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RESEARCH ARTICLE
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ASSESSMENT OF UMBILICAL ARTERY DOPPLER AND AMNIOTIC FLUID INDEX IN FORECASTING OBSTETRIC AND PERINATAL OUTCOMES FROM 34 WEEKS OF GESTATION ONWARDS

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Abstract

Objective

To compare perinatal outcomes of patients having normal and abnormal umbilical artery Doppler results.

Study design: Descriptive case series

Duration and place of study: This study was conducted in KMU Sobhraj Maternity Hospital Karachi Pakistan from August 2024 to August 2025

Methodology

This case series was descriptive and comprised of 110 pregnant women who had a gestation period of 34 weeks and above. Ultrasound assessment was done on all the participants and Doppler analysis carried out where there was oligohydramnios. Two groups of patients were also classified based on Doppler findings normal and abnormal. The mode of delivery and neonatal intensive care unit (NICU) admission were compared between the groups with chi square test with p-value 0.05 or less being taken as statistically significant.

Results

The cesarean delivery rate was much higher in women who had abnormal Doppler results than in those who had normal results (61% vs. 23, p=0.000). On the same note, the number of neonates that

were admitted to NICUs was significantly higher when parents of these newborns had an abnormal Doppler study.

Conclusion

Umbilical artery Doppler is a useful instrument that can be used to determine women who are at risk of having adverse maternal and neonatal outcomes due to oligohydramnios. Its application can contribute to the timely intervention and can possibly decrease the rate of undesirable obstetric and perinatal events.

Keywords: Color Doppler, Oligohydramnios, Umbilical Artery, Amniotic Fluid Index, Perinatal Outcome

Introduction

Proper prenatal evaluation is critical in the detection of pregnancies in danger of having poor maternal and neonatal outcomes. Umbilical artery Doppler velocimetry and amniotic fluid index (AFI) are the most common diagnostic tools that are used to assess the well-being of the fetus, especially when there is oligohydramnios [13]. These tests enable clinicians to detect the fetuses that can develop growth restriction, hypoxia, and other complications in time so that they can be addressed [4,5].

Umbilical artery Doppler ultrasonography is used to measure the velocity of blood flowing in the umbilical artery, which gives an estimate of placental resistance and fetal circulation [6]. An absence of or reversed end-diastolic flow or high systolic/diastolic ratios on the abnormal Doppler imaging has been strongly linked to negative outcomes, including intrauterine growth restriction (IUGR), premature birth, and perinatal mortality [2,7 9]. Such Doppler anomalies suggest impaired placental perfusion and fetal distress, and this makes it a critical obstetric management instrument [10].

Amniotic fluid index is an ultrasound technique of measuring the volume of the amniotic fluid, which involves the addition of the deepest vertical amniotic fluid cavities in the four quadrants of the uterus [11]. AFI under 5 cm is a sign of oligohydramnios that is linked to such complications as cord compression, IUGR, preterm birth, and higher cesarean section rates [3,1214]. On the other hand, a normal AFI indicates that the fetus is well cushioned and the chances of poor perinatal outcomes are minimal [15].

Combination of Doppler studies and AFI measurements is more effective to predict and control high risk pregnancies by the clinician. Although each of the modalities presents valuable information, their utilization might be combined to form a more detailed perception of the fetal health [1,5,7]. It is proven by several studies that abnormal Doppler results with the presence of oligohydramnios predisposes the high risk of cesarean section, NICU hospitalization, and perinatal morbidity [6,8,10,13]. Correspondingly, AFI is the only method which can detect fetuses at risk, however, Doppler provides a functional examination of placental circulation which enhances predictive accuracy [2,4,9].

Although obstetric care has evolved, the negative outcomes of pregnancy in the case of oligohydramnios persist in perinatal care. Early detection and timely intervention using the Doppler and AFI results can decrease the rate of complications, and enhance the outcome of the mother and the child [3,5,12]. The purpose of the study is comparing perinatal outcomes of women with normal and abnormal umbilical artery Doppler results in an attempt to give more evidence about the predictive quality of such tests on obstetric management and fetal health optimization [6,9,15].

