Does bleeding affect fetal Doppler parameters during genetic amniocentesis?

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Abstract

Objective: The aim of this study was to investigate the relationship between fetal Doppler parameters and bleeding at insertion points during amniocentesis.

Material and Methods: This prospective study was conducted between July 2010 and February 2011. A total of 215 amniocentesis procedures were performed during this period. Five patients with Down syndrome were excluded from the study. The remaining 210 patients were divided into Group 1 (bleeding at insertion site) and Group 2 as a control group. One needle type was used for all patients. Umbilical artery resistance index (UARI), umbilical artery pulsatility index (UAPI), middle cerebral artery resistance index (MCARI), middle cerebral artery pulsatility index (MCA PI), and middle cerebral artery peak systolic velocity (MCAPSV) were measured immediately and before and after amniocentesis.

Results: Bleeding at the insertion point during amniocentesis did not significantly change the UARI (34% increase for Group 1 and 46.5% increase for Group 2, p=0.238), the MCARI (52% increase for Group 1 and 45% increase for Group 2, p=0.622), or the MCAPSV (37% increase for Group 1 and 49% increase for Group 2, p=0.199). UARI, MCARI, MCA PI, and MCAPSV were not significantly altered following amniocentesis in Groups 1 and 2. There was a significant increase in UAPI following amniocentesis only in Group 2.

Conclusion: Bleeding during genetic amniocentesis did not change umbilical artery and middle cerebral artery Doppler parameters.

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Introduction

Amniocentesis is the most commonly performed invasive prenatal diagnostic procedure. Although technically simple, it may result with in pregnancy loss. The total pregnancy loss rate due to amniocentesis is the sum of the procedural and the background loss rates (1). Procedure-related fetal losses have been found to be associated with a procedure at 18 weeks or beyond, a procedure performed for abnormal second-trimester biochemical screening test, a bloody tap, and a female fetus but not to the number of punctures or transplacental amniocentesis (2-4). Although considered a complicating factor, transplacental needle passage during amniocentesis has not been shown to induce changes in fetal Doppler parameters when compared to a group with non-transplacental amniocentesis (5, 6).

In the present study, we aimed to investigate the relationship between fetal umbilical artery (UA) middle cerebral artery (MCA) Doppler parameters and bleeding at the insertion point during transplacental amniocentesis.

Material and Methods

This prospective study was conducted between July 2010 and February 2011. A total of 215 amniocentesis procedures were performed during this period. Five patients with Down syndrome were excluded from the study. The remaining 210 patients were divided into Group 1 (bleeding at the insertion site). Group 2 was the control group. One needle type was used for all patients. Bleeding from the insertion site was noted when jet flow from the placenta into the amniotic cavity was detected by ultrasonography. Umbilical artery resistance index (UARI), UA pulsatility index (UAPI), MCA resistance index (MCARI), MCA pulsatility index (MCA PI), and MCA peak systolic velocity (MCAPSV) were measured immediately and before and after amniocentesis. The study was conducted using a color Doppler instrument (ProSound α10, Aloka, Tokyo, Japan) with a 5 MHz convex probe. For an accurate measurement, the fetal head was in the transverse plan. MCA vessels were detected with color Doppler ultrasound overlying the anterior wing of the sphenoid bone. An angle of insonation of <15° was used (near 0°). For fetal MCA

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peak systolic velocity, the highest velocity was used. All of the invasive procedures and Doppler evaluation were performed by a single operator. The study was approved by the ethics and educational issues coordinating committee of the institution where the study was conducted. All of the patients signed written consent that their data could be used with appropriate ethical committee approval prior to genetic amniocentesis.

Statistical Analysis

Statistical analysis was performed using SPSS (R) version 17 (SPSS; Chicago, IL, USA). An independent samples t-test was performed for parametric variables between groups. A paired samples t-test was performed for parametric variables within groups. A chi-square test was performed for non-parametric variables between groups. A P value less than 0.05 was considered significant.

