and one vein) were seen in a cross-sectional view of the umbilical cord. Color-flow imaging of the cord insertion and the hypogastric artery was performed in all patients. The absent side was documented. Data on postnatal follow-up were obtained.

The chi-square test was used to evaluate the association between qualitative variables and Fisher's exact test was also used where necessary. The quantitative variables were

Table 1: Laterality of single umbilical artery and detected malformations

	Absent Artery		Gender	Mother's Age
	Right	Left		
Anencephalus		1	Female	21
Ascites, pleural effusion, ventriculomegaly		1	Male	26
Club foot, Dextrocardia, plexus choroids cysts		1	Male	22
Lumbar myelomeningocele	1		Female	24
Unilateral kidney agenesis, ventricular septal defect		1	Male	24
Sever unilateral ureteropelvic junction obstruction		1	Male	24
Diaphragmatic hernia	1		Male	25
Ventriculomegaly and omphalocele	1		Female	26
Severe small for gestational age		1	Male	30

shown as means ± standard deviation. Student's t test was used to compare quantitative variables. When the variables did not follow a normal distribution the nonparametric Mann-Whitney U test was used. $P<0.05$ was taken as indicating statistical significance. The statistical analysis was carried out using SPSS for Windows.

Results

In this study, 38 cases of SUA were diagnosed, representing a prevalence of 1.1%. The umbilical artery was absent on the left side in 27 (71.1%) and on the right side in 11 (28.9%) fetuses. Figures 1 and 2 show color Doppler USG images of two fetuses: one where both umbilical arteries are present and the other in which the left umbilical artery is absent. The average stage of pregnancy at which SUA was diagnosed was 27 weeks and 2 days, although the earliest diagnosis was made at 16 weeks. The mean age of the pregnant mothers (± SD) was 27.3 ± 4.7.

42.1% of pregnancies with SUA were first pregnancies. Twenty fetuses were male and eighteen were female. Absence of the left artery was more common in male fetuses, but this was not statistically significant (P=0.011). The side of the absent artery did not correlate with the mother's age, number of previous pregnancies, or existence and type of anomaly.

At postnatal evaluation, nine infants with SUA had congenital malformations (24%) [Table 1]. Anomalies of the central nervous, cardiovascular, and genitourinary systems were more common. There were three deaths: the first, antenatally, at week 18 with ventriculomegaly, ascites, and pleural effusion; the second at week 24 with anencephalus; and the third, immediately after birth, due to severe growth retardation.

Discussion

An SUA is detectable as early as at 12 weeks of gestation,[7] but in routinely performed mid-trimester scans, only 30–67% of cases are identified.[3,8,9] USG diagnosis is best done with color Doppler imaging. The intrapelvic route of the umbilical arteries of the fetus is sought for, from around the fetal bladder to the anterior abdominal wall and then into the umbilical cord. Scanning the free loop of the cord in cross section, to see the number of vessels, is also useful.[10] In cases of SUA, the side of the absent artery can be identified according to the fetal position.[11]

The exact cause of SUA is unknown, but primary agenesis, secondary atrophy, and persistence of the only existing artery in the early stages of embryonic life are the three suggested mechanisms.[12] Atrophy is probably the most frequent mechanism. Absence of the left artery is more common.[7] The incidence of SUA has been reported to be as high as 5.9% in a prenatal study of fetuses at 11–14 weeks

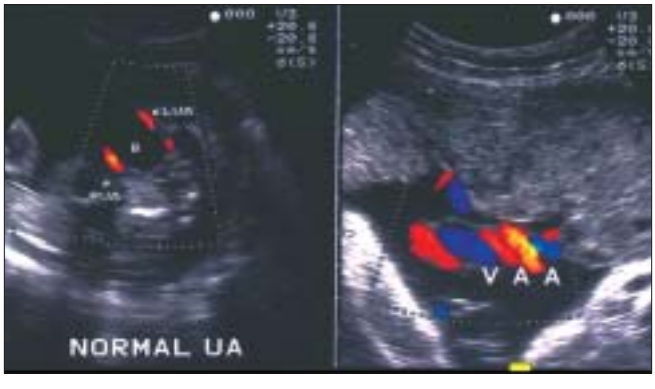

Figure 1: Color Doppler ultrasound in which both umbilical arteries are seen surrounding the fetal bladder

