Evaluation of Cases with Single Umbilical Artery

Murat Muhcu, Ercüment Müngen, Özgür Dündar, Serkan Bodur, Vedat Atay, Yusuf Ziya Yergök

Clinics of Gynecology and Obstetrics, GATA Haydarpaşa Training Hospital, İstanbul

Abstract

Objective: To define the diagnosis of fetuses with single umblical artery and define the accompanying anomalies and associated perinatal complications.

Methods: The records of the fetuses and newborns with single umbilical artery diagnosed within the last six years in our clinic were investigated retrospectively. The cases were compared according to demographical data and perinatal complications. The data obtained from retrospective research were analysed with SPSS software.

Results: We detected 26 fetuses and newborns with single umblical artery and the incidence was found to be 5.5 in 1000 deliveries. Chromosomal and structural anomalies were detected in six and two of the fetuses, respectively. The fetal weights of single umblical artery and control group were 3037±82 gr and 3294 ± 609.35 gr, respectively. The comparison of fetal weights of both groups showed a statistically significant difference ($p<0.05$). Single umbilical artery rate was found to be significantly higher in multiple pregnancies than singletons. The rates of preterm delivery, intrauterine growth restriction, oligohydramnios, fetal structural and chromosomal anomalies were found to be statistically higher in cases with single umbilical artery than control group.

Conclusion: The cases with single umbilical artery must be evaluated carefully in terms of structural and chromosomal anomalies. Also, the risk of preterm delivery and low birth weight must be remembered.

Keywords: Single umbilical artery, prenatal diagnosis, ultrasonography.

Tek umbilikal arter olgularının değerlendirilmesi

Amaç: Tek umbilikal arterli fetusların tanısı, eşlik eden anomaliler ve perinatal komplikasyonları tanımlamak.

Yöntem: Son 6 yıl içinde kliniğimizde saptanmış tek umbilikal arterli fetuslar ve yenidoğanlar retrospektif olarak tarandı. Vakalar demografik bulgular ve perinatal komplikasyonlar yönünden karşılaştırıldı. Araştırmadan elde edilen veriler, SPSS bilgisayar yazılım programı ile analiz edildi. Çalışmaya alınan hastaların demografik verilerini karşılaştırmada Mann-Whitney U testi kullanıldı, perinatal komplikasyonların karşılaştırılmasında Pearson chi-kare ve Fisher testi kullanıldı. P değeri 0.05'ten küçük bulunan sonuçlar anlamlı kabul edildi.

Bulgular: Yirmialtı tek umbilikal arterli fetus ve yenidoğan tespit ettik. İnsidansı 1000 doğumda 5.5 olarak bulduk. İki fetusda (%7.7) kromozomal anomali ve 6 (%23) fetusda yapısal anomali saptadık. Her iki grup fetal ağırlık açısından karşılaştırıldığında, tek umbilikal arter grubunda 3037.82 ± 503.69 gr, kontrol grubunda ise 3294 ± 609.35 gr olup, gruplar arasında istatistiksel olarak anlamlı bir fark vardı ($p<0.05$). Çoğul gebeliklerde tek umbilikal arter oranını daha yüksek olarak bulduk ($p < 0.05$). Kontrol grubu ile kıyaslandığında preterm doğum, IUGR, oligohidroamnios, fetal yapısal ve kromozamal anomali oranının tek umbilikal arteri olanlarda daha yüksek olduğunu bulduk ($p<0.05$).

Sonuç: Tek umblikal arterli olgular yapısal malformasyonlar ve kromozomal anomaliler yönünden dikkatlice araştırılmalı ve bu olgular erken doğum ve düşük doğum ağırlığı yönünden yakından izlenmelidir.