Results

Characteristics of the study population are shown in Table 1. Maternal age and gestational age at amniocentesis were similar among groups. The distribution of nulliparity and indications for amniocentesis were also not significantly different between groups. Patients in Group 1 had significantly more frequent anterior placentation. UA and MCA Doppler characteristics are shown in Table 2. UARI and UAPI before and after amniocentesis were not different between patients in Groups 1 and 2. Among patients in Group 1, 34% had an increase in UARI and 43.5% had an increase in UAPI. Increased UARI and UAPI were observed in 46.5% and 57.5% of patients in Group 2, respectively. The ratio of patients with increased UARI and UAPI did not differ significantly between groups.

Middle cerebral artery pulsatility index was similar in both groups before and after amniocentesis. MCAPSV was similar between groups before and after amniocentesis. The number of fetuses with increased MCAPSV was also similar in Groups 1 and 2.

Changes in UA and MCA Doppler parameters within each group after amniocentesis are shown in Table 3. UARI, MCARI, MCA PI, and MCAPSV were not significantly altered following amniocentesis in Groups 1 and 2. There was a significant increase in UAPI following amniocentesis only in Group 2.

Discussion

The findings of the present study indicate that ultrasonographic evidence of bleeding as a result of transplacental needle passage during mid-trimester genetic amniocentesis does not influence Doppler parameters in the present study cohort.

It is debated whether transplacental needle passage significantly increases the rate of complications. Although some earlier reports did find an increase in fetal loss rates (7, 8), many other studies have not found such an association (9-11). Although convincing evidence is not present in terms of fetal loss, it has been shown that transplacental needle passage may lead to certain procedural complications, such as aspiration of hemorrhagic amniotic fluid or fetomaternal hemorrhage (FMH) (10).

Table 1. Clinical data of the study population

	Group 1 (n:62)	Group 2 (n:153)	p
Maternal age [mean (y)±SD]	33.1±6.0	33.7±6.7	0.52
Gestational age [mean (weeks)±SD]	18.1±1.5	17.8±1.8	0.24
Nulliparity [n (%)]	25 (40.3)	45 (29.4)	0.11
Indication of amniocentesis [n (%)]			**0.59**
Advanced maternal age	15 (24.2)	44 (28.8)	
Sonographic markers	6 (9.7)	10 (6.5)	
Positive maternal screening	38 (61.3)	91 (59.5)	
Previous pregnancy with aneuploidy	3 (4.8)	8 (5.2)	
Placental location [n (%)]			**0.001***
Anterior	59 (95.2)	50 (32.7)	
Posterior	0	89 (58.2)	
Fundal	1 (1.6)	10 (6.5)	
Lateral	2 (3.2)	4 (2.6)	

Y: years; SD: standard deviation
*p<0.05

Table 2. Comparison of umbilical artery and middle cerebral artery Doppler parameters before and after amniocentesis between two groups

	Group 1 (n:62)	Group 2 (n:153)	p
Umbilical artery RI before amniocentesis	0.77±0.08	0.78±0.07	0.57
Umbilical artery RI after amniocentesis	0.76±0.09	0.79±0.08	0.46
Umbilical artery PI before amniocentesis	1.43±0.29	1.45±0.27	0.81
Umbilical artery PI after amniocentesis	1.39±0.29	1.51±0.36	0.43
No. of fetuses with an increase in umbilical artery RI [n(%)]	21 (34)	71 (46.5)	0.24
No. of fetuses with an increase in umbilical artery PI [n(%)]	27 (43.5)	88 (57.5)	0.07
MCA PI before amniocentesis	1.61±0.36	1.71±0.39	0.21
MCA PI after amniocentesis	1.62±0.4	1.70±0.43	0.63
MCA PSV before amniocentesis	25.6±5.3	24.5±4.4	0.26
MCA PSV after amniocentesis	24.2±5.3	24.3±4.2	0.58
No. of fetuses with an increase in MCA PSV [n(%)]	23 (37)	75 (49)	0.19

