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Role Of Doppler Ultrasound In Pregnancy Induced Hypertension

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ABSTRACT

With the advent of B-mode and Doppler USG, it became possible to see specific vessels and to sample waveforms, providing a window into the feto-placental circulation. To assess the blood flow in umbilical artery, middle cerebral artery and uterine artery using Doppler ultrasound in patients with pregnancy induced hypertension and its role in predicting the peri-natal outcome. It was a one year hospital based prospective study. A total of 120 ante-natal patients were studied. All antenatal cases more than 24 weeks of gestation clinically diagnosed as Pregnancy Induced Hypertension were taken for the study. The study showed that in patients with Absent End Diastolic Flow (AEDF) and Reverse End Diastolic Flow (REDF) of Umbilical Artery, the abnormal fetal outcome was 100%. The abnormal fetal outcome was 94.4% with bilateral uterine artery notch presentation, 90% with unilateral notch. In predicting adverse perinatal outcome UA PI has got the highest sensitivity among other parameters i.e. 84.2 %. While bilateral Ut A notch has got the highest specificity of 95.4 %. Thus, Colour Doppler study is a simple, quick and non-invasive procedure for ante-partum foetal surveillance in patients with PIH.

Keywords: Pregnancy Induced Hypertension, Umbilical artery Pulsatility Index, Uterine artery notch , Intra-Uterine Growth Retardation , Absent End Diastolic Flow, Reversed End Diastolic Flow.

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INTRODUCTION

Worldwide hypertensive disorders of pregnancy complicate approximately 5–10 % of pregnancies. Incidence of hypertensive disorders in India is found to be 10.08 % as observed through the data collected by the National Eclampsia Registry (NER). As the patho-physiology of Pre-eclampsia is based on impaired placental perfusion, the use of Colour Doppler Ultrasound is a useful non-invasive method to obtain qualitative and quantitative assessment of both maternal and fetal hemodynamics. With the advent of B-mode and pulsed-wave Doppler USG, it became possible to see specific vessels and to sample waveforms, providing a window into the fetoplacental circulation. Keeping these facts in mind, this study was framed to analyse the blood flow in umbilical artery, middle cerebral artery and uterine artery using Doppler Ultrasound in a group of patients with PIH and thus predict the peri-natal outcome.

Aims and Objectives

1. To analyze the blood flow in umbilical artery, middle cerebral artery and uterine artery using Doppler Ultrasound in a group of patients with PIH
2. To Asses the role of Doppler USG in predicting perinatal outcome in patients of pregnancy induced hypertension

MATERIALS AND METHOD

This is a hospital based prospective study with due approval of the institutional Ethics Committee. A total of 120 ante-natal patients who were diagnosed with Pregnancy Induced Hypertension and were referred to our Department were studied during a period of 1 year, from April 2018 to March2019. The Inclusion and Exclusion Criteria been mentioned below.

Inclusion criteria:

1. -All antenatal cases more than 24 weeks of gestation clinically diagnosed as Pregnancy Induced Hypertension (Gestational age determination was based on a best estimate from menstrual history, clinical gestational age or fetal biometry preferably in the first trimester or early second trimester).
2. -Age group 19-34 years
3. -Both Primi and Multigravda.

Exclusion criteria:

1. -All ante-natal cases with chronic hypertension.
2. -All cases less than 24 weeks of gestation diagnosed as PIH.
3. -Pregnancies with chromosomal or structural fetus malformations
4. -No feasibility to undergo Doppler USG (Obesity, Oligohydramnios)
5. -Intrauterine deaths at the time of first Doppler study.
6. -Patients who cannot be followed up.

The patients who fulfilled the above mentioned inclusion criteria and had none of the exclusion criteria mentioned above were explained about the study and informed written consent was obtained. Before our study, a Proforma with detailed questionnaire was filled up for every participating patient. The particulars of the patient, detailed history and clinical examination findings were noted. All routine investigations were noted and considered baseline for further assessment and follow up.

