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Original Research Article

Prospective Study of Role of Doppler Ultrasound in Management of High-Risk Pregnancy

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Abstract

Background: High-risk pregnancies are associated with increased maternal and perinatal morbidity and mortality. Conventional monitoring methods often fail to detect early fetal compromise. Doppler ultrasound provides a non-invasive means of assessing fetoplacental circulation and detecting abnormal hemodynamic patterns that precede clinical deterioration. This study aimed to evaluate the role of Doppler ultrasound in the management of high-risk pregnancies.

Methods: This prospective observational study was conducted at a tertiary care referral hospital over 12 months and included 100 high-risk pregnant women beyond 28 weeks of gestation. Participants were randomized into two equal groups: Group A (n=50) managed without Doppler and Group B (n=50) managed with Doppler assessment of umbilical and uteroplacental arteries. Maternal and neonatal outcomes were compared between the groups. Data were analyzed using SPSS, with $p<0.05$ considered significant.

Results: The mean gestational age at delivery was significantly higher in Group B compared to Group A (37.1 vs. 36.1 weeks; p=0.041). Caesarean delivery was more frequent in the Doppler group (80% vs. 50%; p=0.006). Adverse fetal outcomes, including stillbirths and intrauterine deaths, were significantly reduced in Group B (2% vs. 18%; p=0.008). Mean birth weight was higher in Group B (2.73 ± 0.67 kg) compared to Group A (2.34 ± 0.67 kg; p=0.004). NICU admissions were lower in Group B (26% vs. 44%), though not statistically significant (p=0.059). Abnormal Doppler indices (10%) and reduced cerebroplacental ratio (8%) correlated with IUGR, low birth weight, and NICU admission.

Conclusion: Doppler ultrasound significantly improves perinatal outcomes in high-risk pregnancies by facilitating earlier detection of fetal compromise and guiding timely interventions. Despite a higher rate of caesarean sections, its use is justified by reductions in perinatal mortality and morbidity. Doppler should be considered an essential tool in the routine management of high-risk pregnancies.

Keywords: High-risk pregnancy, Doppler ultrasound, intrauterine growth restriction, perinatal outcome, caesarean section.

Introduction

Pregnancy is a dynamic physiological process that requires intricate coordination between maternal and fetal systems to ensure optimal growth and development of the fetus. While most pregnancies follow a normal course, a significant proportion are classified as high-risk, characterized by an increased potential for adverse maternal and/or fetal outcomes. [1] High-risk pregnancies may result from pre-existing maternal medical conditions such as hypertension, diabetes mellitus, anemia, or infections, as well as obstetric complications like preeclampsia, intrauterine growth restriction (IUGR), multiple gestations, or fetal structural and chromosomal anomalies. [2] Effective identification, close monitoring, and timely management of such pregnancies are essential to reduce perinatal morbidity and mortality. [3] A major challenge in the management of high-risk pregnancies lies in the early detection of fetal compromise, ideally before

it leads to irreversible hypoxia, acidosis, or intrauterine demise. Conventional modalities such as clinical examination, cardiotocography (CTG), and grayscale ultrasonography provide valuable structural and physiological insights; [4] however, their sensitivity in detecting early placental insufficiency or fetal hypoxia is often limited, particularly in the preclinical stage. This highlights the need for advanced, non-invasive, and reliable diagnostic tools for fetal surveillance that assess not just fetal anatomy, but also fetal well-being in real time. [5]

Doppler ultrasonography has emerged as one of the most significant advancements in this regard. [6] Unlike conventional ultrasound, Doppler imaging evaluates real-time blood flow patterns within fetal and maternal vessels, providing a functional assessment of the fetoplacental circulation. By analyzing vascular resistance, flow velocity, and pulsatility indices, it enables clinicians to monitor adaptive changes occurring in response to uteroplacental insufficiency or fetal hypoxia. [7]

The fetomaternal circulation continuously adapts throughout gestation to meet the growing metabolic demands of the fetus. As described in Callen's Ultrasonography in Obstetrics and Gynecology, "abnormalities in one or more of these vascular systems occur prior to the clinical and laboratory appearance of, or as a result of, many pathological conditions of pregnancy" [8].

In the setting of high-risk pregnancy, specific Doppler findings carry significant prognostic value. For instance, increased resistance or early diastolic notching in the uterine arteries may indicate defective trophoblastic invasion and poor placental perfusion, commonly associated with preeclampsia and IUGR. Similarly, absent or reversed end-diastolic flow in the umbilical.

The present study was undertaken to evaluate the clinical utility of Doppler ultrasound in predicting adverse outcomes and guiding management in various high-risk pregnancy conditions, with the ultimate aim of improving perinatal outcomes.

Material and Methods

This prospective observational study was conducted over 12 months at a tertiary care referral hospital and included 100 high-risk pregnant women randomized into two equal groups using sealed opaque envelopes. Group A (n=50) was managed without Doppler assessment, while Group B (n=50) underwent Doppler ultrasound using a continuous-wave system (Samsung RSEV020) with waveform analysis of the umbilical and uteroplacental arteries. Findings were documented numerically and graphically, and treating obstetricians were informed of abnormal results.

