Correlation Between Transabdominal Chorionic Villus Sampling and Fetal Distress With Color Doppler Sonography

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Abstract- Chorionic villus sampling (CVS) is an invasive method for identifying genetic and metabolic diseases, which is done in the first trimester of pregnancy and can cause many complications. The aim of this study is the evaluation of the correlation between Transabdominal chorionic villus sampling and fetal distress in color Doppler sonography. This study is experimental (before and after). All pregnant women with minor thalassemia in which their husbands were suffering from minor thalassemia or have a history of a child with major thalassemia and after the 12th week of pregnancy were referred to the ultrasound department. RI for fetal Middle Cerebral Artery (MCA) and Umbilical Artery (UA) before and after of CVS were measured and then statistically analyzed using SPSS 22. CVS did not cause a significant increase in RI for the fetal middle cerebral artery (P>0.05). CVS did cause a significant increase in RI for the umbilical artery (P<0.05). Then, CVS did cause a significant decrease in the ratio of RI for fetal Middle Cerebral Artery to RI for Umbilical Artery (P<0.05). Based on these results, it seems that CVS can cause distress in the fetus.

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Keywords: Chorionic villus sampling; Doppler sonography; Fetal distress

Introduction

The ability of the diagnosis of fetal disorders is developing. Chorionic Villus Sampling (CVS) provides the possibility of a diagnosis of chromosome Anomalies and genetic metabolic disorders (1). CVS is performed in two ways of trans abdominal (through the abdomen) and transcervical (through the cervix), since this method is invasive, it can come along with many complications so that every abortion that happens during 14days after CVS is considered related to it (1). Reported complications are infection, subchorionic hematoma, vaginal bleeding, Fetal limb defects, and even fetal death (1,2). Some factors significantly affect the abortion rate after CVS, and both mother's age and the age of pregnancy must be considered at the time of CVS. Some research suggests that Fetal limb defects happen while doing CVS before the 9th week of pregnancy, and the reason is lack of sufficient Blood supply following chorionic vessels damage (1,2). In the other hand, every factor that causes insufficient oxygen supply to the fetus will also cause fetal distress (3), possible Ways to evaluate it, is to assess the uterine artery, the middle cerebral artery of the fetus and umbilical cord artery and fetal heart rate, which is possible by doppler ultrasound. Clinically most physicians choose the resistive index (RI) or pulsatility index to assess the fetal middle cerebral artery and umbilical cord artery (4,5). In the fetal middle cerebral artery diastolic resistance reduction following fetal distress, cause decreased resistance index (RI) in the artery, following distress of fetus, the increase of chorionic resistance causes an increase in RI of Umbilical cord artery. Most researchers use the ratio between the resistance index (RI) for fetal middle cerebral artery and umbilical artery to assess distress. So that normally, the ratio is equal to, or more than one, and following any distress and intrauterine growth retardation ratio will be less than one (5). Therefore, given that in the CVS method, the needle goes through

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the placenta and according to activities of CVS center in Kermanshah and the lack of sufficient knowledge about creating distress after performing invasive CVS, We decided to investigate the relationship between the two, to determine whether a CVS cause distress in the fetus?

Materials and Methods

In this experimental study (before and after), 25 women with minor thalassemia were evaluated. With the confidence of 95% and power of 90% and according to the mean and standard deviation of PI index in two groups: 2.723±0.028 and 2.751±0.029, the minimum sample size was 22(6). The study population included pregnant women with thalassemia minor, also with their husbands with thalassemia minor or child with thalassemia major that referred to Ultrasound department of Kermanshah, Imam Reza hospital for CVS and also were in 12th week of pregnancy or more (Avoiding the systemic disease and drug addiction and multiple pregnancies), all subjects had consent for entering the study.