Anahtar Sözcükler: Tek umbilikal arter, prenatal tanı, ultrasonografi

Correspondence: Dr. Özgür Dündar, GATA Haydarpaşa E. H., Kadın Hastalıkları ve Doğum Kliniği, Tıbbiye Cad. 34668 Üsküdar-İstanbul
e-mail: ozgurdundar72@yahoo.com

Introduction

Normal umbilical cord is constituted by being surrounded by 2 arteries, 1 venous and Wharton gel. Functions of umbilical arteries are to transport fetal deoxygenized blood to placenta. Absence of single umbilical artery is the most seen umbilical cord pathology.[1] Relationships between single umbilical artery and structural anomalies, fetal death, early loss of gestation, growth restriction, and chromosomal defect are shown in many studies.[2-5]

There is a certain development in prenatal scanning of single umbilical artery by means of improved ultrasonography devices. It is reported that it should be observed in a standard way for scanning anomaly by routine antenatal sonography.[6] Incidence of being single of umbilical artery changes between 0.2% and 1.9%.[6]

Sepulveda et al, suggested that it is a good indicator for single umbilical artery if the rate of umbilical venous/umbilical artery diameters is less than 2/1.[7] In addition, Persutte and Leuke emphasized that it is important for scanning of single umbilical artery if diameter of transverse umbilical artery is more than 4 mm at gestational weeks 20-36.[8]

We evaluated single umbilical artery cases as prenatal in our study in terms of fetal structural and chromosomal anomalies and perinatal results.

Methods

In this work, 4952 pregnants being followed antenatally in Obstetrics and Gynecology Department of GATA Haydarpaşa Training Hospital and who gave birth in between January 1999 and December 2005 were scanned retrospectively. Incomplete records of 33 pregnants were removed from the study. Pregnants having single umbilical artery in these records were taken as case group. All pregnants in control group which gave births but did not have cordon anomaly were taken into the study.

Demographic qualities, laboratory and ultrasonographic findings were acquired from their pregnant monitoring cards and information about placenta and umbilical cordons of pregnants who gave births were taken from their birth files. Antenatal fetal measurements and measurements after birth of all pregnants were determined.

While evaluating perinatal results, fetal structural and chromosomal anomaly, maternal systematic illness and pregnants having AFP highness were excluded from control group (n=245).

a. Fetuses which have antenatal fetal measurments below 5% and newborns born under 2500 gr in therm were determined as intrauterine growth restriction (IUGR).

b. Pregnants which have amniotic fluid index below 5 cm or maximal vertical pocket measurement were deemed as oligohydroamnios.

c. Pregnancies ended before 37th gestation week in records were deemed as preterm gestation.

Intrauterine scanning of pregnants monitored and gave birth in our clinic was done by means of transabdominal 3-5 MHz convex probe (Toshiba Powervision 6000, SSA-370A, Tokyo, Japan). Also, in the absence of gray scale ultrasonography for all pregnants which had second trimester anomaly scanning (genetic sonography) or for pregnants that their umbilical cord could not determined clearly (due to oligohydroamnios or maternal obesity), fetal bladder was found in oblique transverse section by means of color doppler ultrasonography and bilateral umbilical artery was observed next to it.

Data acquired from the search was analyzed by SPSS computer software program (version 11.0 for windows; SPSS INC., Chicago IL). Mann-Whitney U test was used for comparing demographic data of patients within the study and Pearson chi-square and Fisher test was used for comparing perinatal complications. Results found less than 0.05 of P value were deemed as significant.

Results

We found fetus or newborn with single umbilical artery in 26 pregnants of 4707 pregnants which have complete records in between January 1999 – December 2005. These pregnants were chosen as case group. We found single umbilical artery incidence as 5.5 in 1000 births. Average maternity age of pregnants in control group was 27.6 ± 4.5 (17-43), it was 28.0 ± 4.8 (20-39) of cases of single umbilical artery. There was no significant difference between two groups in terms of maternal age, parity and gravida (p>0.05). When two groups

were compared in terms of fetal weight; it was found as 3037.82 ± 503.69 gr in the group of single umbilical artery and was found 3294 ± 609.35 gr in control group and there was statistically a significant difference between groups ($p<0.05$). Demographic qualities of patients are shown in Table 1.