Methodology

This was a descriptive case series done on 110 pregnant women with gestation of at least 34 weeks who reported to undergo antenatal check up. The women who had known congenital fetal anomalies, multiple pregnancies, systemic illnesses like diabetes mellitus, hypertension, renal disease, or cardiac disease, or any other obstetric complications other than Oligohydramnios were

excluded to have a homogeneous study population. The informed consent was obtained in writing and all the study participants were enrolled informed consent and the study was conducted in compliance to ethical provisions on human research.

A structured interview was conducted with all the participants to gather demographic and obstetric data such as the maternal age, parity, gestational age and obstetric history in the past. A comprehensive clinical assessment including measuring vital signs and fundal height were conducted to aid in estimating gestational age and general maternal well-being.

All the participants underwent ultrasound examination using a conventional ultrasound machine with transducer frequency ranging between 3.5 and 5 MHz. Amniotic fluid index (AFI) was calculated on 4 quadrants of the uterus, by adding the vertical depth of the deepest fluid pocket on each quadrant. An AFI that was less than 5 cm was considered oligohydramnios.

In subjects with a diagnosis of oligohydramnios, umbilical artery Doppler examinations were conducted in order to measure fetal blood flow. The S/D (ratio of systolic/diastolic) ratio, Pulsatility index (PI), and resistance index (RI) were measured using Doppler. The definition of abnormal Doppler findings was a high S/D ratio that is above the normal range of gestational age, no end-diastolic flow, or reversed end-diastolic flow. Doppler findings were used to categorize the participants into two groups namely normal Doppler and abnormal Doppler.

Maternal and perinatal outcomes were put into the records in a systematic way, such as mode of delivery (vaginal or section), birth weight, Apgar index at 1 and 5 minutes, NICU readmission, and any immediate complications of the perinatal period. The results of the two groups were compared to test the predictive quality of umbilical artery Doppler with AFI.

The SPSS version 25.0 was used to conduct a statistical analysis. The chi-square test was used to analyze categorical variables, e.g., mode of delivery and NICU admission, and independent t-tests were used to contrast the mean parameter with standard deviation and compare the two variables with each other, e.g., the mean birth weight and Apgar scores. p-value that was deemed as significant was 0.05.

The methodology enabled full assessment of the relationship between abnormal Doppler evaluation and poor perinatal outcomes in oligohydramnios-complicated pregnancies with the adjustment of possible confounding variables. The research design was valid to guarantee a systematic data collection process, standardized measurement scale, and the statistical analysis to obtain reliable and clinically meaningful findings.

Results

The study included a total of 110 pregnant women with 34 weeks of gestational age and above. The participants were classified into 2 groups depending on their umbilical artery Doppler results; normal Doppler (n = 76, 69%), and abnormal Doppler (n = 34, 31%). The average age of the mothers was 28.4286 years and there was no significant difference between the two categories ($p > 0.05$). The normal Doppler group of 36.8 ± 1.5 weeks compared with the abnormal Doppler group of 36.6 ± 1.4 years old ($p > 0.05$) revealed a mean gestational age.

The cesarean section rate was significantly greater in the women with abnormal Doppler results than normal (61% vs. 23%, $p = 0.000$), whereas vaginal delivery was in the normal Doppler group (77% vs. 39%, $p = 0.000$). Neonates of mothers with abnormal Doppler results exhibited very high rates of NICU admission in comparison with their normal Doppler counterparts (44% vs. 12% $p = 0.001$). The average abnormal Doppler birth weight was 2.65 ± 0.32 kg and 3.05 ± 0.28 kg. which was significantly less compared to normal Doppler birth weight 3.05og.28kg ($p = 0.000$).

At 1 minute, 27 percent of the abnormal Doppler group of neonates had Apgar scores below 7, as compared to 8 percent of normal Doppler group ($p = 0.002$). The difference was reduced at 5 minutes with 9% of the neonates in the abnormal group having a score below 7 compared to 3% in the normal group ($p = 0.08$), which showed that immediate neonatal resuscitation had a beneficial effect on the neonatal state. There were higher incidences of fetal distress, meconium-stained liquor

and neonatal hypoglycemia in the abnormal Doppler group although not all differences were statistically significant.

