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THE SIGNIFICANCE OF DOPPLER ULTRASOUND IN THE MANAGEMENT OF HIGH-RISK PREGNANCIES

Khalida Salim[1*], Sahira Agha[2], Bushra Khan[3], Sabahat Hamid[4], Neelam Fatima[5], Saadia Akram[6]

[1*]Khalida Salim, Resident Obstetrics and Gynaecology, Almana General Hospital Jubail Saudi Arabia. email: khalidarehman72@gmail.com
[2]Assistant Professor Obstetrics and Gynaecology, Medicare Cardiac and General Hospital Karachi Pakistan. email: S_21078bmu@hotmail.com
[3]Specialist Obstetrics and Gynaecology, Zulekha Hospital Sharjah U.A.E. email: Khan.leokhan@gmail.com
[4]Senior Registrar Obstetrics and Gynaecology, Indus hospital, DHQ Badin Pakistan. email: drsabahathamid@gmail.com
[5]Consultant Obstetrics and Gynaecology, Ibrahim Medical Center Badin Pakistan. email: neelamfatima027@gmail.com
[6]Assistant professor Obstetrics and Gynaecology, Baqai Medical University Karachi Pakistan. email: saadiaakram@baqai.edu.pk

[*]**Corresponding Author:** Khalida Salim
[*]Resident Obstetrics and Gynaecology, Almana General Hospital Jubail Saudi Arabia. email: khalidarehman72@gmail.com

ABSTRACT

Background: Mostly in well-developed countries, the major cause of death in neonatal and mothers is eclampsia and preeclampsia. Every year, approximately 50 thousand maternal deaths are recorded, which are caused by eclampsia. When we talk about the healthcare sector of Pakistan, it is reported that 34 percent of maternal deaths in Pakistan are caused by eclampsia.

Objective: To assess the prevalence of Doppler velocimetry usage among women with high-risk pregnancies and to analyse the impact of Doppler velocimetry on outcomes in the management of high-risk pregnancies.

Study design: An analytical cross-sectional study

Place and Duration: This study was conducted in Almana General Hospital Jubail Saudi Arabia from May 2022 to May 2023

Methodology: Women who had active singleton pregnancies were included in this research. Moreover, the patients had a gestational age of more than 20 weeks, frequent antenatal visits, and normal blood pressure measured. All the participants were between 17 and 34 years old. All of the participants were divided into two groups. Group A included people with an ultrasound Doppler. Group B included people without an ultrasound Doppler. SPSS version 26 was used to analyze the data. The chi-square test was used for the comparison of the results. A significant p-value was defined as less than 0.05.

Results: There were a total of 140 pregnant women included in this research. The average age calculated was 30.5 years. The average gestational age calculated was 35.2 weeks. The average body mass index was 27.5 kg/m2. There were 56 patients in group A and 84 patients in group B.

Conclusion: Positive results in both obstetric and neonatal care were observed through the monitoring of high-risk pregnancies using Doppler studies. However, the use of other well-established diagnostic investigations at each medical facility affects the relevance of Doppler in late pregnancy research.

Keywords: high-risk pregnancies, Doppler studies, pregnant women

INTRODUCTION

Mostly in well-developed countries, the major cause of death in neonatal and mothers is eclampsia and preeclampsia [1]. Every year, approximately 50 thousand maternal deaths are recorded, which are caused by eclampsia [2]. When we talk about the healthcare sector of Pakistan, it is reported that 34 percent of maternal deaths in Pakistan are caused by eclampsia [3]. Pre-eclampsia is a multisystemic disorder that mostly puts pregnancy at high risk. It usually occurs after 20 weeks of pregnancy [4]. The occurrence of pre-eclampsia is reported to be in 3% to 8% of pregnancies around the world, which represents 8.5 million cases annually [5]. Researchers have reported that pre-eclampsia has caused 4% to 6% of complicated pregnancies in developed countries [6]. The third leading cause of maternal mortality and morbidity all around the world is pre-eclampsia [7]. According to the reports of the WHO, around 60 thousand females all around the world become victims of pre-eclampsia and die [8]. The statistics also show that 24 percent of deaths are in India, while 11 percent of deaths are in the UK. There is a 4.1 percent risk of pre-eclampsia in early pregnancies.

