

**MEAN ARTERIAL BLOOD PRESSURE FOR EARLY PREDICTION IN PRE ECLAMPSIA****GAJANAN R. DAIV<sup>a</sup> AND VASUDHA SAWANT<sup>1b</sup>**<sup>ab</sup>Department of Obst. & Gynecology, DR. D. Y. Patil Medical College, Kolhapur, Maharashtra, India**ABSTRACT**

Present study was aimed at detecting the appropriateness of a simple clinical test, namely the efficacy of mean arterial pressure in the second trimester as a predictor of pregnancy included hypertension in the third trimester. Study was conducted on 100 pregnant women with their first visit first visit in second trimester of pregnancy at the antenatal clinic of DR. D. Y. PATIL HOSPITAL. It was observed that the no. of primigravidae and multigravidae in the study group was only half the number of multigravidae. Nulliparity is a known risk factor for the development of PIH. In the present study, it was observed that the percentage of primigravidae Vs multigravidae developing PIH were 60% Vs 36.3%. This difference in the incidence of PIH in primigravidae and multigravidae was found to be statistically significant. It was observed that 70.7% of the subjects in the study group while only 20.7% of subjects in the control group developed pregnancy induced hypertension.

**KEYWORDS :** Pre Eclampsia, Mean arterial blood pressure, Screening of preeclampsia

Hypertensive disorders complicating pregnancy are common and form one of the deadly triad along with haemorrhage and infection that result in large number of maternal deaths. How pregnancy incites or aggravates hypertension remains unsolved despite decades of intensive research and hypertensive disorders remain unsolved problems in obstetrics. There have been various pioneering efforts to develop simple clinical tests directed towards early detection and appropriate treatment of pregnant women likely to develop hypertension e.g. roll over test, angiotensin sensitivity test, calculation of mean arterial pressure in the second trimester of pregnancy. Intensive research on hypertension in pregnant women led to detect that the development of toxemic entity occurred before the twenty fourth week of gestation. Its detection was missed in this period due to haemodynamic changes causing mid trimester drop in the blood pressure values. Hence studying the course of mean arterial pressure scores over the absolute values of systolic and diastolic pressure values may serve as a screening test for the likelihood of pregnancy induced hypertension. Determination of mean arterial pressure is a diagnostic one. The purpose of screening test is to identify those at risk. These test are, in general, not perfect. In evaluating a screening test, individuals are administered the test and the development of disease is predicted. From those data, the sensitivity and the specificity of the test are determined. The appropriate interpretation of that screening test result also depends upon the positive predictive values. Mean arterial pressure screening provides an important adjunctive tool for early

identification of women at increased risk of obstetric complications and adverse fetal outcome. Those women constitute the group of high risk pregnancy who require intensive antenatal care. (ACOG, 2002, Aqustin et al., 1993. Eneroth et al., 1998; Cnossen et al., 2008; Fallis and Langford, 1963).

**MATERIALS AND METHODS**

Present study was aimed at detecting the appropriateness of a simple clinical test, namely the efficacy of mean arterial pressure in the second trimester as a predictor of pregnancy included hypertension in the third trimester. Study was conducted on 100 pregnant women with their first visit first visit in second trimester of pregnancy at the antenatal clinic of DR. D. Y. PATIL HOSPITAL. The women were examined clinically, investigated and then followed up to term to know about the development of pregnancy included hypertension and the outcome of pregnancy.

**Inclusion Criteria**

- A. First antenatal visit in second trimester of pregnancy
- B. Period of gestation should be accurately known by last menstrual period
- C. Regular menstrual cycle
- D. Singleton pregnancy

**Exclusion Criteria**

Disorders which complicate pregnancy postulated as high risk for pregnancy included hypertension

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- A. Essential hypertension
- B. Heart disease
- C. Renal disease
- D. Diabetes

**METHODS**

All the patients who attended antenatal clinic in the second trimester, there detailed past and present obstetric history was taken including any antecedent history of hypertension, diabetes, heart disease and renal disease. A detailed general, systemic and obstetrical examination was done. Their routine investigations were done and special investigations were also conducted as and when indicated in individual cases. All subjects included in the study were followed up to term to determine the development of pregnancy induced hypertension and outcome of pregnancy.

