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## Original Research Article

## The role of color doppler in high risk pregnancies: A prospective comparative study

Pooja Shivaji Wadekar<sup>1\*</sup>, Mangala Sonak<sup>1</sup><sup>1</sup>Dept. of Obstetrics and Gynaecology, Government Medical College, Nagpur, Maharashtra, India

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## ABSTRACT

**Background:** Pregnancy can be considered as the most beautiful period of a woman's life. The recent medical advances are helpful in taking very good care of the female throughout her pregnancy. The pregnancy is constantly observed by clinical examination, laboratory investigations, and radiographic examinations at specific intervals throughout its course.

**Aims:** To study the role of doppler ultrasound in high-risk pregnancies.

**Materials and Methods:** This is a prospective comparative study was conducted in department of Obstetrics and Gynaecology at Government medical college, Nagpur. The study period was 12 months. 232 patients were included in this study.

**Result:** In our study, 2 patients had Chronic hypertension, 2 patients had GDM, 1 patient had Gestational hypertension, 3 patients had Anaemia, 6 patients had Heart Disease, 5 patients had HIV positive, 15 patients had Hypothyroidism, 2 patients had Increased BP, 1 patient had Overt DM, 6 patients had Pre-eclampsia, 1 patient had previous abortion, 4 patients had Rh negative, 5 patients had Sickle Cell Disease (SS) and 15 patients had Sickle Cell trait (AS). Distribution of normal doppler changes in cases according to high risk factor was statistically significant ( $p < 0.0001$ ).

**Conclusion:** In our study, NICU Admission with doppler changes was statistically significant and Association of Baby weight in cases according to doppler changes in uterine artery and Baby weight in cases according to doppler changes in umbilical artery was not statistically significant.

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## 1. Introduction

Fetal well-being is assessed in high risk pregnancies by a variety of methods which includes daily fetal movement count, biophysical profile and non stress test. These do not have a high degree of sensitivity and specificity.<sup>1</sup> Doppler ultrasound informs about the hemodynamic status of fetus and gives an efficient diagnosis of fetal jeopardy which helps in management of high-risk pregnancies.<sup>2</sup> Doppler scan is a cost effective and non invasive method to assess fetal well-being at an early stage even before physical changes in biophysical profile appear and thus is being

hailed in modern obstetrics as one of the most important achievements.<sup>3</sup>

“High risk pregnancies (HRPs) are defined as those pregnancies with preexisting or current conditions that put the mother, the fetus and the newborn baby at higher than normal risk for complications during or after the pregnancy and birth”.<sup>3</sup>

Doppler provides an estimate of downstream placental vascular resistance and placental blood flow. A strong association between reduced end diastolic umbilical artery blood flow velocimetry and increased vascular resistance in the umbilical placental micro circulation leading to fetal acidosis has already been established.<sup>4</sup>

\* Corresponding author.

E-mail address: [wadekarpooja@gmail.com](mailto:wadekarpooja@gmail.com) (P. S. Wadekar).

Specifically an increased umbilical artery systolic/diastolic ratio is a risk factor for progression of fetal acidosis, fetal distress, preterm delivery, low Apgar scores and even perinatal deaths.<sup>4</sup>

An obstetrician's decision making improves to prevent intrauterine death as hypoxic cerebral damage begin before labor and intrapartum asphyxia is probably more damaging when superimposed on underlying hypoxia.<sup>5</sup> Hence timely interventions can be taken.<sup>4</sup> In cases of early diagnosis can be done which reduces the fetal morbidity and mortality.<sup>6</sup> This technique studies the blood flow in the umbilical artery and MCA of fetus in the high-risk pregnancies especially those with preeclampsia gestational DM, IUGR.<sup>6</sup>

The present study was aimed for the assessment of perinatal and maternal outcome in high-risk pregnancies.

## 2. Materials and Methods

The present study titled 'The role of colour doppler in high risk pregnancies -A prospective comparative study' was carried out at a tertiary care institute. 116 cases and 116 controls were recruited for the study after fulfilling inclusion and exclusion criteria.