We found rate of single umbilical artery as high in most gestation ($p<0.05$). When compared with control group, we found that preterm birth, IUGR, oligohydroamnios, fetal structural and chromosomal anomaly rate was higher for ones having single umbilical artery ($p<0.05$). Perinatal results of patient are shown in Table 2.

Single umbilical artery for intrauterine is diagnosed in averagely 24.4 ± 4.2 (12-41) gestation week. We ascertained 23 of these cases by obstetric sonography which were done during antenatal monitoring (88.5%). 3 cases could not being ascertained antenatally even obstetric sonography was done (11.5%). Postnatal single umbilical artery was existing in all cases we found single umbilical artery by antenatal sonography.

12 of 26 newborns were female (46%) and 14 of them were male (54%) which have single umbilical artery. Single gestation in 23 cases and twin gestation in 3 cases were found. We found 17 of cases before 20th gestation week that we found antenatally (73.9%).

Chromosomal analyze is done to totally 9 fetuses (34.6%). There was additional structural anomaly in 6 of them (23%). Chromosomal analyze is done to other 3 fetuses due to maternal age. Two fetuses are diagnosed as chromosomal anomaly (7.6%). Both of these chromosomal anomalies are found as trisomy 18. Structural and chromosomal anomalies are shown in Tables 3 and 4.

Table 1. Demographic qualities.

	Single umbilical artery (n = 26) (%)	Control (n = 4952) (%)	p
Maternal age (year)	27.6 ± 4.5	28.0 ± 4.8	Not significant
Gravida	1.65 ± 0.83	1.58 ± 0.81	Not significant
Birth Weight (gr)	3037.82 ±503.69	3294.45 ± 609.35	0,04
Nulliparity	15 (%56.7)	2926 (%59)	Not significant
Plural gestation	4 (%15.4)	168 (%3.4)	0.012
Chromosomal anomaly	2 (%7.7)	8 (%0.2)	0.001
Congenital anomaly	6 (%23)	97 (%1,69)	0.001
Birth weight	3545.5±476.4	3532.4±402.7	p>0.05

Note: Values are given as average (percentage) and ±standard deviation.

Table 2. Perinatal results.

	Single umbilical artery (n = 26) (%)	Control (n = 4707) (%)	p
Preterm birth	6 (%23)	398 (%8.4)	0.008
Cesarean	11 (%42.3)	1794 (%41.9)	Not significant
IUGR	4 (%15.4)	244 (%5.1)	0.04
Oligohydroamnios	6 (%23)	269 (%5.7)	0.001
Apgar 1st minute	8.09 ± 0.57	8.11 ± 0.81	Not significant
Apgar 5th minute	9.52 ± 0.61	9.59 ± 0.62	Not significant

Note: Values are given as average (percentage) and ±standard deviation.

Table 3. Congenital and chromosomal anomalies found in cases with single umbilical artery.

1. Big artery transposition, VSD, trisomy 18
2. Choroid plexus cyst, talipes, Trisomy 18 (abnormal triple test).
3. Fallot tetralogy
4. Right ventricular hypoplasia
5. Hipospadisyas
6. Hypoplastic left heart

Table 4. Fetal anomalies found in our control group

Anomalies of central nervous system		**Health anomaly**	
Menigomiolesel and ventriculomegaly	10	Ventricle hypoplasia	3
Anensephaly	14	A-V canal defect	3
Holoprosensephaly	3	VSD	5
Ensephalosel	2	Fallot tetralogy	2
Corpus callosum agenesis	1	Big artery transposition	3
Dandy Walker syndrome	3		
Microsephaly	2	**Others**	
Genital urinary system		Immune – non-immune hydropsy	7
Infantile polycystic kidney	4	Omphalosel	5
Posterior uretral valv	3	Sacrococcigeal teratoma	1
Fetal hydronephrosis	13	Pierre Robin syndrome	1
Potter syndrome	1	Fetal ovarian cyst	2
Muscle skeleton system		Crack palate lip	4
Arthrogryposis multiplex	1		
Talipes	4		**Total (97)**