Gestational age was determined from the last menstrual period and early ultrasound (<24 weeks). All women underwent standard antenatal care; Group B received additional management based on Doppler indices. Inclusion criteria were high-risk pregnancies >28 weeks with factors such as hypertension, anemia, diabetes, Rh negativity, or epilepsy, regardless of antenatal care status. Exclusion criteria included multiple gestations, congenital anomalies, or maternal history of alcohol use, smoking, or autoimmune disease. Data were entered into Microsoft Excel and analyzed with SPSS. Categorical variables were expressed as percentages, continuous variables as mean ± SD, and $p<0.05$ was considered statistically significant.

Results

A total of 100 high-risk pregnant women were enrolled, with 50 in each group. The mean age of participants was 26.6 ± 5.78 years in Group A and 27.8 ± 5.76 years in Group B, with most belonging to the 21–30 year age group. The difference in age distribution was not statistically significant ($p=0.293$). The majority of women were unbooked (83% overall), with similar distribution across both groups. The median gravida was 2 in both groups, with 38% primigravida overall, and the median parity was 1. Abortion history was comparable, and the majority had one or more live births. The mean gestational age at delivery was significantly higher in Group B (37.1 ± 1.97 weeks) compared to Group A (36.1 ± 2.53 weeks; $p=0.041$). The distribution of risk factors among study participants is shown in Table 1 below:

Table 1: Risk factors distribution among study participants

High risk pregnancy*	Group A	Group B
ANEMIA	6	3
Diabetes	5	6
HTN associated	40	39
CARDIAC ISSUE	0	4
RH NEGATIVE	2	1
TRANSVERE LIE	0	1

***Multiple response type, one participant may have any number of Risk factors**

The mode of delivery differed significantly between the groups: LSCS was performed in 80% of Group B compared to 50% in Group A, while vaginal delivery was more common in Group A

(p=0.006). Full-term deliveries were more frequent in Group B (84%) compared to Group A (68%), whereas preterm births were higher in Group A (32%), though not statistically significant (p=0.061). Labour induction was significantly more frequent in Group B (74%) than Group A (32%) (p<0.001).

Table 2: Comparison of foetal Outcomes in Group A and Group B

Foetal outcome	Group A	Group B	Total	p value
Adverse Outcome[#]	9	1	10	
No Adverse Outcome	41	49	90	
Total	50	50	100	0.008*

***Statistically significant, [#]Includes Death, IUFD, Stillbirth**

NICU admissions occurred in 44% of newborns from Group A and 26% from Group B; although the difference did not reach statistical significance (p=0.059), the trend favored Doppler use. Mean birth weight was significantly higher in Group B (2.73 ± 0.67 kg) compared to Group A (2.34 ± 0.67 kg; p=0.004).

In Group B, abnormal amniotic fluid index (AFI) was noted in 10% and abnormal Doppler indices in 10%, while reduced cerebroplacental ratio (CPR<1) was observed in 8% of cases. These abnormal findings correlated with adverse neonatal outcomes, including low birth weight, NICU admission, and IUGR.

Discussion

The present study evaluated the role of Doppler ultrasound in the management of high-risk pregnancies and demonstrated that its use significantly improved perinatal outcomes. The two groups were comparable in terms of baseline characteristics such as age, gravidity, parity, booking status, and associated risk factors, ensuring a fair comparison. Hypertensive disorders were the most frequent risk factor in both groups, consistent with findings from previous studies such as those by Pinki et al. (2024) [10] and Nagar et al. (2015) [11], which also reported hypertensive disorders as the leading contributor to high-risk pregnancies. Gestational age at delivery was significantly higher in the Doppler group, indicating that surveillance may have allowed pregnancies to continue safely for longer. Similar results were reported by Singh et al. (2021) [12], who observed higher mean gestational age in the Doppler-monitored cohort. This suggests that timely detection of placental insufficiency and guided interventions can reduce preterm deliveries.

Mode of delivery showed a significant shift toward caesarean section in the Doppler group (80% vs. 50%). This finding is in agreement with Singh et al. (2021) [12] and Messawa et al. (2012) [13], who also reported higher operative delivery rates in women monitored with Doppler. The increased LSCS rate likely reflects early identification of fetal compromise, allowing clinicians to intervene before intrapartum deterioration. Although this may raise concerns about rising operative delivery, the trade-off is improved neonatal outcomes. Adverse fetal outcomes, including stillbirths and IUFD, were significantly reduced in the Doppler group (2% vs. 18%). This finding is supported by the systematic review by Imdad et al. [14], which reported reductions in perinatal mortality and stillbirth rates with Doppler monitoring in high-risk pregnancies. Our results also align with the observations of Kolate et al. (2024) [15], who found significant correlations between abnormal Doppler indices and poor neonatal outcomes, emphasizing its predictive value.

