Document heading doi: 10.21276/apjhs.2019.6.3.5 **Original Research Article**

Antenatal blood pressure for prediction of gestational hypertension: A prospective observational study

Rameshwari Beck[1], Shashi Dinkar Minj[2*], Ayon Mitra[3] , Syed Shah Nawaz Al Hossaini[3]

[1]Assistant Professor, Department of Obstetrics and Gynaecology, Hazaribagh Medical College (HMCH), Kolghatti, Hazaribagh, Jharkhand 825301, India
[2]Associate Professor, Department of Anaesthesiology, ICARE Institute of Medical Sciences and Research, Haldia, PO- Balughata, Banbishnupur, West Bengal 721645, India
[3] Assistant Professor, Department of Obstetrics & Gynaecology, ICARE Institute of Medical Sciences and Research, Haldia, PO- Balughata, Banbishnupur, West Bengal 721645, India

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ABSTRACT

Background: Hypertensive disorders during pregnancy occur in women with preexisting primary or secondary chronic hypertension, and in women who develop new-onset hypertension in the second half of pregnancy. Early detection of preeclampsia will help reduce the morbidities and mortalities associated with the disorder. The study aims to evaluate the clinical utility of second trimester MAP in the prediction of preeclampsia or gestational hypertension. **Methods:** This was a prospective cohort study of 200 normotensive, nonproteinuric pregnant women without prior history of gestational hypertension. The women were booked patients attending the antenatal clinic at a tertiary care teaching Hospital, Haldia and were all in their second trimesters of pregnancy. The outcome measures were systolic blood pressure, diastolic blood pressure, and MAP. The end point of the study was the development of preeclampsia or gestational hypertension. The diagnosis of preeclampsia was made by the attending obstetrician. **Results:** A prospective observational study was carried out on 200 pregnant women between 16-26 weeks of gestation during the time period of 1st Jan 2016- 30th Dec 2016 and results were analyzed. The maximum number of subjects (51.5%) were in the peak reproductive age group of 26-30 years followed by 21.5% and 18% from (21-25 yrs) and 31-35 yrs respectively. The mean age of the study cases was 27.90 years with a SD of ±7.24. The youngest in the study was 19 years of age and eldest was 42 years of age. The parity distribution of the study population was primigravida (39.5%) and 60.5% were multigravida. The development of gestational hypertension among the subjects was 11.5%. Rest of the pregnant women were normotensive. The maximum number of subjects in the gestational hypertension group was in the age group of 26-30 years (n=23, 34.8%) followed by 21-25 yrs age group (30.4%) and 31-35 yrs age group (17.4%). **Conclusions:** Accurate measurement of blood pressure (BP) is crucial to the diagnosis and management of hypertensive disorders in pregnancy

Key words: Mean arterial blood pressure, pregnancy, gestational hypertension, preeclampsia, systolic blood pressure, diastolic blood pressure

INTRODUCTION

Hypertension is the most common medical problem encountered during pregnancy, complicating up to 10% of pregnancies[1].Hypertensive disorders during pregnancy are classified into 4 categories, as recommended by the National High Blood Pressure Education Program Working Group on High Blood Pressure in Pregnancy[2]. collectively termed as sinonasal disease.

- Chronic hypertension
- Preeclampsia-eclampsia
- Preeclampsia superimposed on chronic hypertension
- Gestational hypertension (transient hypertension of pregnancy or chronic hypertension identified in the latter half of pregnancy). This terminology is preferred over the older but widely used term

*Correspondence
Shashi Dinkar Minj
Associate Professor, Department of Anaesthesiology, ICARE Institute of Medical Sciences and Research, Haldia, PO-Balughata, Banbishnupur, West Bengal 721645, India.
E-mail: drsdinkar@gmail.com

"pregnancy-induced hypertension" (PIH) because it is more precise.

Pregnancies complicated by pre-eclampsia, chronic hypertension, or both, are at significantly increased risk of adverse outcomes. For most women, the assessment of blood pressure and urinalysis form the mainstay of routine antenatal care[3]. Pre-eclampsia is the most severe form of hypertensive disorder of pregnancy and is associated with maternal and fetal mortality, intrauterine growth restriction, and preterm birth[4,5]. It is defined as de novo high blood pressure occurring after 20 weeks' gestation in conjunction with proteinuria[4-6]. The pathophysiology of preeclampsia is heterogeneous, complex, and poorly understood involving both maternal and placental factors[7]. Abnormalities in the development of placental vasculature is considered to be a primary cause of the placental hypoxia and ischemia, which then leads to release of numerous bioactive factors into the maternal circulation causing widespread endothelial dysfunction and culminating in hypertension, proteinuria and other manifestations of the disease affecting the liver, renal, hematological, and central nervous systems[8,9].