Examination was performed with the patient in supine position. Fetal weight was estimated by obtaining four standard US measurements: biparietal diameter, head circumference, abdominal circumference, and femur length. For purposes of this review we used an estimated fetal weight less than the 10th percentile for gestational age as the definition for IUGR.

Equipment Used: Samsung RS80A high end USG machine. Colour Doppler Ultra-Sonography was done and the arteries that were considered for the analysis were Umbilical Artery, Uterine Artery and Middle Cerebral artery. The wave forms were obtained during foetal inactivity and apnoea.

Parameters evaluated:

Pulsatility index (PI), resistance index (RI) and systolic/diastolic ratio of these arteries were obtained. These values were considered abnormal when they lie beyond the 5th and 95th percentile for gestational age.

Follow up:

Patients were followed up till delivery. The foetal outcome immediately after birth was recorded. Any newborn requiring NICU admissions were recorded. The weight of the new born taken from the recorded data from the labour room. IUD, IUGR, birth weight less than 2.5 kg and NICU admission are collectively taken as adverse perinatal outcome.

Statistical Analysis:

The data collected on various aspects were compiled, tabulated and subject to statistical analysis. Sensitivity, Specificity, Negative predictive values and positive predictive values of umbilical artery PI, CPR <1, Uterine artery notch and uterine artery PI are calculated manually. True positives are the patients with adverse perinatal outcome and have got abnormal parameters; False negative patients are the patients with abnormal perinatal outcome despite parameters within 5^{th} and 95^{th} percentile; False positive are the cases with abnormal parameters but with normal perinatal outcome and True negative are the cases with normal perinatal outcome and normal parameters. The data are also subjected to graphical representation.

RESULTS AND DISCUSSION

- A total of 120 patients were analyzed in our study.

- The cases under PIH were distributed under the age group of < 20, 20-24, 25-29, and 30-34yrs. The majority of the PIH cases came under the age group of 20-24 accounting for about 40%. 33% cases were found in 25-29 age groups. Thus 73 % of cases were found in 20-29 yrs age group.
- In this, pregnancies with hypertension group 70 (58%) patients were Primigravida. 36 (30%) patients were second gravida. Rest of 14 cases were Third gravida or more.
- Uterine Artery PI was normal in 53.4% and abnormal in 46.7% of cases.
- On evaluation of the CP ratio, it was found to be normal (>1) in 46.67% and abnormal (<1) in 53.34%.
- 60% of the cases had abnormal Umbilical Artery PI, where 12 cases had AEDV and 4 cases had REDV.
- On comparison of the outcomes of abnormal Umbilical Artery Indices, out of 72 cases 88.8% had abnormal fetal outcome and out of 64 cases of abnormal C/P ratio, 87.5% was the abnormal fetal outcome.
- On evaluation of the AEDF and REDF of Umbilical Artery, the abnormal fetal outcome was 100%.
- In relation to the uterine artery indices, the abnormal fetal outcome was 94.4% with bilateral notch presentation, 90% with unilateral notch presentation and 37.5% with no notch.
- With both B/L notch presentation in Uterine Artery and abnormal Umbilical Artery the abnormal fetal outcome was found to be 100%.
- In predicting adverse perinatal outcome UA PI has got the highest sensitivity among other parameters i.e. 84.2 %. While bilateral Ut A notch has got the highest specificity of 95.4 %.
- For predicting IUGR, Umbilical Artery has got the highest sensitivity (83.3%). CPR (<1) , has got a sensitivity and specificity of 72.2 % and 75% respectively.

Pregnancy induced Hypertension is a dreaded complication of pregnancy which can lead to a wide variety of complications. So, timely diagnosis is an important step towards its management.