### 2.1. Inclusion criteria

1. Singleton pregnancy
2. Willing for regular ante natal follow up
3. Willing for delivery at the institute
4. Willing to participate in the study.
5. Women with a gestational age more than 28weeks
6. Pre-existing medical disorders like Hypertensive disorders of pregnancy
7. Diabetes
8. Renal disease
9. Thyroid disorders
10. Anaemia and sickle cell diseases
11. H/o Asthama/ Epilepsy/ Hepatitis
12. History of pre-eclampsia or eclampsia in previous pregnancy.
13. History of IUGR or stillbirth.
14. Oligohydramnios
15. Thrombocytopenia
16. H/O preterm delivery
17. History of recurrent Pregnancy loss
18. Pre-eclampsia in current pregnancy.
19. Extremes of age (<20 yrs and >35yrs)

### 2.2. Exclusion criteria

1. Patients with multiple pregnancies.
2. Patients with congenital anomaly of fetus.
3. Patient unreliable to follow up.
4. Patients not willing to deliver at this institute

Patients from OPD and antenatal ward were included. Informed consent was obtained. Patients were followed from initial visit to delivery. Group A had high-risk pregnancies with Doppler, Group B had matched high-risk pregnancies without. Group A underwent ultrasonographic exams with Doppler. Uterine, umbilical, middle cerebral, and ductus venosus Doppler were performed. Indices like RI, PI, and S/D ratios were measured. Abnormal patterns were noted. MCA parameters included PI, PSV, and S/D ratio. CPR was calculated. Ductus venosus Doppler was done using a triphasic waveform. Group A Doppler was performed from 32 weeks onwards, repeated as needed. Management varied based on Doppler and hospital protocols. Group B was managed according to protocols. Delivery details and fetal outcomes were recorded.

### 2.3. Statistical analysis

For statistical analysis data were entered into a Microsoft excel spreadsheet and then analyzed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism version 5. Data had been summarized as mean and standard deviation for numerical variables and count and percentages for categorical variables. Two-sample t-tests for a difference in mean involved independent samples or unpaired samples. Unpaired proportions were compared by Chi-square test or Fischer's exact test, as appropriate.

P-value  $\leq 0.05$  was considered for statistically significant.

## 3. Results

As per Table 1 - total number of primigravida in cases were 76 (with maximum distribution among 18-25 years) and in controls were 75 (with maximum distribution among 18-25 years). Total number of multigravida in cases were 40 (with maximum distribution among 25-30 years) and in controls were 41 (with maximum distribution among 18-25 years).

As per Table 2 cases and controls were divided according to high risk factors. Sickle cell trait/disease was the most common risk factor in cases(24%) and controls (25%).

According to Table 3 cases and controls were divided according to gestational age. Maximum cases were of gestational age 34-36 weeks in cases and more than 36 weeks in controls.

According to Table 4 cases and controls were divided according to mode of delivery. Maximum cases delivered by LSCS and maximum controls by vaginal delivery.

As per Table 5 most common complication was need for blood products in both cases and controls.

As per Table 6 babies of 50% cases and 45.6% controls had poor perinatal outcome. Among cases 28% had normal doppler and 21% had abnormal doppler.

As per Table 7 babies of 20% cases and 30% controls needed NICU admission. Among those 20% cases 6% had

**Table 1:** Distribution of cases and controls according to age and parity

Age group	Cases		Controls	
	Primi	Multi	Primi	Multi
< 18	1	0	2	0
18 to 25	41	16	38	20
25 to 30	25	19	27	15
30 to 35	07	04	05	06
>35	02	01	3	00
Total	76	40	75	41

**Table 2:** Distribution of cases and controls according to high risk factors

High risk Factors	Number of cases	%	Number of controls	%
Chronic hypertension	5	4.3	9	7.7
GDM, Overt DM	5	4.3	5	4.3
Gestational hypertension	9	7.7	9	7.7
Severe Anemia	4	3.4	4	3.4
Heart Disease	7	6.03	8	6.8
HIV positive	6	5.1	6	5.1
Hypothyroidism	23	19	23	19.8
Severe pre-eclampsia and eclampsia	17	14.5	13	11
BOH	1	0.8	0	0
Rh negative	11	9.4	10	8.6
Sickle Cell (SS, AS)	28	24	29	25
<b>Total</b>	<b>116</b>	<b>100</b>	<b>116</b>	<b>100</b>