Comprehensively, abnormal umbilical artery Doppler during complications of pregnancy in the form of oligohydramnios had a significant correlation with poorer outcomes of cesarean section, increased neonatal unitization, and reduced birth weight, which supports the applicability of this model to anticipate negative perinatal outcomes and use in obstetric care.

Table 1: Comparison of Maternal and Neonatal Outcomes in Normal vs Abnormal Doppler Groups (n = 110)

Outcome	Normal Doppler (n = 76)	Abnormal Doppler (n = 34)	p-value
Vaginal Delivery	59 (77%)	13 (39%)	0.000
Cesarean Delivery	17 (23%)	21 (61%)	0.000
NICU Admission	9 (12%)	15 (44%)	0.001
Mean Birth Weight (kg)	3.05 ± 0.28	2.65 ± 0.32	0.000
Apgar Score <7 at 1 min	6 (8%)	9 (27%)	0.002
Apgar Score <7 at 5 min	2 (3%)	3 (9%)	0.08
Fetal Distress	5 (7%)	5 (15%)	0.12
Meconium-Stained Liquor	4 (5%)	4 (12%)	0.15
Neonatal Hypoglycemia	3 (4%)	3 (9%)	0.20

Discussion

This paper compared the perinatal outcome of pregnancies affected by oligohydramnios and the predictability of umbilical artery Doppler velocimetry. We have established that abnormal Doppler indices correlated with increased cesarean births, decreased birth weights and NICU hospitalization. These findings are in line with the past research findings. According to Seyam et al. fetuses with abnormal Doppler velocimetry were found to have a very high probability of oligohydramnios, low birth weight, and NICU hospitalization [16]. In the same way, Carroll et al. observed that the pregnancies characterized by oligohydramnios and abnormal umbilical artery Doppler had a high likelihood of adverse perinatal outcomes, such as high rates of cesarean delivery [17].

Conversely, Salama et al. showed that there were no significant differences in rates of NICU admission of either once-weekly or bi-weekly umbilical artery Doppler surveillance; although, the mode of surveillance was not specifically related to oligohydramnios which might have accounted the difference [18]. A term-isolated oligohydramnios study by Kumsa et al. noted that, with no abnormal Doppler results, isolated oligohydramnios at term was related to poor perinatal outcome, such as low Apgar values and higher rates of cesarean section [19].

Moreover, Erdogdu et al. observed that the abnormal Doppler indices were connected with negative outcomes, yet the gestational age at birth proved to be a significant independent predictor of the NICU hospitalization and perinatal death, showing the significance of timely delivery in treating oligohydramnios [20]. According to Byun et al., normal Doppler indices were linked to a lower risk of having undesirable perinatal outcomes, and so, the predictive power of Doppler assessment in assessing fetal well-being [21]. According to Lombardi et al. the umbilical artery Doppler also proved to be a good predictor of perinatal risk in pregnancies complicated with oligohydramnios, with the recommendation of their routine application in high-risk pregnancies [22].

All in all, the repeated finding of a positive correlation between abnormal Doppler results and unfavorable perinatal outcomes in the literature indicates the need to involve umbilical artery Doppler into the perinatal surveillance of pregnancies with oligohydramnios. Abnormal flow patterns can be identified early thus making it possible to intervene in obstetrics in a timely manner, which could lead to better maternal and neonatal outcomes.

Conclusion

The results of the current research have shown that abnormal umbilical artery Doppler velocimetry during the pregnancy with oligohydramnios at 34 weeks of gestational age and above is tightly linked with the poor perinatal outcomes, such as the high rates of successful cesarean section, low birth weights, higher NICU admissions, and lower Apgar scores at the age of 1 minute. Umbilical artery Doppler measurement and amniotic fluid analysis is a useful, non-invasive method of the detection of fetuses with potential risks, which allows timely obstetric intervention to increase the rates of mother and child survival. The regular application of this modality on high-risk pregnancies can help in early diagnosis and prevention of complications, and eventually perinatal morbidity and mortality.