**Mean Arterial Pressure**

The mean arterial pressure is the average of all pressures measured, millisecond by millisecond over a period of time. It is not equal to the average of systolic and diastolic pressure, because the pressure remains nearer to the diastolic pressure than to systolic pressure during the greater part of the cardiac cycle. Hence, the mean arterial pressure is determined about 60%by the diastolic pressure and 40% by the systolic pressure. The mean arterial pressure is calculated by the Burton's formula,

$$\frac{\text{Systolic pressure} + 2 \times \text{diastolic pressure}}{3}$$

**Procedure**

Blood pressure recordings of each subject were taken at each visit with the subject with the subject in sitting position. The recording was taken in the right arm of the subject after she was seated for atleast 5 minutes to remove the effect of excitement. The recording of the blood pressure was taken by the same observer at each visit with the same instrument for all subjects. The blood pressure recorded during phase korot-koff sounds, was taken as systolic, while that during phase IV was taken as diastolic pressure. Mean arterial pressure was calculated by the Burton's formula,

$$\frac{S+(2 \times D)}{3}$$

At least two readings 4 weeks apart between 13-28 weeks gestations were taken. Mean arterial pressure in second trimester (MAP-2) was taken as the average of two readings.

The study group of 100 women were divided in to two groups, study and control groups according to whether the MAP-2 was 90 or <90mm hg. Both the groups were followed up to term to see for the development of pregnancy

**Table 1 : Total Number of Subject = 100**

Study Group	Control Group
MAP-2 > 90mm Hg	MAP-2 < 90mm Hg
48	52

**Table 2: Age Distribution of Subjects**

Age Group	Study Group		Control Group	
	Count	%	Count	%
15-19Yrs	6	12	3	5.7
20-24Yrs	24	50.3	27	51.9
25-29Yrs	13	27.3	20	38.6
>30Yrs	5	10.40	2	3.8
TOTAL	48	100	52	100

**Table 3 : Parity Distribution of Subjects**

Parity	Study Group		Control Group	
	Count	%	Count	%
Primigravida	21	47.6	15	29.3
Multigravida with previous viable pregnancy	24	49	33	62.4
Multigravida with previous abortion(s) only	3	3.4	4	8.3
Total	48	100	52	100

**Table 4: Age and Development of PIH**

Age Group	Study Group			Control Group		
	Total	With PIH	%	Total	With PIH	%
15-19Yrs	6	5	87.5	3	1	33.3
20-24Yrs	24	17	70.8	27	4	14.1
25-29Yrs	13	10	71.8	20	4	20.3
>30Yrs	5	3	60.6	2	1	50
Total	48	35		52	10	

**Table 5: Parity and Development of PIH**

Parity	Study Group			Control Group		
	Total	With PIH	%	Total	With PIH	%
Primigravida	21	17	80.9	15	4	32.6
Multigravida with previous viable pregnancy	24	15	65.7	33	5	15.3
Multigravida with previous abortions	3	2	6.6	4	1	25
Total	48	34		52	10	

**Table 6: Nulliparity and PIH**

Development of PIH	Primigravida		Multigravida	
	Count	%	Count	%
(+)	21	60	20	36.3
(-)	15	40	37	63.7
TOTAL	36	100	57	100

**Table 7: Recurrence of PIH**

Previous History of PIH	Total	Subjects Developing PIH		Subjects NOT Developing PIH	
		Count	%	Count	%
(+)	27	15	57.1	12	42.9
(-)	30	4	14.7	26	85.3
TOTAL	57	19		38	

**Table 8: Development of PIH in Study and Control Groups**

Development of PIH	Study Group		Control Group	
	Count	%	Count	%
(+)	35	72.7	10	20.7
(-)	13	27.3	42	79.3
TOTAL	48	100	52	100

**Table 9: Correlation of Map-2 with 3rd Trimester Blood Pressure**

MAP-2 (mm hg)	MAP-3 (mm hg)
75-79	91.0
80-84	94.5
85-89	99.0
90-94	101.0
95	109.0

**Table 10: Development of PIH at various Map-2 ranges**

MAP-2 (mm hg)	Subjects Developing PIH		Subjects NOT Developing PIH	
	Count	%	Count	%
75-79.9	2	12.5	10	87.5
80-84.9	4	20.2	19	79.8
85-89.9	5	36.4	12	63.6
90-94.9	20	68.2	10	31.8
>95	14	80	4	20
TOTAL	45		55	