Hypertensive disorders of pregnancy (HDP) remain among the most significant and intriguing unsolved problems in obstetrics. In India, the prevalence of HDP was 7.8% with pre-eclampsia in 5.4% of the study population[10].Mehta B et al study indicated that the prevalence of hypertension in pregnancy was significantly higher in pregnant women with gestational period ≤20 weeks (10.0%) than women with gestational period >20 weeks (5.3%)[11].However in various hospital-based studies, frequency of preeclampsia and eclampsia was found to be higher which manifests after 20 weeks of gestation[12-14]. Early detection of preeclampsia would allow for appropriate monitoring and management to forestall the development of complications. The objective of this screening study is to investigate the potential value of and compare MAP, systolic blood pressure (SBP) and diastolic blood pressure (DBP) 4 weeks apart between 16 to 26 weeks of gestation in the prediction of PE.

Materials & methods

This was a prospective cohort study of 200 normotensive, nonproteinuric pregnant women without prior history of gestational hypertension.

Inclusion Criteria

1. First visit at or before 20 weeks of pregnancy.
2. Singleton pregnancy.

Exclusion Criteria

1. Patients with other disorders complicating pregnancy such as essential hypertension, heart disease, renal disease, diabetes, hydramnios, twins, Rh negative pregnancy were excluded.
2. Gross congenital anomaly in the foetus.

Blood pressure was measured for each patient at every visit by auscultatory method. Blood pressure of each patient was recorded at each visit by the same instrument. The recording was taken after the patient was seated for at least 10 minutes to remove the effect of excitement. At least two readings, 4 weeks apart between 16 to 26 weeks of gestation was taken. Mean arterial pressure was calculated. Mean arterial blood pressure in second trimester (MAP) was taken as the average of two readings.

The women were booked patients attending the antenatal clinic at a tertiary care teaching hospital and were all in their second trimesters of pregnancy at recruitment. The outcome measures were systolic blood pressure, diastolic blood pressure, and estimation of the MAP. The end point of the study was the development of preeclampsia. Pregnant women were diagnosed with preeclampsia if they developed hypertension with systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg and ≥ 2^+ of proteinuria[15]. Late-onset preeclampsia was defined as the onset of clinical disease after 34 weeks gestation and early-onset preeclampsia as starting before 34 weeks gestation. The blood pressure was determined using the Accoson's Mercury Sphygmomanometer (cuff size 15 × 43 cm). The subjects were seated and rested for 5 min before measurement. The systolic blood pressure was taken at the first korotkoff sound and diastolic at the fifth korotkoff sound[15].Preeclampsia was defined as the onset, after 20 weeks gestation of proteinuria (≥300 mg/24 h or ≥100 mg/L, equivalent to ≥ 2^+ on dipstix urinaysis) on at least two random urine samples at least 4 to 6 h apart but not more than 7 days apart, and systolic blood pressure ≥140 mmHg or a diastolic blood pressure ≥ 90 mmHg measured using an appropriate sized cuff repeatable at least 4–6 hours apart but not more than 7 days apart and a remission of these symptoms by 6 weeks postpartum[15].Approval for the study was obtained from the institutional ethics committee and consenting subjects signed an informed consent form. At recruitment, initial blood pressure measurements were recorded and the MAP calculated by dividing the sum of the systolic and twice the diastolic blood pressure by three[16].

Results

A prospective observational study was carried out on 200 pregnant women between 16-26 weeks of gestation during the time period of 1st Jan 2016- 30th Dec 2016 and results were analyzed. The maximum number of subjects (51.5%) were in the peak reproductive age group of 26-30 years followed by

21.5% and 18% from (21-25 yrs) and 31-35 yrs respectively. The mean age of the study cases was 27.90 years with a SD of ±7.24. The youngest in the study was 19 years of age and eldest was 42 years of age. The parity distribution of the study population were primigravida (39.5%) and 60.5% were multigravida [Table 1].