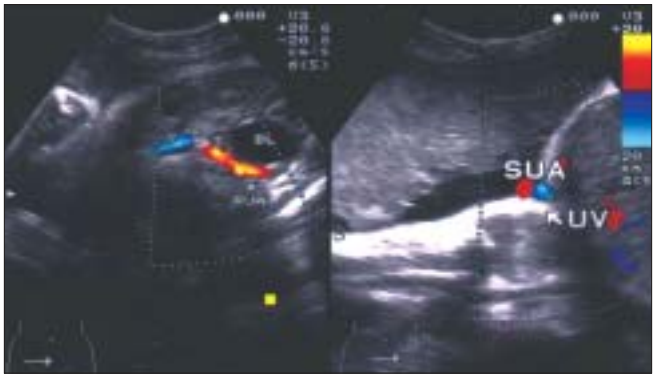

Figure 2: Color Doppler ultrasound of the umbilical cord in which only the right umbilical artery in seen

gestation.[13] The incidence ranges from 0.2–1.6% (euploid pregnancies) to 9–11% (aneuploid fetuses).[14] SUA is three to four times more frequent in twin pregnancies.

In our study, the incidence of SUA was 1.1 per 100 pregnancies. This is consistent with the available data from examination of the umbilical cord after delivery.[12] With USG, a false positive diagnosis to the extent of 0.1%[15] has been found, but this can be reduced with the use of color Doppler imaging and higher-resolution equipment. Moreover, our heterogeneous population included both low- and high-risk patients, ruling out an important bias.

More frequent absence of the umbilical artery on the left side was a finding similar to the results of Abuhamad et al.[16] (n = 77 cases) and Geipel *et al*.[7] (n = 102 cases), but in contrast to the studies by Blazer *et al*.[17] (n = 46 cases) and Fukada et al. (n = 10 cases),[18] who found no such difference.

SUA is associated with other fetal anomalies.[4,6,19,20] There is no specific pattern in the occurrence of malformations and it is not clear why this anomaly is linked to other fetal anomalies. The reported incidence of associated anomalies differs greatly[21] and may be influenced by ethnic, geographical, and socioeconomic factors. Our results indicate that 24% of fetuses with SUA at 16 weeks gestation or greater have a considerable concurrent anomalies.

There was no specific pattern of associated anomalies in our study, but there was a predominance of cardiovascular and urogenital anomalies. Our data show that the laterality of the SUA appears to be unrelated to the existence or the type of the malformations, as other authors[17] have noted.

Fetuses with SUA and associated malformations have a perinatal mortality that is six times greater than those with SUA but without associated malformations.[3] The reason for the poorer perinatal outcome and for the occurrence of other fetal anomalies in fetuses with SUA is not clear. The Doppler flow indices are reported to be similar to those of normal fetuses.[20] A wider pathological process in fetuses with SUA, which may affect the placenta, may explain the poorer perinatal outcome and increased need for abdominal delivery. All authors agree that if an SUA is found, a detailed USG must be carried out in order to detect associated fetal anomalies.[22] Repeated USG scans between 22 and 24 gestational weeks and monitoring by USG to detect possible alterations in fetal growth, even when no other associated malformations are found, are recommended.[23,24] An echocardiography may also be carried out and genetic studies done if associated anomalies are detected.[16]

In conclusion, according to our data it appears that evaluating cord vessels by USG during the 20th week of pregnancy is valuable and fetuses with SUA will benefit from a detailed assessment and USG monitoring.

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