The age distribution of the participants in our study suggests that higher number of patients (56.6%) with PIH were below 25 years of age. This is comparable to a collaborative study of hypertensive disorders of pregnancy by WHO which concluded that preeclampsia occurs more commonly during first pregnancy and in very young or older women[1]. It is also comparable to a study done by Manjusha Sajith et al[2] where highest incidence of hypertension occurred in the age group of 18-22 years (41.3%) and primi gravida patients (53.8%). Also Nulliparous women

have a three-fold higher risk of pre-eclampsia compared with multiparous women[3]. In our study maximum 70 numbers of patients (58%) were primi gravida.

In the present study there were total 12 cases with absent end-diastolic flow (AEDF) and 4 cases with reversed end-diastolic flow (REDF) in umbilical artery. In AEDF group, 8 cases had abnormal foetal outcome and 4 cases had delivered still-born babies. In all 4 cases with REDF, the outcome was still-birth. Madazli et al[4] has shown that the prevalence of perinatal death in foetuses with absent or reversed end diastolic flow velocity is reported to be over 40%. Vijay kumar Mane et al [5], out of 10 patients of reversal/absence end diastolic velocity, 4(40%) had IUFD and 6 patients (60%) had to undergo emergency LSCS for compromised foetus due to chronic hypoxia of which 2 had early neonatal death.

Out of 72 cases with IUGR, 60 (83.3%) had abnormal umbilical arterial Doppler PI and 12 (16.6%) had normal Doppler parameters. These results are higher comparable to a study done by Hinal Bhagat et al [6], in which out of 55% pregnancies affected with IUGR, (68%) had abnormal umbilical arterial Doppler indices. It suggests that IUGR and abnormal perinatal outcome is associated with abnormal umbilical artery Doppler study.

We got 72 patients with abnormal UA PI, out of which 64 (88.8 %) developed some adverse foetal outcome which can be compared with the study done by Smitha K et al [7] in which out of 100 patients, 50 patients had abnormal UA PI (95th Centile) and 42 (84%) developed at least one adverse outcome.

In our study Umbilical artery PI has got the highest sensitivity of 84.2% and 83.3 % and specificity of 81.8 % and 75% for predicting adverse perinatal outcome and IUGR respectively. Similar to Yoon et al [8] where Umbilical artery PI has got the highest sensitivity for predicting the adverse foetal outcome and IUGR. Another study comparable to ours was done by V.A.A Lakshmi et al[9] where sensitivity of umbilical artery PI for predicting adverse foetal outcome came out to be 86.7 % and specificity came out to be 63.8 %.