Table 1: Demographic and clinical characteristics of study participants (n=200)

Age Groups	Frequency	%
<=20 yrs	7	3.5%
21 - 25 yrs	43	21.5%
26 - 30 yrs	103	51.5%
31 - 35 yrs	36	18%
36 - 40 yrs	9	4.5%
≥ 40 yrs	02	1%
Primi	79	39.5%
Multi	121	60.5%
Total	200	100%

Table 2: Development of gestational hypertension among study participants

GHTN	Frequency	%
No	177	88.5%
Yes	23	11.5%
Total	200	100%

Table 2 shows the development of gestational hypertension among the subjects was 11.5%. Rest of the pregnant women was normotensive.

Table 3: Age distribution and development of gestational hypertension (n=200)

Age Groups	No GHTN		GHTN		P Value
	Frequency	%	Frequency	%	
<=20 yrs	7	3.95%	0	0.0%	-
21 - 25 yrs	36	20.34%	7	30.4%	P = 0.5611
26 - 30 yrs	95	53.67%	8	34.8%	P = 0.3072
31 - 35 yrs	32	18.1%	4	17.4%	P = 0.9730
36 - 40 yrs	06	3.4%	3	13.04%	P = 0.6050
≥ 40 yrs	01	0.06%	1	4.34%	P = 0.8840
Total	177	100%	23	100%	-

Table 3 shows the development of gestational hypertension in various age groups. The maximum number of subjects in the gestational hypertension group was in the age group of 26-30 years (n=23, 34.8%) followed by 21-25 yrs age group (30.4%) and 31-35 yrs age group (17.4%).

Table 4: Distribution of subjects according to mean arterial pressure among pregnant women [n=200]

MAP	Frequency	%
70 - 75	10	5%
76 - 80	38	19%
81 - 85	69	34.5%
86 - 90	46	23%
91 - 95	22	11%
96 - 100	13	6.5%

>100	2	1%
Total	200	100%

Table 4 shows the distribution of subjects according to various ranges of MAP. The maximum number of subjects (n=69, 34.5%) fall in the MAP range of (80-85) followed by 23% of (86-90) whereas the minimum number of subjects (n=2, 1%) fall in the MAP range of >100.

Table 5: Development of gestational hypertension at various ranges of mean arterial pressures [n=200]

MAP	Total Patients	GHTN	%
70 - 75	10	0	0%
76 - 80	38	0	0%
81 - 85	69	1	1.45%
86 - 90	46	4	8.7%
91 - 95	22	6	13.64%
96 - 100	13	10	76.92%
>100	2	2	100%
Total	200	23	11.5%

Table 5 shows the development of gestational hypertension at various MAP ranges. None of the patients (0%) who had MAP in the range of 70-75 and 76-80 developed gestational hypertension, whereas all the patients (100%) who had MAP > 100 developed gestational hypertension. The second highest incidence of gestational hypertension was in the MAP range of 96-100 (76.92%). It was seen that as the MAP increases, incidence of gestational hypertension increases.

DISCUSSION

The strengths of this screening study for PE are, firstly, the prospective examination of a large population of pregnant women attending for routine care in a well-defined gestational age range which is widely used for the assessment of fetal growth and well-being, secondly, the use of a well-defined methodology and appropriately trained doctors to measure blood pressure and thirdly, the application of a statistical approach that is widely accepted in screening for aneuploidies and pregnancy complications to examine the performance of screening and calculate patient-specific risks[17].

The definition of hypertension in pregnancy was not uniform for a long time[18,19]; it used to be defined as an elevation in blood pressure during the second trimester from a baseline reading in the first trimester or from pre-pregnancy levels. However, a definition based on absolute blood pressure values (systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥90 mmHg) is now preferred. Hypertension in pregnancy is not a single entity but comprises (i) pre-existing hypertension; (ii) gestational hypertension with its subunit of (iii) pre-eclampsia; (iv) pre-existing hypertension with superimposed gestational hypertension with proteinuria; and (v) antenatally unclassifiable hypertension[20].

Antenatal Care guidance recommends BP measurement at every antenatal visit and outlines the steps involved in BP measurement using the auscultatory technique. This includes use of the correct-sized cuff, initial inflation of the cuff 20–30 mmHg above the palpable systolic BP, deflation at a rate of 2 mmHg per second, recording BP to the nearest 2 mmHg and use of Korotkoff phase V to indicate diastolic BP[21].