RI: resistance index; PI: pulsatility index; MCA: middle cerebral artery; PSV: peak systolic velocity

It has been previously hypothesized that hemorrhage into the amniotic cavity occurs in most cases when transplacental amniocentesis is performed (12). Visualization of blood jet from the placenta into the amniotic cavity provides ultrasono-

Table 3. Changes in umbilical artery and middle cerebral artery Doppler parameters before and after amniocentesis within groups

	Group 1 (n:62)	Group 2 (n:153)
UARI change	-0.01±0.08	0.07±0.07
UAPI change	-0.04±0.31	0.05±0.31*
MCARI change	-0.02±0.12	0.01±0.1
MCA PI change	0.01±0.48	-0.01±0.42
MCAPSV change	-0.7±4.3	-0.2±4.8

UA: umbilical artery; PI: pulsatility index; MCA: middle cerebral artery; PSV: peak systolic velocity *p<0.05

graphic evidence of transplacental hemorrhage (13). Accurate estimation of the level of transplacental bleeding into the amniotic cavity may not be possible through ultrasonography alone. Testing for fetal erythrocytes in maternal circulation may be useful to detect the presence of FMH in this case. However, this may still be of limited value to evaluate the impact of bleeding on the fetus. In the present study, most of the cases of transplacental bleeding occurred in anteriorly located placentas. However, ultrasonographically detected bleeding did not occur in all cases of anteriorly located placentas.

Middle cerebral artery peak systolic velocity is used to evaluate fetuses with anemia due to various etiologies (14). While it is primarily used to detect severity of fetal anemia in red cell alloimmunization, it can be used to diagnose fetal anemia due to different causes. Several authors have demonstrated the validity of MCAPSV in detecting fetal anemia from other causes, such as congenital parvovirus infection and non-immune hydrops fetalis (15, 16). Most authors report a sensitivity of nearly 100% in experienced centers, although this may vary depending on the experience of the operator or the severity of the fetal anemia (17, 18) . While the increase of MCAPSV is well established in chronic situations leading to fetal anemia, the role of Doppler studies in acute fetal blood loss is less clear. Results of two previous studies indicate that acute FMH also leads to an increase in MCAPSV. Baschat and associates have detected increased MCAPSV in a case of severe acute FMH, confirmed by the Kleihauer-Betke test (19). In a later study, Yamaguchi and associates demonstrated increased PSV of MCA in an actively bleeding fetus due to spontaneous rupture of a sacrococcygeal teratoma (20). To the best of our knowledge, no study has previously investigated the effect of transplacental bleeding on MCAPSV. Our results indicate that bleeding at amniocentesis did not significantly affect MCAPSV in our study population.

Most previous reports have stated that amniocentesis has no significant effect on umbilical artery Doppler parameters (5, 6, 21), while others have found transient changes or changes attributable to maternal anxiety (22, 23). Two main conclusions can be inferred based on the results of these studies. The amount of fetomaternal bleeding is significantly below the limit that triggers fetal hemodynamic responses. In addition, the physiological reaction to placental puncture in the fetoplacental unit is sufficient to contain the acute insult. Our results are mostly consistent with previously published data, as we were unable to detect any significant changes, except for increased in UAPI in Group 2. As no bleeding or transplacental passage occurred in this group, we speculate that factors other than placental perforation and bleeding (such as transient uterine activity) might cause increased UAPI.

In conclusion, ultrasonographic evidence of bleeding is commonly encountered during transplacental mid-trimester amniocentesis. This complication is almost always self-limited and has no significant short-term consequences in terms of middle cerebral and umbilical artery Doppler parameters.

Ethics Committee Approval: *Ethics committee approval was received for this study from the ethics committee of Başkent University.*

Informed Consent: *Written informed consent was obtained from patients who participated in this study.*

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