**Table 11: Comparison of Map Values in Normotensive and Hypertensive Women**

DEVELOPEMENTT OF PIH	(+)	(-)
NO. OF SUBJECTS	45	55
MEAN VALUE OF MAP-2 (mm Hg)	92.1	84.9

**Table 12 : Evaluation of Sensitivity, Specificity and Predictive Value of Map-2 as Predictor of PIH**

Value of MAP-2	Development of PIH		Total
	(+)	(-)	
>90mm Hg	35 (True Positive)	13 (False Positive)	48
<90mm Hg	10 (False Negative)	42 (True Negative)	52
TOTAL	45	55	100

Sensitivity	$35/(35+10) \times 100 = 77.2\%$
Specificity	$42/(13+42) \times 100 = 75\%$
Predictive value of positive test	$35/(35+13) \times 100 = 72.9\%$
Predictive value of negative test	$42/(42+10) \times 100 = 80.7\%$

**Table 13: Type of Onset of Labor**

Type of Onset	Study Group		Control Group	
	Count	%	Count	%
Spontaneous	24	50	43	83.4
Induced	22	46	7	12.7
Elective Caesarean	2	4	2	3.9
Total	48	100	52	100

**Table 14: Mode of Delivery**

Mode of Delivery	Study Group		Control Group	
	Count	%	Count	%
Spontaneous Vaginal Delivery	35	72.9	45	86.5
Instrumental Vaginal Delivery	1	2.1	1	2.0
Caesarean Section	12	25	6	11.5
Total	48	100	52	100

**Table 15: Comparison of Birth Weights**

Mean Birth Weight (Kg)	Study Group	Control Group
	45	55

Result show in table 1- 15. It was observed that the no. of primigravidae and multigravidae in the study group was only half the number of multigravidae. Nulliparity is a known risk factor for the development of PIH. In the present study, it was observed that the percentage of primigravidae Vs multigravidae developing PIH were 60% Vs 36.3%. This difference in the incidence of PIH in primigravidae and multigravidae was found to be statistically significant. It was observed that 70.7% of the subjects in the study group while only 20.7% of subjects in the control group developed pregnancy induced hypertension (Fernando, 2008; Hines and Brown, 1933).

## DISCUSSION

The obstetrician has accepted the challenge of determining the state of health of the mother which is the basic prerequisite of having a healthy baby'. One of the most important and intriguing challenge in the obstetric care is gestational hypertension and associated complications, the pathophysiology and diagnosis of which lies behind a veritable iron curtain. Mean arterial pressure in the second trimester is a screening test, which helps in selecting women from the obstetrical population who are at increased risk of developing pregnancy induced hypertension and its complications. In such cases, intensive and frequent antenatal care can aid in early diagnosis and management of gestational hypertension and prevention of its complications.

In the present study a total of 100 obstetric cases were taken by random sampling from the antenatal clinic. These cases were divided into two study groups (MAP-

2>90mmHg.) which consisted of 52 subjects. All subjects were followed from 2nd trimester upto term.

#### Age and Development of PIH

Maximum no. of subjects in both the groups were in- the peak reproductive-period i.e. from 20-24 years. It was observed that highest incidence of PIH in total subjects was seen in the age groups < 20 years and > 30 years. It was observed that the no. of primigravidae and multigravidae in the study group was only half the number of multigravidae. Nulliparity is a known risk factor for the development of PIH. In the present study, it was observed that the percentage of primigravidae vs multigravidae developing PIH were 60% vs 36.3%. This difference in the incidence of PIH in primigravidae and multigravidae was found to be statistically significant.

It was observed that 70.7% of the subjects in the study group while only 20.7% of subjects in the control group developed pregnancy induced hypertension. The impact of blood pressure upon circulatory dynamics is best expressed by utilizing the mean arterial pressure (MAP). This also has the advantage of working with a single figure derived from systolic and diastolic readings. The sensitivity of MAP -2 as a screening test to detect potentially hypertensive women is 77.2%. Sensitivity indicates the ability of a test to identify, correctly all those who do not have the disease in question, i.e. "true positives". The specificity of MAP -2 in the present study is 75%. This indicates the ability of the test to identify correctly, those who do not have the disease in question, i.e. "true negative". In addition to sensitivity and specificity, the performance of a screening test is measured by its "Predictive value" which reflects the diagnostic power of the test. The positive predictive value of MAP -2 in the present study is 70.8%, which indicates the probability that a patient with a positive test result has, in fact, the disease in question. Similarly, the negative predictive value of MAP-2 in the present study is 80.7%, which indicated the probability that a patient with a negative test does not have the disease in question.

