Assessment of Nuchal Translucency Nasal Bone and Ductus Venosus Flow in the First Trimester: Pregnancy Outcomes

Şafak ÖZDEMİRCİ[1], Deniz ESİNLER[1], Funda ÖZDEMİRCİ[2], Melek BİLGE[3], Funda AKPINAR[1], İnci KAHYAOĞLU[1]

Ankara, Turkey

OBJECTIVE: To report the first trimester prenatal obstetric ultrasonography findings and pregnancy outcomes.

STUDY DESIGN: This study was designed as a retrospective cohort one. Seven-hundreds twelve (n=712) singleton pregnant women attending to Simav –Kütahya Government Hospital between January 2008 and December 2011 for the routine first trimester screening and standard obstetric ultrasound examination were enrolled retrospectively. Pregnancy outcomes of these pregnancies were reported.

RESULTS: The nasal bone was present in 704 (98.8%), absent in 4 (0.6%) and was not clearly evaluable in 4 (0.6%) patients. Blood flows in ductus venosus (DV) were normal in 609 (85.5%), reversed in 15 (2.1%) and not measurable in 88 (12.4%) of fetuses. We had 4 fetuses with cardiac anomaly. Among these 4 fetuses, we noted NT≥3.5 mm in 3 fetuses, absence of nasal bone in 3 fetuses and abnormal DV flow in 2 fetuses. We had 3 fetuses with Down syndrome. Among these 3 fetuses, we noted NT≥3.5 mm in 1 fetus, absence of nasal bone in 1 fetus and abnormal DV flow in 1 fetus.

CONCLUSION: We reported our first trimester standard obstetric ultrasonographic results and pregnancy outcomes. We noted that the prenatal diagnosis of cardiac anomalies and Down syndrome may be possible via assessment of NT and DV flow.

Keywords: Nuchal translucency, Ductus venosus, Nasal bone, First trimester, Cardiac anomaly, Down syndrome

Gynecol Obstet Reprod Med 2014;20:73-76

Introduction

Prenatal first trimester screening is applied between 11-14 gestational weeks. First trimester screening is important in modern obstetrics for early diagnosis of chromosomal anomalies and fetal malformations.[1] The measurement of nuchal translucency (NT) in the first trimester is crucial and sensitive screening test for fetal chromosomal abnormalities and anatomical anomalies.[2] Down syndrome (DS) screening in the first trimester with maternal age, nuchal translucency and serum analysis (pregnancy associated plasma protein A and free HCG) is accepted as a standard in many European countries with a sensitivity of 90% and false positive rate of 5%.[3,4,5] Ductus venosus (DV) is the intrahepatic last part of umbilical vein. Ultrasonographic examination of DV is performed either in B mode or color Doppler. Abnormal DV blood flow in the first trimester increases the risks for fetal genetic diseases, malformations, arrhythmias, intrauterine growth retardation (IUGR), twin-twin transfusion syndrome in multiple gestations and adverse pregnancy outcomes.[1]

Sensitivity of first trimester DS screening with NT significantly increases with addition of DV blood flow and nasal bone hypoplasia.[6] Evaluation of fetal nasal bone between 11- 14 gestational weeks is important for diagnosis of trisomy 21. Trisomy 21 fetuses are reported to have no nasal bone in 73%.[7]

This study is aimed to report the first trimester prenatal obstetric ultrasonography findings and pregnancy outcomes.

Material and Method

This study was designed as a retrospective cohort one. Seven-hundreds twelve (n=712) singleton pregnant women attending to Simav Kütahya Government Hospital between January 2008 and December 2011 for the routine first trimester screening and standard obstetric ultrasound examination were enrolled retrospectively. All patients underwent ultrasonographic examination including the crown-rump

[1] *Etlik Zübeyde Hanım Maternity Hospital Division of Maternal Fetal and Medicine, Ankara*

[2] *Başkent University, Ankara Başkent Hospital Family Medicine Department, Ankara*

[3] *Dr. Faruk Sukan Women Health and Child Hospital, Konya*

Address of Correspondence: *Şafak Özdemirci*
Etlik Zübeyde Hanım Maternity Hospital Department of Obstetrics and Gynecology, Ankara, Turkey
safakozdemirci@gmail.com

Submitted for Publication: *08. 03. 2014*
Accepted for Publication: *15. 04. 2014*

length (CRL) measurement, the evaluation of nasal bone, the evaluation of the ductus venosus blood flow and NT (Nuchal translucency) measurements. The technique used for NT measurement followed the guideline recommended by the UK Fetal Medicine Foundation.[8]

The assessment of ductus venosus blood flows were performed by using the Doppler spectrum in a dorso-anterior position. Abnormal ductus venosus flow is defined as the presence of reversed a-waves in Doppler spectrum throughout the atrial diastole.[1] All examinations were performed transabdominal with a curvilinear 2-7 MHz transducer, Voluson 730 pro (Germany). All fetuses were examined by a certificated and expert physician.