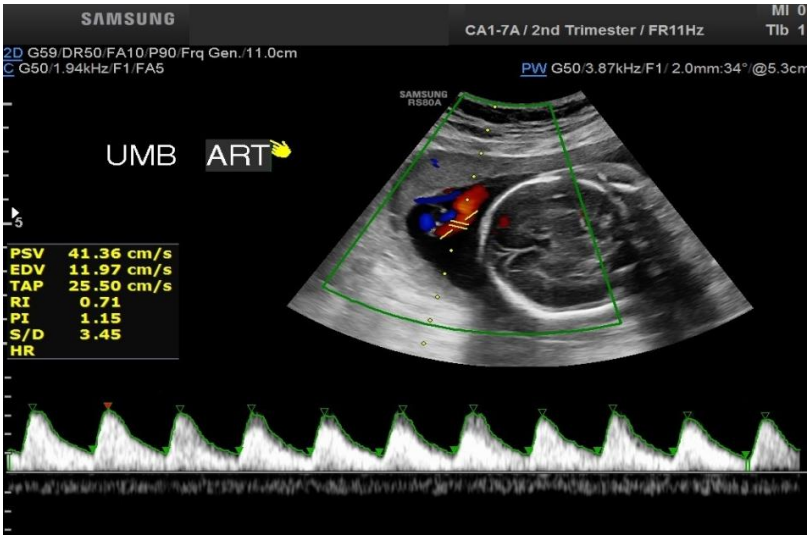


Figure 1: Showing normal umbilical artery waveforms

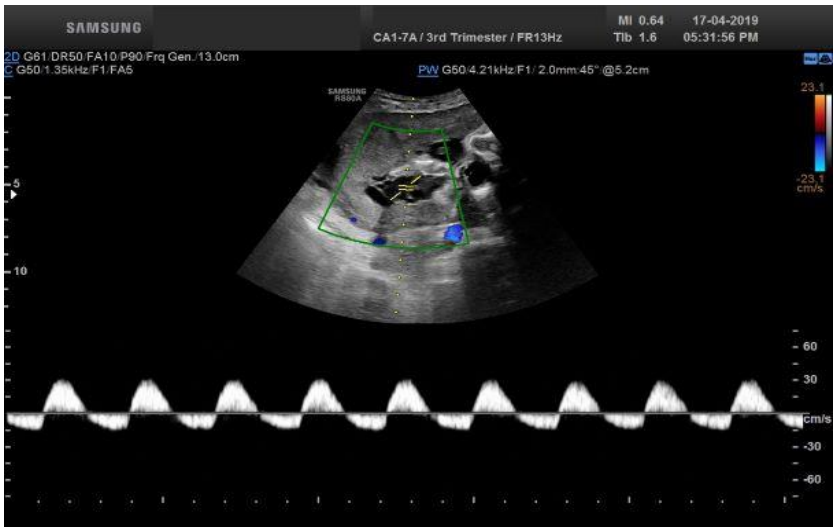


Figure 2 :Another patients showing reverse end diastolic flow

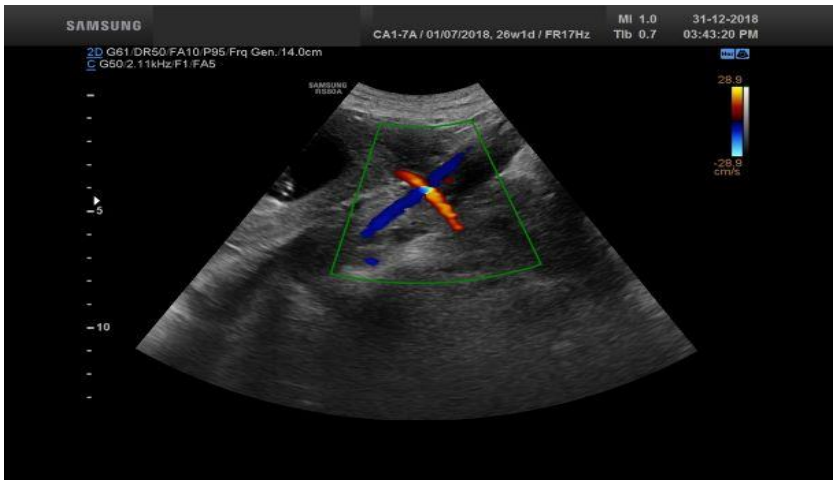


Figure 3: Showing localization of uterine artery at the level of crossover of external iliac artery

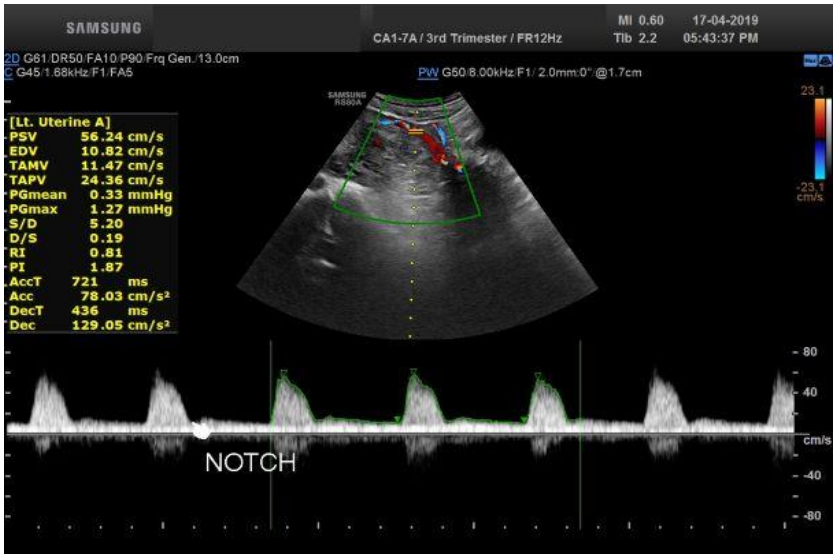


Figure 4: Spectral waveforms showing marked uterine artery notching

A total of 120 patients were included in the study based on inclusion and exclusion criteria. Colour Doppler Ultrasonography was done to assess for any abnormalities in the Uterine, Umbilical and Middle Cerebral Arteries.