Discussion

Umbilical cord is constituted of 2 arteries and 1 venous. But in some cases, single umbilical artery does not develop in terms of primary agenesis or atrophy of single artery.[9] Absence of left umbilical artery is observed rather than the left one.[10] For years, absence of single umbilical artery was diagnosed by umbilical cord examination in birth but in recent years, diagnosing the prenatal single umbilical artery is descended to 12th gestational weeks by the help of modern ultrasonography devices.[10]

Chromosomal anomaly incidence in fetuses in which single umbilical artery was ascertained at first trimester is reported as higher than chromosomal anomaly incidence in fetuses in which single umbilical artery was ascertained at birth.[11]

It is a good indicator that for single umbilical artery if the rates of umbilical venous and umbilical artery are less than 2/1 by gray scale ultrasonography.[7] Also it is important for scanning of single umbilical artery if diameter of transverse umbilical artery is more than 4 mm at gestational weeks 20-36 but in recent years, becoming widespread of Doppler ultrasonography and finding fetal bladder in oblique transverse section and observing bilateral umbilical artery next to it provide early diagnosis.[8,11]

Single umbilical artery diagnosis at second trimester is a good indicator for scanning of accompanying anomalies and chromosomal anomalies. For that purpose, cases having fetal single umbilical artery should be determined by detailed fetal anatomic study and fetal echocardiography by experienced experts in prenatal ultrasonography. After all these studies, invasive attempt having chromosomal diagnosis purpose (karyotype indication) is not effective for cases accepted as isolated. If there are accompanying anomalies, fetal karyotyping should be done.[11] Finding single umbilical artery does not increase trisomy 21 risk but it increase 7 times of trisomy 21 risk. Trisomy 18 appears in early weeks by many ultrasonographic diagnoses.[12] There was trisomy 18 within 2 cases in our study. No family predisposition is reported for single umbilical artery cases.[13]

There was no another anomaly accompanying 3 twin gestations we found as isolated and it was at high rate as it was reported in literatures before.[14] There was trisomy 18 in 2 cases and congenital anomaly rate was 23%, thus it is same with the rates of literature.[12,13,15]

Duerbeck et al found that abnormal ascertainment of S/D rate of fetuses having single umbilical artery was ten times higher than control group.16

Diagnosis of single umbilical artery is related with many factors. These are wall thickness of maternal abdomen, existence of scar in lower abdomen, gestational week, fetal position, amniotic fluid amount, length of umbilical cord, being twisted, experience of scanner and quality of device. Single umbilical artery is hardly diagnosed due to fusion of umbilical artery in areas close to placenta.[17]

No scanning was planned as to gestational week in our study; cases which were ascertained that they had single umbilical artery in any gestational were taken into study. 23 of the cases (88.5%) are found as antenatal. 3 cases (11.5%) could not found as antenatal even obstetric sonography was done. We ascertained these cases in the examination of placenta and its additions during birth. We found 17 of 23 cases that we ascertained antenatally before 20th gestation week (73.9%).

There is no need for chromosomal analyze if there is no structural anomaly or risk factor at pregnants having isolated single umbilical artery.[10]

As the reason of cases that we could not ascertain antenatally may arise from technical difficulties or lack off education, they may also arise due to lack of interest of the scanner to umbilical cord veins. When major anomaly is not ascertained during ultrasonography, umbilical cord is not interested, thus, umbilical artery pathologies are less diagnosed; when major anomaly is ascertained, ultrasonography is done for long times, thus, umbilical artery pathologies are more diagnosed.