Hypertensive pregnancy disorders complicate 10% of all pregnancies and cover a spectrum of conditions, namely preeclampsia, eclampsia, and chronic and gestational hypertension. Preeclampsia is a pregnancy-specific disorder clinically characterized by hypertension and proteinuria that occurs after 20 weeks of gestation. It remains a leading cause of both fetal and maternal morbidity and mortality worldwide[22]. Although the exact pathophysiologic mechanism is not clearly understood, preeclampsia is primarily a disorder of placental dysfunction leading to a syndrome of endothelial dysfunction with associated vasospasm. In most cases, pathology evaluation demonstrates evidence of placental insufficiency with associated abnormalities such as diffuse placental thrombosis, an inflammatory placental decidual vasculopathy, and/or abnormal trophoblastic invasion of the endometrium. The hypertension occurring in preeclampsia is due primarily to vasospasm, with arterial constriction and relatively reduced intravascular volume compared with that of a normal pregnancy[23].

Blood pressure measurement is a screening test that is used in antenatal care to detect or predict hypertensive disease.6 Prediction of women at risk for developing gestational hypertension or pre-eclampsia is crucial to allocation of monitoring resources and, possibly, use of preventive treatment. Poon and co-workers used the combination of maternal medical history and mean arterial pressure at 11^{+0} to 13^{+6} weeks gestation to predict pre-eclampsia and gestational hypertension and found that, for a 10% false-positive rate, 60% of those who will develop pre-eclampsia, and 40% of those who will develop gestational hypertension, can be identified[24].

In a meta-analysis involving 34 studies and 60599 women, mean arterial pressure was a better predictor of pre-eclampsia than systolic blood pressure, diastolic blood pressure, or an increase in blood pressure when blood pressure was measured in the first or second trimester of pregnancy. Diastolic blood pressure and mean arterial pressure were more strongly associated with the risks of pregnancy-induced hypertension and pre-eclampsia as compared with systolic blood pressure[25].Age and parity are two of the identified maternal risk factors for the development of GHTN. Extremes of age (age below 20 years and above 35 years) are known to be associated with higher incidence of GHTN. Like the overall incidence of GHTN, incidence among various age groups and parity varies from place to place[26]. In Karachi, found an incidence of 9% among older women and 27% among primigravidae. However, reported an incidence of hypertensive disorders of pregnancy of 41.3% among 18-22 years old patients in their own study.11 53.8% of these study participants were primigravidae[27]. In normal pregnancy, BP initially decreases until 18 to 20 weeks' gestation and then rises until delivery [28-30], and studies have indicated that higher BP pre-pregnancy and in the first trimester are associated with increased risk of developing gestational hypertension and preeclampsia[25,31,32].Study by Heta G. Vyas et al revealed total 121 numbers of women were diagnosed with pregnancy induced hypertension in their study. Out of that 53.72% were in the young age group and 67.77% were primigravida[33]. Hypertensive pregnant women having twin gestation are more prone to development of PIH (OR=12.55). Pregnant women who had undergone treatment of infertility (OR=2.11) and who had history of missed abortion (OR=5.54) are more prone to develop hypertension. These are novel factors associated with PIH. The antenatal care trial research of the World Health Organization conducted in some countries of South America and Asia showed that the incidence of PE was 2.2% and that of gestational hypertension was 7.0% among pregnant women, including those with chronic complications[34]. The Haruka Muto et al study demonstrated that the incidence rates of PE and GH were 2.6% and 5.8%, respectively[35]. This might be because women with chronic disease, who were regarded as high risk for hypertensive disorders, were excluded in our population. Among the nulliparous women, the incidence of PE was 4.1%, which was similar to the incidence of 5.3% in a prospective observational study of only nulliparous women without any chronic complications.[36] Among the multiparous women, Baschat et al showed an incidence of PE of 3.1%. This higher incidence could also be explained by the different study participants, including any women with complications[37].

Conclusion

Measurements of blood pressure recorded during the second half of pregnancy, used in conjunction with blood pressure early in pregnancy and other maternal risk factors, can improve the identification of women who are at risk of developing pre-eclampsia later in pregnancy and could be used to differentiate women who require more intensive monitoring from those who are likely to have a normal pregnancy. Hypertensive disorders in pregnancy may cause maternal and fetal morbidity, and they remain a leading source of maternal mortality.

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