First, after obtaining the consent of the pregnant women, personal information of every pregnant woman related to age, age of the pregnancy, and position of the placenta, pass number came in the specified form. If the mother had various systemic diseases such as hypertension, diabetes, etc. or addiction to drugs or had more than one fetuse , that subject was excluded from the study. Then color doppler ultrasound device, Siemens G40 model with Convex probe 3-5 Mhz, was used to determine the resistance index (RI) of the fetal middle cerebral artery, and umbilical artery. Then an experienced radiologist performed chorion sampling by the abdominal method and after sampling, again measured RI of the fetal middle cerebral artery and umbilical artery (UA) using doppler sonography. Obtaining values were entered in the table, and collected data were statistically analyzed using SPSS22. To summarize data, a descriptive index (mean and standard deviation) was used. To compare before and after parameters, paired-*t*-test and McNemar was used. The significance level was set at 0.05.

Results

In this study, 25 pregnant women with thalassemia minor, who were referred to the ultrasound department of Imam Reza Hospital of Kermanshah for chorionic villus sampling and had all inclusion criteria were enrolled. Patients were between 15 and 34 years old, with an average of 25.8 years and a standard deviation of 5.59. The mean age of pregnancy was between 12 and 16 weeks, with an average of 12.4 weeks and a standard deviation of 0.95. Positions of Placenta in 12 patients (48%) were posterior, 12 patients (48%) anterior and 1 (4%) were right lateral. The number of passes in 22 (88%) subjects was 1 and in 3 subjects (12%) were 2. Descriptive characteristics and determination of the effect of a CVS on RI of the fetal middle cerebral artery (MCA), the impact of a CVS on RI of Umbilical artery (UA), the impact of a CVS on the ratio of RI of the middle cerebral artery (MCA) to RI of Umbilical artery (UA) in pregnant women with thalassemia minor have been summarized in Table 1. According to results in Table 1, CVS does not affect RI of the middle cerebral artery of the fetus in pregnant women with thalassemia minor (P>0.05). CVS affect RI for the Umbilical artery of the fetus in pregnant women with thalassemia minor (P<0.05). CVS affects the ratio of RI for fetal middle cerebral artery to RI for Umbilical artery in pregnant women with thalassemia minor (P<0.05). The relationship between CVS and fetal distress in pregnant women with thalassemia minor have been summarized in Table 2. According to Table 2, the relationship between CVS and causing fetal distress in pregnant women with thalassemia minor is significant (P<0.05).

Table 1. Descriptive characteristics and determination of the effect of CVS on RI of fetal MCA, RI of UA and the ratio of RI for MCA to RI for UA

	Mean±SD Before CVS	Mean±SD After CVS	*P*
RI of fetal MCA	0.79± 0.06	0.79± 0.09	0.9
RI of fetal UA	0.72±0.09	0.8± 0.08	0.001>
The ratio of RI for MCA to RI for UA	1.11±0.15	0.99± 0.20	0.006

Table 2. Frequency, the correlation between CVS and fetal distress in the pregnant woman with thalassemia minor

Measurement stage	$\frac{RI(MCA)}{RI(UA)}$ (After CVS)		*P*
$\frac{RI(MCA)}{RI(UA)}$ (Before CVS)	1>	1≤	
1>	1	1	0.021
1≤	9	14	