Even there is no structural anomaly; perinatal results of fetuses with single umbilical artery are worse than fetuses with normal umbilical cords. The reason could not found.[1] Moreover; its cooperation with other fetal anomalies could not being clarified.

In the existence of single umbilical artery; early birth, lower birth weight, cesarean ate, congenital anomaly rate and perinatal mortality increase.[2,5] Finding preterm birth, IUGR, oligohydroamnios, rate of fetal structural and chromosomal anomalies higher than ones with single umbilical artery when comparing with control groups show that perinatal results are worse ($p<0.05$).

Conclusion

Cases with single umbilical artery should be examined in terms of chromosomal and congenital anomalies. Pregnants diagnosed as isolated single umbilical artery should be monitored as higher risked pregnants. These pregnants should be monitored at third trimester in order to diagnose early by thinking of early birth, low birth weight and intrauterine growth restriction cases.

References

1. Gornall A S, Kurinczuk J J, Konje J C. Antenatal detection of a single umbilical artery: does it matter? *Prenat Diagn* 2003; 23: 117-123.
2. Benirschke K, Bourne GL. The incidence and prognostic implication of congenital absence of one umbilical artery. *Am J Obstet Gynecol* 1960;79: 251-254.
3. Saller DN, Keene CL, Sun CC, et al. The association of single umbilical artery with cytogenetically abnormal pregnancies. *Am J Obstet Gynecol* 1990; 163: 922.
4. Froehlich LA, Fukikura T. Significance of a single umbilical artery. Report from the collaborative study of cerebral palsy. *Am J Obstet Gynecol* 1966; 94: 274-9.
5. Leung AKC, Robson WLM. Single umbilical artery. A report of 159 cases. *Am J Dis Child* 1989;143: 108-111.
6. Heifetz SA. Single umbilical artery. A statistical analysis of 237 autopsy cases and review of the literature. *Perspectives in Pediatric Pathology* 1984; 8: 345.
7. Sepulveda WH. Antenatal sonographic detection of single umbilical artery. *J Perinat Med* 1991;19:391.
8. Persutte WH, Leuke RR. Transverse umbilical arterial diameter: technique for the prenatal diagnosis of single umbilical artery. *J Ultrasound Med* 1994;13:763.
9. Monie IW. Genesis of single umbilical artery. *Am J Obstet Gynecol* 1970; 108: 400-405.
10. Geipel A, Germer U, Welp T, Schwinger E, Gembruch U. Prenatal diagnosis of a single umbilical artery: determination of the absent side, associated anomalies, Doppler findings and perinatal outcome. *Ultrasound Obstet Gynecol* 2000; 15: 114-7.
11. Khong TY, George K. Chromosomal abnormalities associated with a single umbilical artery. *Prenat Diagn* 1992; 12: 965.
12. Rembouskos G, Cicero S, Longo D, Sacchini C, Nicolaides KH. Single umbilical artery at 11–14 weeks' gestation: relation to chromosomal defects. *Ultrasound Obstet Gynecol* 2003; 22: 567-70.
13. Nyberg DA, Mahony BS, Luthy D, Kapur R. Single umbilical artery—prenatal detection of concurrent anomalies. *J Ultrasound Med* 1991; 10:247.
14. Abuhamad AZ, Shaffer W, Mari G, et al. Single umbilical artery: does it matter which artery is missing? *Am J Obstet Gynecol* 1995;173: 728.
15. Byrne J, Blanc WA. Malformations and chromosome anomalies in spontaneously aborted fetuses with single umbilical artery. *Am J Obstet Gynecol* 1985; 151: 340.
16. Duerbeck NB, Pietrantoni M, Reed KL, et al. Doppler flow velocities in single umbilical arteries. *Am J Obstet Gynecol* 1991; 165: 1120.
17. Szpakowski M. Morphology of arterial anastomoses in the human placenta. *Folia Morphol* 1974; 33: 53-60.