Table A) Distribution of Cases According To Age

Age Group(years)	No. Of cases
<20	20
20-24	48
25-29	40
30-34	12

Table B) Distribution According To Parity

Parity	No. Of cases
Primi Gravida	70
Second Gravida	36
Third Gravida	14

Table C) Distribution of Cases under Normal and Abnormal Uterine Artery Indices

Uterine artery	No. Of cases
Normal	64
Abnormal PI	56

Table D) Distribution of Cases under Normal and Abnormal Umbilical Artery Indices

Waveform(UA)	No. of Cases
PI(>95th percentile)	72
AEDV	12
REDV	4
Normal	48

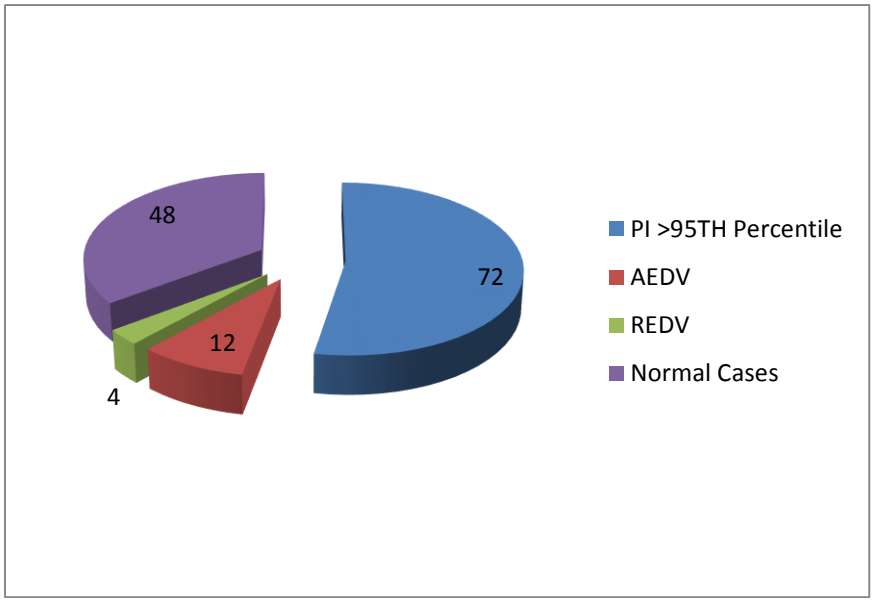


Table E) Distribution of Cases under Normal and Abnormal Cerebroplacental Ratio

CP Ratio	No. Of cases
<1 (Abnormal)	64
>1 (Normal)	56

Table F) Comparison of Fetal Outcome in Cases In Relation To Umbilical Artery Indices

Doppler Findings	Fetal Outcomes	
	Normal	Abnormal
UA PI Abnormal (>95th Percentile)- 72	8	64 (88.8%)
Abnormal CP ratio (<1) - 64	8	56(87.5%)
AEDF - 12	0	12(100%)
REDF – 4	0	4(100%)