Discussion

According to the results of this study, CVS caused a significant increase in RI of Umbilical artery in pregnant women with thalassemia minor but did not cause a significant increase in RI of the middle cerebral artery (MCA) in pregnant women with thalassemia minor. Thus, CVS significantly elevated the ratio of RI of fetal middle cerebral artery to RI of Umbilical artery (RI of MCA/RI of UA) in pregnant women with thalassemia minor. The ratio of RI of fetal middle cerebral artery to RI of Umbilical artery not only will reflect circulatory failure due to the umbilical artery RI changes, but also suggest changes in proportion to the correction of RI of the middle cerebral artery (MCA) (7). The literature review indicated that there is no similar study to our study, and in fact, in many of the studies, parameters like PI and FHR before and after CVS has been checked. This is one of the limitations of our studies. In the study of Zoppini *et al.*,, CVS caused significant and unpredictable fluctuations in PI and FHR of the umbilical artery, but it had no effect on RI of the maternal arcuate artery (8) that was in line with our study. Ibba *et al.*, examined the impact of CVS on the umbilical artery's waves, and unlike our study, found that CVS did not cause significant changes in PI of the umbilical artery (9). In the Hibbard cohort's study, in contrast to our study, no significant changes happened in the amount of fetal umbilical artery blood supply after CVS (10). Kofinas *et al.*, concluded that by increasing the amount of sampled tissue, FHR increases, but chorionic vascular resistance will not change much (11). Martinez *et al.*, have observed no reduction in FHR and an increase in PI after CVS trans-cervical approach in those who were 11 weeks of pregnancy, but after this time, they have observed no change (6). In the study of Khalil A *et al.*, in the investigation of 8822 singleton pregnancies which CVS had been performed in 308 of them, they found out that performing CVS in the first trimester of pregnancy doesn't have a significant impact on the difference between PI of UA In the first and second trimester of pregnancy (12). In the study of Brezinka *et al.*, unlike our study, they did not observe any significant difference in PI of UA before and after CVS in 35 pregnant women (13). It is important to consider that incompatibility of our study with some of the above mentioned studies could be because of using RI of UA in our study, the difference between sampling methods(abdominal or cervical) and the quantity of sampler's skill, number of passes, and different ages of pregnancy. The most important result of this study indicates that after performing CVS the rate of woman who the ratio of RI for MCA/RI for UA for them after CVS was lesser than 1, compared to before CVS showed a significant increase(before CVS was lesser than 1for 2 (8%) women, and after CVS was lesser than 1 for 20 women(40%)). Thus the correlation between CVS and fetal distress in normal pregnancies, in every age of the pregnancy, the Diastolic parameter in UA was higher than MCA. Therefore, chorionic resistance remains less than the resistance of MCA, and the ratio of RI for MCA/RI for UA will be more than 1.If there is any abnormal increase in the brain's blood supply, the parameter will be less than 1 (14). Experimental studies have shown that the fetus can redistribute blood flow and cause an increase in blood flow of vital organs (brain, adrenal glands, heart) during chronic hypoxia (15). Redistribution of blood flow in the brain can set up 2-3 weeks before extreme changes in Umbilical cord artery's blood supply (16). In different studies, it has been shown that the Doppler parameter of MCA/UA is a better predictor for inappropriate results of pregnancy rather than UA and MCA parameters (17). The evaluation of doppler ultrasound is valuable in the prediction of fetal distress for the growth of the fetus, especially in pregnant women with young ages (18) and It seems that it improves the results of midwifery care in high-risk pregnancies and is promising in the reduction of childbirth deaths (19). Of course, it is worth mentioning that Doppler parameters are tests for the performance of the chorion of the fetus, but they don't indicate the situation of the fetus (20). The parameters of

RI for MCA, RI for UA, RI for MCA/RI for UA of the fetus should be interpreted with caution in complicated pregnancy situations (21).

Finally, according to the above, it seems that although the sample size of this study was small, due to the use of RI of MCA/RI of UA of the fetus for determination of fetal distress, there is a relationship between CVS and fetal distress in pregnant women with thalassemia minor.

According to the results of this study, it seems that using the ratio of RI MCA/UA of the fetus is a better diagnostic way for showing fetal distress after CVS, and we suggest to our colleagues to use the results of this study as a new and helpful way to understand the complications of CVS on the fetus and avoiding unnecessary CVS.

Ethical Considerations

This study was approved by the Ethics Committee of Kermanshah University of Medical Sciences. In this study, informed consents were obtained from the participants. Additional chargee were paid by the researcher and the patient information was confidential.