Birth weight was significantly higher in the Doppler group, with fewer cases of IUGR, again consistent with previous studies. Messawa et al. [13] reported better mean neonatal weights in Doppler-monitored pregnancies, although not always statistically significant. Similarly, our study showed that abnormal Doppler findings (10% cases) correlated with low birth weight, NICU admission, and IUGR, highlighting the utility of Doppler in identifying fetuses at risk. NICU admissions were higher in Group A, though not statistically significant. This trend reflects the ability of Doppler to identify compromised fetuses early, leading to timely delivery and reduced neonatal morbidity. Similar findings have been reported in studies by Khan et al. (2022) [16], who noted lower preterm births and better neonatal outcomes with Doppler use.

Overall, the present study reinforces the evidence that Doppler ultrasonography is an invaluable tool in high-risk pregnancy management. It facilitates early detection of fetal compromise, prolongation of pregnancy when safe, and timely intervention when necessary. Although its use may increase caesarean section rates, the substantial reduction in perinatal mortality and morbidity justifies its role in routine evaluation of high-risk pregnancies.

Conclusion

Our study demonstrates that the use of Doppler ultrasound in the management of high-risk pregnancies significantly improves maternal and fetal outcomes. While baseline characteristics such as age, gravidity, parity, and booking status were

comparable between groups, several important differences emerged. Doppler monitoring was associated with higher gestational age at delivery, increased rates of timely caesarean section, reduced incidence of preterm births, and a significant decrease in adverse fetal outcomes, including stillbirths and intrauterine deaths. Neonatal birth weight and overall outcome scores were also significantly better in the Doppler group. Although the use of Doppler increased operative delivery rates, this was justified by the marked improvement in perinatal survival and reduction in complications. These findings affirm that Doppler ultrasonography is an indispensable, non-invasive tool for the evaluation and management of high-risk pregnancies, allowing earlier detection of fetal compromise and timely clinical intervention to achieve better perinatal outcomes.

Bibliography

1. Pascual ZN, Langaker MD. Physiology, pregnancy. In: StatPearls [Internet]. StatPearls Publishing; 2023.
2. Chang KJ, Seow KM, Chen KH. Preeclampsia: Recent advances in predicting, preventing, and managing the maternal and fetal life-threatening condition. International journal of environmental research and public health. 2023; 20(4):2994.
3. Dangal G. High-risk pregnancy. The Internet Journal of Gynecology and Obstetrics. 2007; 7(1):1–7.
4. Hussain NM, O'Halloran M, McDermott B, Elahi MA. Fetal monitoring technologies for the detection of intrapartum hypoxia-challenges and opportunities. Biomedical Physics & Engineering Express. 2024; 10(2):022002.
5. Ayres-de-Campos D, Spong CY, Chandraharan E. FIGO consensus guidelines on intrapartum fetal monitoring: Cardiotocography. International Journal of Gynecology & Obstetrics. 2015; 131(1):13–24.
6. Harvey CJ, Pilcher JM, Eckersley RJ, Blomley MJ, Cosgrove DO. Advances in ultrasound. Clinical radiology. 2002; 57(3):157–77.
7. Mone F, McAuliffe FM, Ong S. The clinical application of Doppler ultrasound in obstetrics. Obstetrician & Gynaecologist. 2015; 17(1).
8. Callen PW. Ultrasonography in obstetrics and gynecology. 1988;
9. Kitili MN. Correlation of Uterine Artery Doppler Velocimetry with Laboratory Findings in Patients with Severe Preeclampsia Presenting to Kenyatta National Hospital. 2021;
10. Pinki P, Amit A, Gupta P. Doppler in High-Risk Pregnancy and Its Correlation with Feto-Maternal Outcomes: A Prospective Study. Cureus. 2024; 16(3).
11. Nagar T, Sharma D, Choudhary M, Khoiwal S, Nagar RP, Pandita A. The role of uterine and umbilical arterial Doppler in high-risk pregnancy: a prospective observational study from India. Clinical Medicine Insights: Reproductive Health. 2015; 9: CMRH-S24048.
12. Singh H, Agrawal M, Bhake A, Singh R. Color Doppler Evaluation in High-Risk Pregnancies and Perinatal Outcome. Journal of Datta Meghe Institute of Medical Sciences University. 2021; 16(2):257–60.
13. Messawa M, Ma'ajeni E, Daghistani MH, Ayaz A, Farooq MU. The role of Doppler ultrasound in high risk pregnancy: A comparative study. Nigerian Medical Journal. 2012; 53(3).
14. Imdad A, Yakoob MY, Siddiqui S, Bhutta ZA. Screening and triage of intrauterine growth restriction (IUGR) in general population and high risk pregnancies: a systematic review with a focus on reduction of IUGR related stillbirths. BMC public health. 2011; 11(Suppl 3):S1.
15. Kolate D, Suryarao P, Bhattacharjee N, Sansare S. Assessing the Role of Fetal Doppler in High-Risk Obstetrics: Evidence From a Comprehensive Study. Cureus. 2024; 16(9).
16. Khan S, Amir F, Shaikh EM, Fayaz M, Bano K. The Role of Doppler Ultrasound in High Risk Pregnancy. Journal of the Society of Obstetricians and Gynaecologists of Pakistan. 2022; 12(3):193–8.