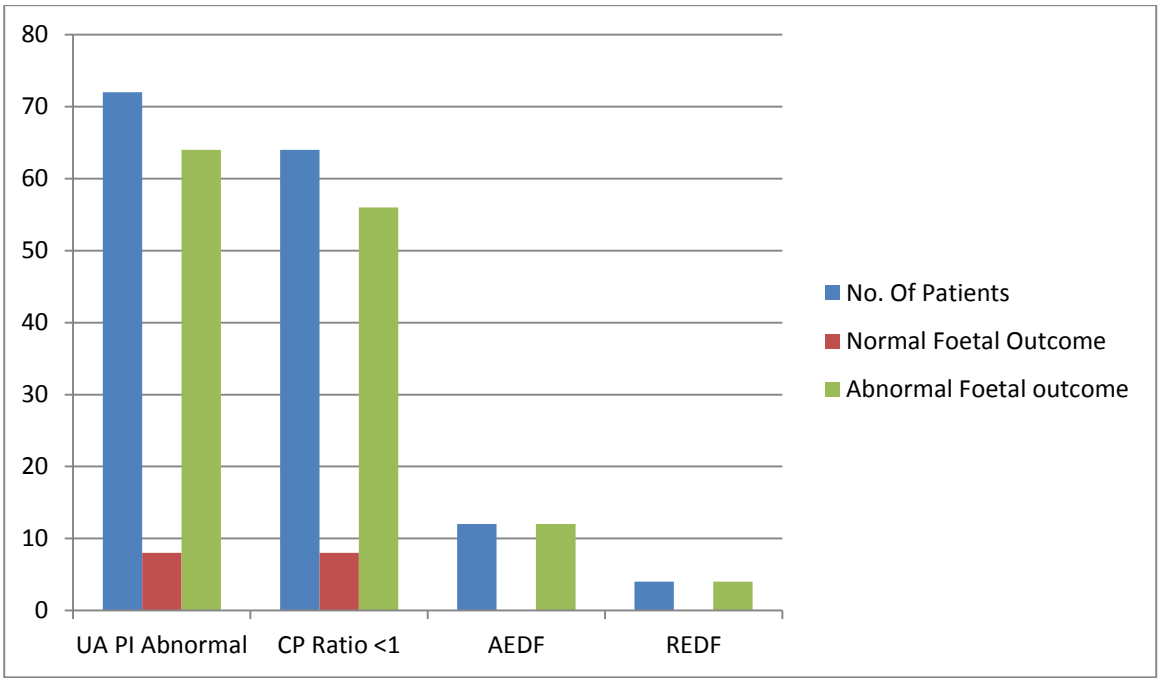


Table G) Comparison of Fetal Outcome In Cases In Relation To Diastolic Notch In Uterine Artery

Doppler Findings (No. of cases)	Fetal Outcomes	
	Normal(44)	Abnormal(76)
Bilateral Notch (36)	2	34
Unilateral Notch (20)	2	18
No Notch (64)	40	24

Table H) Fetal Outcome in Cases of Bilateral Uterine Artery Notch In Relation To Umbilical Arterial Doppler

B/L Uterine Artery Notch (36)	UA PI	Fetal Outcomes	
		Normal	Abnormal
	Normal (10)	2	8
	Abnormal(26)	0	26