Within the fetal blood circulation in the umbilical cord, there is the Doppler flow velocity waveform. There are such fluid flow waves (FVW) from fetal-placental circulation that are dependent on blood pressure, fetal heart rate, peripheral vascular resistance, or downstream [9]. In order to measure the Doppler signals productively and specifically, there are a number of different kinds of measurements mentioned in the literature [10]. To calculate the indicators, three variables and their ratios between them are considered. These variables are high systolic speed (A), moderate speed, and high diastolic peak speed (B). Pulsatility index and resistance index are usually used in clinical practice (PI = (A-B) / description) and (RI = (A-B) / A) [11]. Doppler waveforms were used during research that was performed during the 3rd trimester and showed positive effects on pregnancy. Nevertheless, there was an observation of a minor impact on obstetric management [12]. When Doppler studies were initiated, they helped in identifying and investigating major risks. Moreover, it is also important to establish goals and policies that involve the identification of high-risk pregnant women to be monitored and cared for, prioritising interventions, developing risk management strategies, and allocating resources.

The current study is conducted to assess the prevalence of Doppler velocimetry usage among women with high-risk pregnancies and to analyze the impact of Doppler velocimetry on outcomes in the management of high-risk pregnancies.

METHODOLOGY

The Ethical review board approved this research. Women who had active singleton pregnancies were included in this research. Moreover, the patients had a gestational age of more than 20 weeks, frequent antenatal visits, and normal blood pressure measured. All the participants were between 17 and 34 years old. Patients were randomly assigned to follow-up samples.

Exclusion criteria: Any patient who had high blood pressure, a history of multiple pregnancies, proteinuria, heart disease, or any other kidney disease was not a part of this research.

The WHO calculator was used to estimate the sample size. A 22% poly/oligohydramnios fraction without Doppler velocimetry was taken as a reference. Overall, a 95% CI was taken. All of the participants were those who were presented in the Department of Gynaecology and Obstetrics of our hospital. Every patient was informed about the research, and their written consent was obtained. Every patient's detailed history was gathered, which included information about proteinuria, high blood pressure, gestational age, and weight. With this detailed history, the frequency of high-risk

pregnancies was identified. The results of participants with Doppler velocimetry and external results were compared.

All of the participants were divided into two groups. Group A included people with an ultrasound Doppler. Group B included people without an ultrasound Doppler. During the first visit of the participants in Group A, they were given waveform studies, which were followed by tests and further followed by Doppler studies. During the Doppler flow velocity analysis, a continuous system was used. The participants positioned a wedge under one hip while lying face up and tilted sideways. The ratio of the peak systolic (S) to very low diastolic (D) Doppler shift frequency was calculated using the waves observed in the umbilical artery and a maternal uteroplacental. The patients were asked about their last menstrual period to calculate their gestational ages. All the participants had to give their blood samples to check the blood sugar level, electrolytes, blood urea, total blood count, and serum creatinine. SPSS version 26 was used to analyse the data. The chi-square test was used for the comparison of the results. A significant p-value was defined as less than 0.05.

RESULTS

There were a total of 140 pregnant women included in this research. The average age calculated was 30.5 years. The average gestational age calculated was 35.2 weeks. The average body mass index was 27.5 kg/m2. Table 1 shows the statistics of this research. Note: All values in Table 1 are shown as averages.

Table no. 1: Demographic statistics

Variables	Group A (With Doppler)	Group B (Without Doppler)
Age (years)	30.2	31.9
Body mass index(kg/m2)	28.1	27.5
Gestational age (week)	24.5	27.8
Gestational age initially	36.2	37.5

Table number 2 shows the distribution of qualitative variables.

Table no. 2: distribution of qualitative variables

Variables	N	%
Doppler velocimetry		
● With	56	40
● Without	84	60
Diabetes mellitus	61	43.5
Anemia	59	42.1
Obesity	71	50.7
C-section	102	72.8
Abnormal AF	54	38.5
Preterm delivery	56	40

Table number 3 shows the comparison of the results of patients from both of the groups.

Table no. 3: comparison of the results of patients from both of the groups

Outcomes	Group A (With Doppler)	Group B (Without Doppler)
Abnormal AF		
● Yes	26	29
● No	30	47
Preterm delivery		
● Yes	16	39
● No	39	44
C-section		
● Yes	36	65
● No	19	18

DISCUSSION

The findings showed that utilizing Doppler velocimetry in the umbilical cord to detect unfavourable pregnancy outcomes was more effective than using ultrasonography to assess fetal well-being. Interestingly, previous investigations by other writers had ignored the effect of age on pregnancy [13]. In this study, we examined how alterations in UAPI led to a threefold increase in predicting higher risks for four out of five indicators associated with adverse reproductive outcomes. Although the risk for respiratory distress syndrome was 50% higher, it did not reach statistical significance.