**Table 3:** Distribution of cases and controls according to gestational age

Gestational age	Cases	%	Controls	%
28 to 30wk	3	2.5	5	4.3
31 to 32wk	2	1.7	2	1.7
32 to 34wk	5	4.3	1	0.8
34 to 36wk	22	18.9	22	18.9
> 36wk	84	72.4	86	74.1
Total	116	100	116	100

**Table 4:** Mode of delivery in cases and controls

Mode of delivery	Cases	%	Controls	%
Vaginal	40	34.2	69	59.3
Instrumental delivery	1	0.8	02	1.7
LSCS	75	65	45	39
<b>Total</b>	<b>116</b>	<b>100</b>	<b>116</b>	<b>100</b>

**Table 5:** Maternal complications in cases and controls

Complications	Cases (n=116)	%	Controls (n=116)	%
PPH	17	14.6	20	17.2
Sepsis	7	6.03	10	8.6
ICU Admission	0	0	5	4.3
Need of Blood Products	24	20.6	26	22.4
Total	48(41.3%)	41.3	61(52.5%)	52.5

**Table 6:** Perinatal outcome of cases (normal and abnormal doppler) and controls

Perinatal Outcome	Cases (n=116)	Normal Doppler (n=68)	Abnormal Doppler (n=48)	Controls(n=116)
Neonatal death	01	0	1	10
Fresh still born	30	16	14	19
Macerated still born	27	17	10	24
<b>Total</b>	<b>58(50%)</b>	<b>33(28.4%)</b>	<b>25(21.5%)</b>	<b>53(45.6%)</b>

**Table 7:** Requirement of NICU admission in cases (normal and abnormal doppler) and controls

NICU Admission	Cases (n=116)	Normal Doppler (n=68)	Abnormal Doppler (n=48)	Controls (n=116)
Required	20(17.2%)	7(6%)	35(30%)	30(25.8%)
Not required	96(82.7%)	61(52.5%)	13(11.2%)	86(74.8%)
<b>Total</b>	<b>116</b>	<b>68(58.6%)</b>	<b>48(41.3%)</b>	<b>116</b>

**Table 8:** Perinatal outcome in cases with doppler changes

Perinatal outcome	Uterine artery	Umbilical artery			Middle cerebral artery	Deranged CPR
	Diastolic Notching	Increased S/D	AEDF	REDF	Increased Distolic Flow	
Neonatal deaths	0	0	0	0	1	0
Macerated stillborn	1	2	3	0	1	3
Fresh still born	2	2	3	1	2	2
<b>Total(n=116)</b>	<b>3</b>	<b>4</b>	<b>6</b>	<b>1</b>	<b>4</b>	<b>5</b>

normal doppler and 30% had abnormal doppler.

As per Table 8 the most common doppler changes in cases of neonatal deaths was increased diastolic flow in middle cerebral artery, in macerated still born was absent end diastolic flow in umbilical artery and deranged CPR, in fresh still born was absent end diastolic flow in umbilical artery. Overall most commonly involved doppler change was absent end diastolic flow in umbilical artery.

#### 4. Discussion

In our study, age range was from 17 to 38 years. 49.1% cases were in the age group of 18 to 25 years and 58% controls were in the age group 18 to 25 years. In the study by Upma Saxena, et al<sup>7</sup> age ranged from 20-35 years with 65.33% women in the age group of 26-30 years with mean age of 28.53 years. In the study by Kavitha G et al.<sup>8</sup> women were divided into two age groups 20-25 years (n=60) and 26-30 years (n=80). In our study majority of cases and controls were primigravida 65.5% and 64.6% respectively. In the study by Akhtar Ahmed et al.<sup>9</sup> most of the cases were multigravida (64%). In the study by Messawa, et al.<sup>10</sup> multipara women 85 (85%) were insignificantly high in group A than in group B. in both cases (72.4%) and controls(74.1%). In our study maximum numbers of cases and controls were found in the gestational age of more than 36 weeks. In cases(1.7%) the least numbers were found in the age group 31 to 32 weeks and in controls(1.7%) it was found in age group 32 to 34 weeks. In the study by Singh H et al<sup>11</sup> maximum cases(37%) in the study group presented at gestational age between 34.1 and 37 weeks. Mean gestational age was 35.5 weeks for the study group. In the study by Akhtar Ahmed et al<sup>9</sup> most of patients were more than 37 weeks of gestation. The most common high risk factor in cases and controls was AS/SS pattern. In the study by Singh H et al<sup>11</sup> maximum cases were of PIH(20%), followed by anemia(15%) and pregnancy with Rh factor