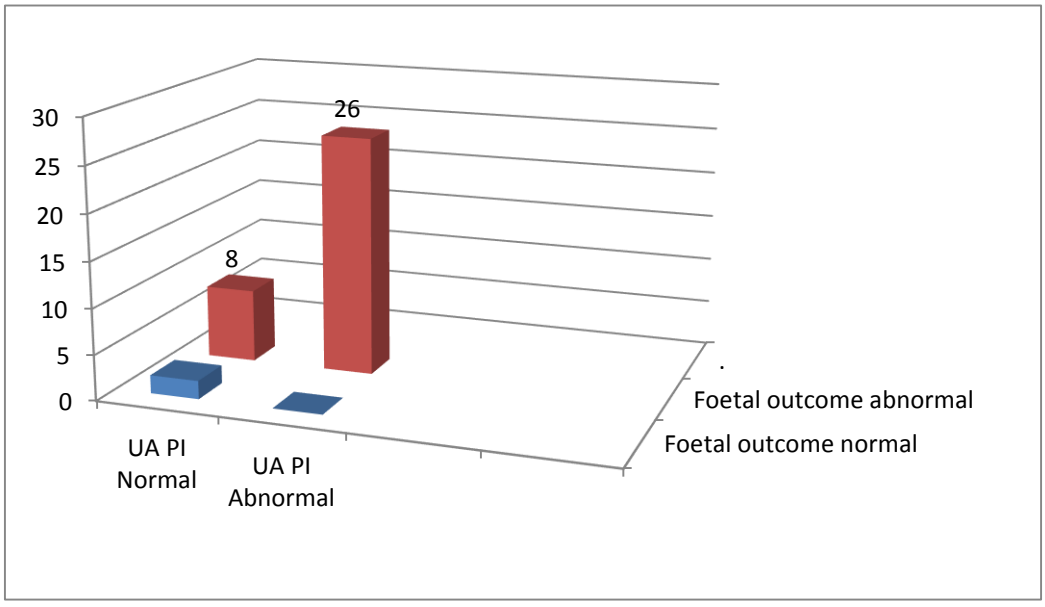


Table I) Diagnostics Value Of Doppler Findings For Adverse Pregnancy Outcome

Doppler Findings	Adverse Pregnancy Outcomes (78)			
	Sensitivity	Specificity	PPV	NPV
UA PI	84.2%	81.8%	88.8%	75%
CPR <1	73.6%	81.8%	87.5%	64.2%
Ut A Notch B/L	44.7%	95.4%	94.4%	50%