Several studies using numerous vasculatures found an improvement in fetal well-being, demonstrating Doppler velocimetry's ability to predict reproductive outcomes in fetus with a proven IUGR diagnosis [14, 15, 16]. We included expecting women with high blood pressure in this study because we knew it could cause placental demise and subsequent fetal risk even in the absence of obvious indications. The significant alterations observed in the Doppler velocimetry pattern, such as the complete absence of diastole or irregular flow, supplied valuable insights for assessing unfavourable birth outcomes [17]. This study looked not only for the absence or delay of diastolic alterations in the umbilical cord but also for variants in which pulsatility indices exceeded the 95th percentile.

In this study, 75% of cases had a three-day interval between Doppler scans, compared to 50% of cases in Baschat et al.'s study, which had a one-day interval [18]. In this study, the median time between the previous Doppler examination and delivery was not calculated. Certain research, on the other hand, revealed a median interval of more than 7 days [19]. The difference in results could be explained by a difference in the timing of the Doppler study in relation to delivery, especially since significant changes in the Doppler patterns of the umbilical artery and cerebral artery appeared 10–14 days before fetal status eteriorated. Premature birth is a substantial contributor to infant sickness and death. Previously, certain authors concentrated solely on neonates, particularly those under 32 weeks of gestation [20]. This is in contrast to our study's strategy, which took into account multiple pregnancy groups, allowing for a distinct investigation of neonatal outcomes as well as an assessment of the influence of preterm birth on maternal well-being.

When gestational age modifications were taken into consideration, significant results emerged. It is commonly acknowledged that in cases of placental abruption and fetal hemodynamic changes, there is a proclivity to terminate the pregnancy in order to prevent intrauterine fetal death. As a result, the relationship between Doppler alterations and decreasing gestational age demonstrates that as pregnancy duration diminishes, the prognosis for reproductive outcomes deteriorates. When evaluating the interaction between Doppler changes and gestational age, this highlights the complexities of determining pregnancy outcomes.

The Doppler indications revealed in this recent study with usual outcomes are consistent with earlier research findings and are compatible with results observed in current investigations across multiple institutions. Furthermore, when comparing normal pregnancies to atypical outcomes, our study found no statistically significant difference in rates. A significant implication of this is that Doppler examination of the uterine artery may be unreliable for recognising pregnancies with unfavourable effects such as placental abruption, which contradicts other studies' recommendations. Essentially, certain variables may have an impact on our fate. This disparity could be attributed to the small sample size, which had a significant impact on the results, emphasising the importance of having a large enough sample size to validate our findings.

The small sample size is due to a number of issues, including insufficient antenatal care facilities, the restricted use of Doppler scans in the management of pregnant women, and the prevalent low socioeconomic position in many underdeveloped areas. Because Doppler scans are commonly used in antenatal care during this period, incorporating them as a normal component of the conventional second-trimester scan can help to increase the sample size. In this study, we included a second-trimester abnormality scan to analyse the cervix concurrently. Aside from the aforementioned variables, the lack of obvious distinctions between normal and difficult pregnancies could be ascribed to a variety of unique aetiologies, which are frequently neglected in the design of much

research. This omission contributes to decreased sensitivity and clarity in a variety of scientific endeavours.

The issues highlighted in this current study exhibit similarities with findings in other research. Interestingly, however, the study contradicts prior literature by revealing that high blood pressure disorders were not the predominant cause in this cohort. This suggests that isolated hypertension might not play a significant role in causing placental abruption, resulting in no notable differences in uterine symptoms when compared to normal pregnancies. In contrast, hypertensive disorders, which typically manifest later in pregnancy and tend to be more severe, were associated with other maternal conditions like diabetes mellitus and coagulation disorders. Intrauterine growth restriction emerged as one of the more prevalent challenges observed. A theory says that IUGR happens when there is less blood flow between the uterus and the placenta, which can happen as early as 20 weeks after fertilisation. This occurs despite the restoration of uteroplacental flow with general Doppler indicators by the 22nd to 23rd week when the tests were conducted.

Although recent research indicates that preterm birth is a common problem, our data revealed no differences in Doppler indicators between preterm and full-term pregnancies. This contradicts previous research that found a link between preterm birth and uncommon Doppler abnormalities. Many of these situations could be the result of medical procedures, particularly in reaction to other concerns such as high blood pressure diseases.

CONCLUSION

Positive results in both obstetric and neonatal care were observed through the monitoring of high-risk pregnancies using Doppler studies. However, the use of other well-established diagnostic investigations at each medical facility affects the relevance of Doppler in late pregnancy research.

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