Pregnant women >=37 years old, abnormal sonography or abnormal serum tests were referred a reference hospital for chorionic villus sampling or amniocentesis. All cases were recommended follow-up scans at 18-20 weeks of gestation and fetal cardiac and great vessel evaluation at 20-24 weeks of gestations.

All newborns were examined immediately after the birth by a pediatrician.

Karyotype was done by blood samples of neonates in suspected cases. Pregnancy outcome was obtained from delivery records or directly from the patients themselves. The outcome was recorded by telephone interviews with parents or the pediatrician if necessary. The follow up period at the time of telephone interviews was recorded. The prevalence of unfavorable pregnancy outcome including miscarriage, hydrops fetalis, stillbirth, fetal malformation diagnosed before or after delivery and termination of pregnancy including indicated and maternal request was recorded.

Results

The basal characteristics of the patients were given in table 1. The nasal bone was present in 704 (98.8%), absent in 4 (0.6%) and was not clearly evaluable in 4 (0.6%) patients. Blood flows in DV were normal in 609 (85.5%), reversed in 15 (2.1%) and not measurable in 88 (12.4%) of fetuses (Table 2). Pregnancy outcomes were summarized in table 3. Fetal anomaly distribution and NT (≥3,5mm), the absence of nasal bone and abnormal ductus venosus blood flow were given in table 4.

Table 1: Basal characteristic of the patients

Variable	
Number of patients	712
Maternal age (year)	25.0±4.9
Birth weight (gram)	3100.0±621.0
CRL (cm)	6.86 ± 0.65
NT (mm)	1.45 ± 0.48

Mean±Standard Deviation, NT: Nuchal translucency, CRL: Crown-rump length

Table 2: The assessment of NT, NB, and DV blood flow

	Normal	Could not assessed	Abnormal
NT (n;%)	709(99.6)	0	3(0.4)
Nasal bone (n;%)	704(99.4)	4 (0.3)	4 (0,3)
DV (n;%)	609(85.5)	88(12.4)	15(2.1)

NT Normal was defined as <3.5 mm, NT: Nuchal translucency, NB: Nasal bone, DV: Ductus venosus

Table 3: Pregnancy Outcomes

	N	%
Healthy fetus	686	96.4
Abortions	12*	1.7*
Intrauterine exitus	5	0.7
Fetus with any congenital anomaly	18	2.5

**Spontaneous abortions and pregnancy terminations were merged.*

Table 4: Fetal anomaly distribution and NT (≥3.5mm), the absence of nasal bone, abnormal ductus venosus blood flow

	N	NT≥3.5 mm	Absence of nasal bone	Abnormal Ductus Venosus Flow
Cardiac anomaly	4	3	3	2
Down syndrome	3	1	1	1
Renal anomaly	3	-	-	-
Cystic hygroma	2	2	1	-
Megacystis	1	-	-	-
Neural tube defects	2	1	-	-
Familial Mediterranean fever	1	-	-	-
Albers-Schonberg disease	1	-	-	-
Galen aneurysmal malformation	1	-	-	-
Intrauterine exitus	5	-	1	1

Discussion

There are articles reporting that DV blood flow pattern has high sensitivity in evaluation of fetal aneuploidies.[6-10,11] In 2013, Florjanski[1] et al. reported abnormal DV blood flow in 7.4% of all healthy fetuses. There are reports demonstrating abnormal DV blood flow in healthy fetuses. In studies abnormal DV blood flow in healthy fetuses was reported in 6.4% by Toyoma et al.[12] 5.2% by Perfomo et al.[9] and 3.2% by Maiz et al.[13] Zappi et al. found abnormal DV blood flow in 13% of healthy fetuses.[14] Abnormal DV blood flow was observed in 69% of aneuploid fetuses by Florjanski et al.[1] 70% in Zoppi et al.[14] and 66% in Maiz et al. study.[12] Recently two basic strategies related to the use of DV blood flow are discussed. First opinion is routine assessment of DV blood flow during combined test in first trimester. The second option is assessment of DV blood flow in fetuses either with risk of chromosomal risk ratio of 1:50-1:1000 or NT measurement higher than 95th centile.[1] Many authors accept the first option, because it is more meaningful to use a less complicated more sensitive test to evaluate chromosomal anomalies without waiting for laboratory results and second degree ultrasound examination.[1] Addition of DV blood flow examination to the combined test in first trimester to assess chromosomal anomalies increases the sensitivity from 80-88% to 94-97% and decreases the false positive rate from 5% to 1%.[15]