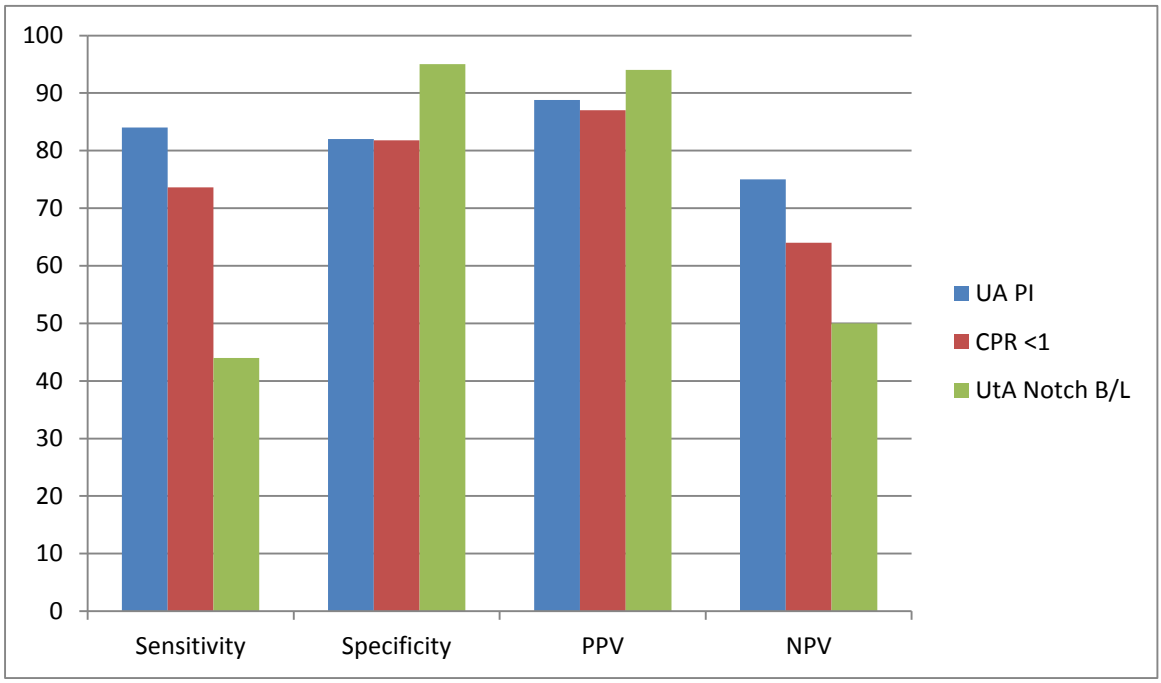
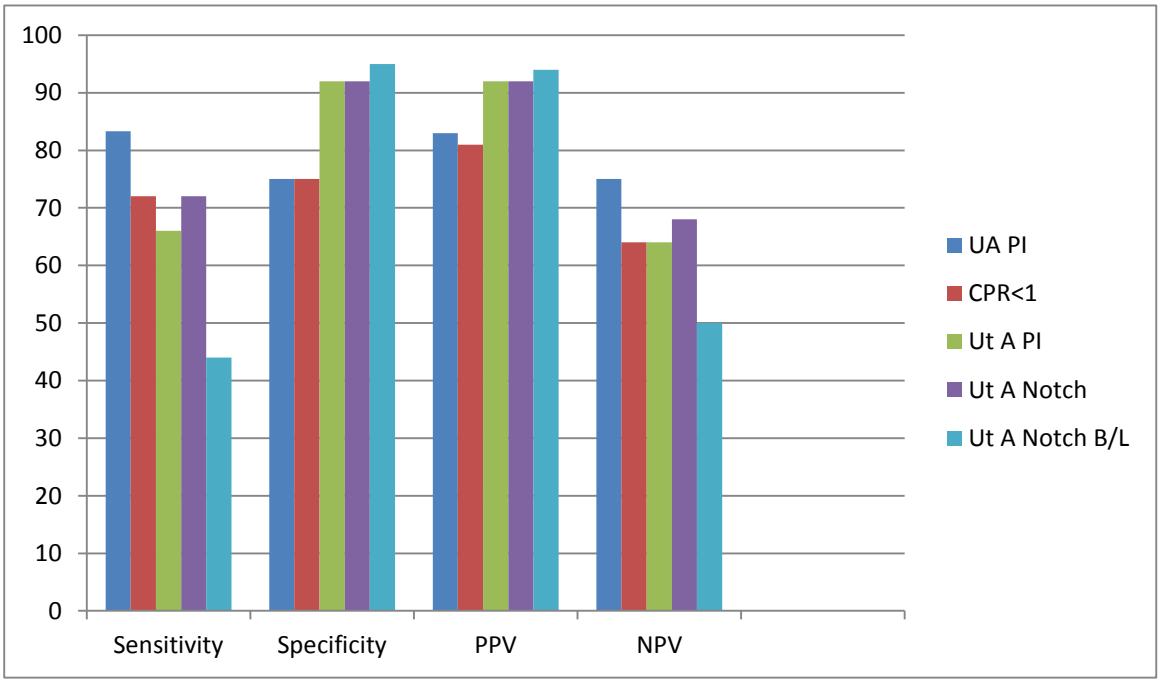


Table J) Diagnostics Value of Doppler Findings For IUGR

Doppler Findings	IUGR (72)			
	Sensitivity	Specificity	PPV	NPV
UA PI	83.3%	75%	83.3%	75%
CPR <1	72.2%	75%	81.2%	64.2%
Ut A PI	66.6%	91.6%	92.3%	64.7%
Ut A Notch	72%	91.6%	92.8%	68.7%
Ut A Notch B/L	44.7%	95.4%	94.4%	50%



CONCLUSION

From our study we can draw a conclusion that pregnancy induced hypertension is associated with significant fetomaternal morbidity and mortality. Absent end diastolic flow and reversed end diastolic flow in umbilical artery is an ominous sign for adverse perinatal outcome. Reversed end diastolic flow is more ominous than absent end diastolic flow for predicting perinatal mortality. The newborns of patients having both abnormal umbilical artery PI and bilateral uterine artery notch invariably needs NICU admissions. As a single parameter, Umbilical artery PI has got the highest sensitivity while uterine artery notch has got the highest specificity for predicting adverse perinatal outcome. Colour Doppler study is a simple, quick and non-invasive procedure for antepartum foetal surveillance.

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