negative blood group (14%), BOH(8%). In the study by Urmila S, et al<sup>12</sup> the most common risk factor found in the study group was PIH (44%) either alone (22%) or in combination with other risk factors like IUGR and BOH (22%). In our study most common mode of delivery was LSCS in cases and controls. In the study by Urmila S, et al.<sup>12</sup> in the high risk group majority of the patients (78%) had LSCS (lower segment cesarean section) while in the control group most of the patients had vaginal delivery.

Out of 116 cases, there were 58(50%) perinatal deaths. Out of which 0.86% were neonatal deaths, 25.8% were fresh still births, 23.2% were macerated still births. Out of 116 controls, 53(45%) were perinatal deaths. Out of which 18.8% were neonatal deaths, 35.8% were fresh still births, 45.6% were macerated still births. The most common doppler finding here was deranged CPR (Cerebral placental ratio). In the study by Amin et al<sup>13</sup> among 46 pregnancies with abnormal Doppler, the perinatal mortality and morbidity was 41.3% and 23.9%, respectively, as compared to patients with normal Doppler waveforms with 3.7% perinatal mortality and 11.1% morbidity. In the present study out of 116 cases 17.2% cases required NICU admission and 82.7% did not require NICU admission. In controls 25.8% required NICU admission and 74.8% did not require NICU admission. In our study it was found that, in patients with normal doppler 89.7% did not require NICU admission and 10.3% needed NICU admission. In patients with abnormal doppler 72.9% did not require NICU admission and 27.1% needed NICU admission. This was found to be statistically significant. Increased S/D in umbilical artery and AEDF showed maximum number of admissions. Association of high risk factors with NICU admissions was found to be statistically insignificant. In the study by Arduini and Rizzo<sup>2</sup> 46.7% (56 of 120) of fetuses, there was at least one of the following adverse outcomes: perinatal deaths, cesarean delivery for fetal distress, asphyxia that necessitate admission to the neonatal

intensive care unit for more than 48 hours.

In our study 0.8% cases and 8.6% controls had neonatal deaths. In this 1 case (0.8%) with abnormal doppler there was increased diastolic flow in MCA in a patient of overt DM. This baby had weight of 2.6kg and was delivered at a gestational age of 36 weeks. In the study by Mikovic et al.<sup>14</sup> in the high risk group with abnormal Doppler indices, the average birth weight was 1327+ 245gm, neonatal mortality 8.6%, while perinatal mortality was 14.3%. Out of 48 cases with deranged doppler 9 had changes in uterine artery (7.7%), 4.3% had changes in umbilical artery, 5.17% had changes in MCA, 0.8% had changes in ductus venosus.

## 5. Conclusion

Thus, it is seen that abnormal obstetric umbilical artery velocimetry is a good predictor for predicting poor perinatal outcome like IUGR, NICU admissions, perinatal complications and even neonatal deaths. High risk pregnancies present a potential challenge for obstetricians for effective care to result in better maternal and perinatal outcome. Thus, doppler ultrasound can serve as a non-invasive, non-traumatic, and easily available diagnostic tool for antenatal monitoring of high risk pregnancies.

## 6. Source of Funding

None.


## 7. Conflict of Interest


None.

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## Author biography

**Pooja Shivaji Wadekar**, Junior Resident  <https://orcid.org/0009-0002-0883-6104>

**Mangala Sonak**, Associate Professor  <https://orcid.org/0000-0002-4450-6068>

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