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References

1. Yohn P.MC Gahan , Barry B. Goldberg. Diagnostic ultrasound, 2nd ed. USA, Informa Healthcare, 2008:105.
2. Carol M.Rumack, Stephanie R. Wilson Y . Williom Charboneau, Deborah Levine. Diagnostic ultrasound, 4nd ed. Amsterdam, Netherlands, Elsevier Mosby, 2011:1546-47.
3. Cunningham, Leveno, Bloom, Hauth, Rouse, spong. Williams obstetrics, 23 rd ed. USA, Mc Graw Hill 2010:429-431.
4. Arthorc.Fleischer, Frank A. Manning, Philippe Jeomty, Roberto Romero. Sonography in Obstetrics & Gynecology: (Principles and Practice),USA, Mc Graw Hill 2001;1:250-251.
5. Paul. L Allan, Paul A.Dubbins, Mayran A.pozniak, W. Normanmcdicken:Clinical Doppler Ultrasound. Churchill Livingstone, USA, Harcourt publisher, 2007:259-263.
6. Martinez JM, Comas C, Ojuel J, Borrell A, Puerto B, Fortuny A. Immediate changes in umbilical blood flow after transcervical chorionic villus sampling performed by biopsy forceps. Prenat Diagn 1996;16:223-9.
7. Sterne G, Shields LE, Dubinsky TJ. Abnormal fetal cerebral and umbilical Doppler measurements in fetuses with intrauterine growth restriction predicts the severity of perinatal morbidity. J Clin Ultrasound 2001;29:146-51.
8. Zoppini C, Ludomirsky A, Godmilow L, Weiner S, Maislin G, Donnenfeld AE. Acute hemodynamic effects induced by chorionic villus sampling: a preliminary investigation. Am J Obstet Gynecol 1993;169:902-7.
9. Ibba R M, Monni G, Olla G, Cao A. Umbilical artery velocity waveforms before and after chorionic villus sampling . Prenat Diagn 1994;14:799-802.
10. Hibbard JU, Loy GL, Hibbard MC.Does chorionic villus sampling compromise fetal umbilical blood flow? Prenat Diagn 1994;14:1107-12.
11. Kofinas AD, D'Amico K, McGuiness T, Clay D, King K. Transabdominal chorionic villus sampling at 9.5-12 weeks' gestation. Placental vascular resistance and fetal cardiovascular responses. J Reprod Med 1995;40:453-7.
12. Khalil A, Akolekar R, Syngelaki A, Penco JM, Nicolaides KH. Effect of chorionic villus sampling on uterine artery Doppler. Fetal Diagn Ther 2010;28:9-13.
13. Brezinka C, Hagenaars AM, Wladimiroff JW, Los FJ. Fetal ductus venosus flow velocity waveforms and maternal serum AFP before and after first-trimester transabdominal chorionic villus sampling. Prenat Diagn 1995;15:699-703.
14. Yalti S, Oral O, Gürbüz B, Ozden S, Atar F. Ratio of middle cerebral to umbilical artery blood velocity in preeclamptic & hypertensive women in the prediction of poor perinatal outcome. Indian J Med Res 2004;120:44-50.
15. Jensen A, Roman C, Rudolph AM. Effects of reducing uterine blood flow on fetal blood flow distribution and oxygen delivery. J Dev Physiol 1991;15:309-23.
16. Dubiel M, Gudmundsson S, Gunnarsson G, Marsál K. Middle cerebral artery velocimetry as a predictor of hypoxemia in fetuses with increased resistance to blood flow in the umbilical artery. Early Hum Dev 1997;47:177-84.
17. Pattinson R, Dawes G, Jennings J, Redman C. Umbilical artery resistance index as a screening test for fetal well-being. I: Prospective revealed evaluation. Obstet Gynecol 1991;78:353-8.
18. Harneet N, Kapila AK , Kaur M M. Cerebral and umbilical arterial blood flow velocity in normal and

growth retarded pregnancy. J Obstet Gynecol India 2009;59:47-52.
19. Neilson JP, Alfirevic Z. Doppler ultrasound for fetal assessment in high risk pregnancies. Cochrane Database Syst Rev 2000;2:CD000073.
20. Arias F.Accuracy of the middle-cerebral-to-umbilical-artery resistance index ratio in the prediction of neonatal outcome in patients at high risk for fetal and neonatal complications. Am J Obstet Gynecol 1994;171:1541-5.
21. Fouda UM, ElKassem M A M, Hefny S M, Hashem A T Role of middle cerebral artery, umbilical artery resistance indices and middle cerebral artery to umbilical artery resistance index ratio in predicting unfavorable perinatal outcomes of normotensive and hypertensive diabetic pregnancies. Life Sci J 2013;10:2371-7.