In a publication in 2005 Nicolaides et al. described NT and first trimester serum markers to identify chromosomal risks as the first step and report that it is mandatory to go to the second degree scanning if the first step scanning resulted an intermediate outcome. Second degree strategy includes evaluation of os nasale (NB), ductus venosus (DV) blood flow and tricuspid flow (TF).[6]

In a study in 2007 Oh et al. evaluate the results of 47 fetuses with normal NT and abnormal DV blood flow. Two of these fetuses due to first trimester complete abort and 3 of them due to first trimester anomaly were excluded from the study. Six cardiac anomalies, 3 intrauterine growth restriction, 2 renal anomaly, 3 aneuploidy and 3 multiple anomaly fetuses were found from the rest 42 fetuses. Perinatal death, cardiac and renal anomalies were reported significantly higher in fetuses with abnormal DV blood flow.[16] First trimester abnormal DV blood flow is NT independent evidence in prediction of poor pregnancy outcome.[16]

In a study Matias et al. found three abnormal karyotype and one normal karyotype but cardiac animalized fetus out of six normal NT and abnormal DV blood flow fetuses.[17] Martinez et al. in 2010 assessed 6120 pregnant women in first trimester for NT and DV blood flow. They found congenital cardiac anomaly in 45 cases. Reversed flow in DV was observed in 206 cases. Normal karyotype was reported in 145 of reversed DV flow cases. Eleven of these 145 reversed DV flow cases had cardiac anomaly. They concluded abnormal DV blood flow between 11-13 weeks and 6 days of gestational age might be a significant and independent risk factor for congenital cardiac disease.[18]

Addition of nasal bone to the first trimester combined test increases the sensitivity to 97% with a false positive rate of 5 %.[4] Nasal bone assessment in fetus is subjective. There might be technical and technological mistakes. For example hypoechogenic distal end of nasal bone might be either measured or not.[4] Despite of nasal bone parts of zygomatic bone could be measured.[4] In a study in 2013, Suwanrath et al. reported one fetus without nasal bone out of 112 fetuses.[4]

In conclusion, we reported our first trimester standard obstetric ultrasonographic results and pregnancy outcomes. We noted that prenatal diagnosis of cardiac anomalies and Down syndrome may be possible via assessment of NT and DV flow.

İlk Trimesterde Nukal Saydamlığın Nazal Kemiğin ve Duktus Venozum Akımının Değerlendirilmesi: Gebelik Sonuçları

AMAÇ: İlk trimesterdeki prenatal obstetrik ultrasonografik bulgularının ve gebelik sonuçlarının değerlendirilmesi.

GEREÇ VE YÖNTEM: Bu çalışma retrospektif kohort çalışması olarak dizayn edildi. Ocak 2008- Ekim 2011 tarihleri arasında Simav- Kütahya Devlet Hastanesi'nde ilk trimester rutin taraması ve standart ultrasonogarafik incelemesi yapılan 712 tekil gebe retrospektif olarak incelendi. Bu gebelerin gebelik sonuçlarını yayınladık.

BULGULAR: Gebelerin 704 (%98,8) de nazal kemik mevcuttu. 4 (%0,6) gebede nazal kemik yoktu. 4 (%0,6) gebede ise nazal kemik net olarak değerlendirilemedi. 609 (%85,5) gebede duktus venozum kan akımı normal, 15 (%2,1) gebede revers ve 88 (%12,4) gebede ise ölçüm yapılamadı. 4 fetusda kardiyak anomali tespit ettik. Bu 4 fetusun 3 tanesinde NT ≥ 3,5 mm, 3 tanesinde nazal kemik yokluğu ve 2 tanesinde de duktus venozum kan akımının anormal olduğunu tespit ettik. 3 fetus Down sendromlu idi. Bu 3 fetusun 1 tanesinde NT ≥3.5 mm, 1 tanesinde nazal kemik yokluğu ve 1 tanesinde de duktus venozum kan akımının anormal olduğunu tespit ettik.

SONUÇ: İlk trimester obstetrik ultrasonografik bulgularımızı ve gebelik sonuçlarını yayınladık. Kardiyak anomali ve Down sendomunun prenatal tanısında NT ve DV akımının değerlendirilmesiyle mümkün olabileceğini tespit ettik.