The percentage of women with induced labour was significantly higher in the study Group (46.1) than in the control group (12.7%). This difference was found to be statistically significant. The risk of induced labour in the

study group is 6 times higher (OR=6) than in the control group. This difference is due to the much higher incidence of PIH in the study group compared to the control group.

There was higher rate of caesarean section in study group ( 25% ) as compared to control Group(11.5%). This difference is due to much higher incidence of PIH in the study group compared to control group. Similar observation was noted by case control study conducted by Yadav s, Saxena U5oin 1997 on 650 patients (Page and Christianson,1976; Schwartz, 1964; Sibai et al., 1986; )

#### CONCLUSION

Hypertension in pregnancy is one of the commonest medical disorders of pregnancy having high maternal foetal morbidity and mortality. It occurs as a primary disorder in pregnant women.

Mean arterial pressure screening provides an important adjunctive tool for early identification of women at increased risk of obstetric complications and adverse felt out-come. In all these high risk patients, careful follow up and appropriate treatment helps in preventing severity of the disease and perinatal mortality. Mean arterial pressure has a predictive value in diagnosis in PIH in second trimester as its detection is missed in this period due to haemodynamic changes causing mid trimester drop in the blood pressure values. Hence, mean arterial pressure, scores over the absolute values of systolic and diastolic pressure values u, as a screening test for the detection of pregnancy induced hypertension.

#### REFERENCES

- ACOG committee on obstetric practice, 2002. ACOG practice bulletin. Diagnosis and management of preeclampsia and eclampsia. No. 33, January 2002. American college of Obstetricians and gynaecologists. *Obstet Gynecol.*, **99** : 159-67.
- Agustin Conde Agudelo, Jose M. B., Roberto L. and Eduardo FB.,1993. what does an elevated mean arterial pressure in second half of pregnancy predict- gestational hypertension in preeclampsia. *AM J Obstet and Gynecol*, **169**:509-13.

- American college of obstetricians and gynaecologists, 2002. Diagnosis and management of preeclampsia and eclampsia. Practice Bulletin no. 33.
- Cnossen J. S., Vollerbregt K. C., de Vrieze N., Ter Riet G., Mol B. W. Franx A., Khan K. S. and Van der post JA., 2008. Accuracy of mean arterial pressure and Blood pressure measure-ments in predicting preeclampsia: systematic review and meta-analysis BMJ. May 17th ; **336**(7653): 1117-20.
- Eneroth - Grimfors E., Bevegard S., Nilson B.A.,1988. Evaluation of three simple physio-logic test as predictor of induced hypertension. A pilot study Acta Obstet and Gyne-col Scand. , **67**(2):109.
- Fallis N. E., Langford H. G.,1963. Relation of second trimester blood pressure to toxemia of pregnancy in the primigravida patient. A M J Obstet Gynecol., **87**:123-125.
- Fernando Arias. Hypertensive Disorders in Pregnancy, 2008. In Shirish N Daftary : text book of high risk pregnancy and delivery. 3rd edition. Elsevierpublication, India, 398,399,403,412.
- Hines E. A. and Brown G. E.,1933. A standard test for measuring the variability of the blood pressure; its significance as an index of the prehypertensive state. Ann Int Me, **7**: 209-17.
- National High Blood Pressure Education Program,2000. Working Group Report On High Blood Pressure in Pregnancy. Am j obstet Gynecol.,: 183: 51
- National High Blood Pressure Education Program,2004. Working Group on High Blood Pressure in Pregnancy. Working Group report on high blood pressure in Pregnancy. Bethesda, Md.: U.S.Dept. of Health and Human Services, public Health Services, Na-tional institutes of health, National Heart, Lung, and Blood institutes 2000 NIH Publication No. 00-3029, Accessed online .
- Page E. W. and Christianson R.,1976. The impact of mean arterial pressure in the middle tri-mester upon the outcome of pregnancy AM J Gynecol ., **125**:740-6
- Report of the National High Blood Pressure,2000, Education Program Working Group on High Blood Pressure in Pregnancy. Am J Obstet Glynecol.,: **183**: S1-22.
- Schwartz R.,1964. The behaviour of the circulation in normal pregnancy. I. Arterial Blood Pressure. Arch. Gynecology :**199**:549.
- Sibai B. M., el-Nazer A and Gonzalez-Ruiz A.,1986. Severe preeclampsia- eclampsia in young primigravida women: subsequent pregnancy outcome and remote prognosis AM J Obstet Gynecol., **155** (5): 1011-6.