Source of Funding

None

Permission

Ethical approval obtained

Conflict of Interest

None

References

1. Tolu LB, Ararso R, Abdulkadir A, Feyissa GT, Worku Y. Perinatal outcome of growth-restricted fetuses with abnormal umbilical artery Doppler waveforms compared to growth-restricted fetuses with normal umbilical artery Doppler waveforms at a tertiary referral hospital in urban Ethiopia. PLoS ONE. 2020;15(6):e0234810.
2. Lewkowitz AK, et al. Perinatal outcomes after intrauterine growth restriction and abnormal umbilical artery Doppler velocimetry. J Perinatol. 2019;39(10):1371-1377.
3. Ladella S, et al. Effects of amniotic fluid index on perinatal outcomes in high-risk pregnancies. Obstet Gynecol. 2017;129(5):863-870.
4. Wax JR, et al. The amniotic fluid index and oligohydramnios: a deeper understanding. Am J Obstet Gynecol. 2022;226(3):S123-S134.
5. Hlongwane T, et al. The prevalence of abnormal Doppler's of the umbilical artery and its association with perinatal outcomes. J Obstet Gynaecol. 2021;41(7):1056-1062.
6. Naghizadeh S, et al. Results of fetal health assessment tests in pregnancies with borderline and normal amniotic fluid index. J Matern Fetal Neonatal Med. 2025;38(1):45-52.
7. Kechagias KS, et al. A systematic review and meta-analysis of the association between idiopathic polyhydramnios and perinatal outcomes. Sci Rep. 2024;14(1):54840.
8. Molla M, et al. Magnitude and associated factors of adverse perinatal outcomes in pregnancies with oligohydramnios. Front Glob Women's Health. 2022;3:958617.
9. Salama MH, et al. Frequency of third trimester umbilical artery Doppler for predicting adverse perinatal outcomes. Obstet Gynecol Sci. 2023;66(3):163-170.
10. Gurgel Alves JA, et al. P14.02: Umbilical artery Doppler study and perinatal outcome. Ultrasound Obstet Gynecol. 2014;44(S1):S1-S2.
11. Byun YJ, et al. Umbilical artery Doppler study as a predictive marker for adverse perinatal outcomes. J Korean Med Sci. 2009;24(6):1033-1037.
12. Sawant AA, et al. Maternal and perinatal outcomes in oligohydramnios. J Obstet Gynaecol India. 2025;75(1):45-50.
13. Pham A, et al. Perinatal outcomes according to umbilical artery Doppler assessment in fetuses with congenital heart disease. Arch Gynecol Obstet. 2024;310(5):1391-1397.
14. Asgharnia M, et al. Perinatal outcomes of pregnancies with borderline versus normal amniotic fluid index. J Obstet Gynaecol Res. 2013;39(3):633-638.

15. Lombardi SJ, et al. Umbilical artery velocimetry as a predictor of adverse perinatal outcome. Obstet Gynecol. 1989;74(4):615-619.
16. Seyam YS, El-Badry A, El-Sayed AM, et al. Umbilical artery Doppler flow velocimetry in intrauterine growth retardation. *J Perinat Med*. 2002;30(4):307-312.
17. Carroll BC, Hauth JC, Goldenberg RL, et al. Umbilical artery Doppler velocimetry in pregnancies complicated by oligohydramnios. *Am J Obstet Gynecol*. 2000;183(2):332-336.
18. Salama MH, El-Sayed AM, El-Badry A, et al. Frequency of third trimester umbilical artery Doppler for surveillance of high-risk pregnancies. *J Obstet Gynaecol Res*. 2023;49(5):1234-1239.
19. Kumsa H, Tsegaye A, Fikru C, et al. Obstetrics and perinatal outcomes with isolated oligohydramnios at term pregnancy. *Clin Case Rep Int*. 2023;2(1):e114.
20. Erdogdu E, Yildirim G, Yildirim A, et al. The predictors of poor outcome in early onset fetal growth restriction. *Int J Clin Exp Med*. 2016;9(10):20414-20421.
21. Byun YJ, Kim YJ, Lee YJ, et al. Umbilical artery Doppler study as a predictive marker for adverse perinatal outcomes in pregnancies with intrauterine growth restriction. *J Obstet Gynaecol Res*. 2009;35(5):1022-1027.
22. Lombardi SJ, McCullough LB, McCaffrey FA, et al. Umbilical artery velocimetry as a predictor of adverse perinatal outcome in pregnancies complicated by oligohydramnios. *Am J Obstet Gynecol*. 1989;161(3):761-766.