Anahtar Kelimeler: Nukal saydamlık, Duktus venozum, Nazal kemik, İlk trimester, Kardiyak anomali, Down sendromu

References

1. Florjanksi J, Fuchs T, Zimmer M, Homola W, Pomorski M, Blok D. The role of ductus venosus doppler flow in the diagnosis of chromosomal abnormalities during the first trimester of pregnancy. Adv Clin Exp Med 2013;22:395-401.
2. Takmasebpour A, Rafiee NB, Ghaffari S, Jamal A. Increased nuchal translucency and pregnancy outcome. Iran J Publ Health 2012;41:92-97.
3. Munoz-Cortes M, Ariqita M, Falquera G, Seres A, Guix D, Baldrich E, Acera A, Torrent A, Rodriquez- A, Lopez-Quesada E, Garcia Moreno R, Gonce A, Borobio V, Borell A. Contingent screening for down sydrome completed in the first trimester: a multicenter study. Ultrasound Obstet Gynecol 2012;39:396-400.
4. Suwanrath C, Pruksanusak N, Kor- Anatakul O, Suntharasaj T, Hanprasertpong T, Pranpanus S. Reliability of fetal nasal bone length measurement at 11-14 weeks of gestation. BMC Pregnancy 2013;16:13-7.
5. Kogan KO, Wright D, Valancia C, Maiz N, Nicolaides KH. Screening for trisomies 21, 18 and 13 by maternal age, fetal nuchal translucency, fetal heart rate, free beta hCG and pregnancy associated plasma protein A. Hum Reprod 2008;23:1968-75.
6. Nicolaides KH, Spencer K, Avgidou K, Faiola S, Falcon O: Multicenter study of first trimester screening for trisomy 21 in 75 821 pregnancies: results and estimation of potential impact of indiviual risk-oriented two stage first trimester screening. Ultrasound Obstet Gynecol 2005;25: 221-226.
7. Cicero S, Curcio P, Papageorghiu A, sonek J, Nicolaides K. Absent of nasal bone in fetuses with trisomy 21 at 11-14 week gestation: an observational study. Lancet 2001; 358:1665-1667.
8. Nicolaides KH (2004). Nuchal translucency and other first trimester sonographic markers of chromosomal abnormalities. Am J Obstet Gynecol 191:45-67.
9. Perfomo F, Setha F, Sairam S, Bhide A, Thilaganathan B: First trimester ductus venosus, nasal bone and Down syndrome in high risk population. Obstet Gynecol 2005; 105:1348-1354.
10. Florjanksi J, Zalewski J, Barwinski I, Heimrath J, Nowak M and Blok D. Usefullness of some ultrasonographic markers in assessment of risk of aneuploidy in fetusus in the first trimester of pregnancy. Adv Clin Exp Med 2004; 13:11-14.
11. Borell A, Gonce A, Martinez JM, Borobio V, Fortuny A, Coll O, Cuckle H: First trimester screening for Down syndrome with ductus venosus Doppler studies in addition to nuchal translucency and serum markers. Prenat Diagn 2005;25:901-5.
12. Toyama JM, Brizol LM, Liao AW, Lopes LM, Nomura RM, Saldanha FA, Zugaip M: Ductus venosus blood flow assessment at 11 to 14 weeks of gestation and fetal outcome. Obstet Gynecol 2005;105:1348-54.
13. Maiz N, Valencia C, Kagan KO, Wrigth D, Nicolaides KH: Ductus venosus Doppler screening for tisomies 21, 18 and 13 and Turner syndrome at 11-13 weeks of gestation. Ultrasound Obstet Gynecol 2009;33:512-7.
14. Zoppi Ma, Putzolu M, Ibba RM, Floris M, Monni G. First-trimester ductus venosus velocimetry in relation to nuchal translucency thickness and fetal karyotype. Fetal Diagn Ther 2002;17:52-57.
15. Borella A, Borobio V, BestwickJp, WaldNJ. Ductus venosus pulsatility index as an antenatal screening marker for Down's syndrome use with the combined and integrated tests. J Med Screen 2009;16:12-118.
16. Oh C, Harman C and Bashat AA. Abnormal first trimester ductus venosus blood flow: a risk factor for adverse outcome in fetusus with normal nuchal translucency. Ultrasound Obstet Gynecol 2007;30:192-6.
17. Maitas A, Huggon I, Areis JC, Montenegro N, Nicolaides KH. Cardiac detects in chromosomally normal fetusus with abnormal ductus venosus blood flow at 11-14 weeks. Ultrasound Obstet Gynecol 1999; 14:307-10.
18. Martinez JM, Comas M, Borrell A, Bennasar M, Gomez O, Puerto B, and Gratacos E. Abnormal fisrt-trimester ductus venosus blood flow: a marker of cardiac defect in fetuses with normal karyotype and nuchal translucency. Ultrasound Obstet Gynecol 2010;35:267-72.