



## Diagnostic accuracy of mean arterial pressure in second trimester for prediction of preeclampsia in females.

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## INTRODUCTION

Preeclampsia (PE) is high blood pressure (BP) that occurs after 20 weeks of pregnancy and is accompanied by proteinuria.<sup>1</sup> It is a leading cause of perinatal and maternal morbidity and mortality, affecting more than 2% of pregnancies.<sup>2</sup> Preeclampsia was shown to be 26 percent more likely in nulliparous patients and 17 percent more likely in multiparous patients in one study.<sup>3</sup> The most prevalent medical condition that occurs during pregnancy is hypertension. In the United States, hypertensive disorders are the leading cause of maternal death during pregnancy.<sup>4</sup>

Incomplete placentation is the most common cause of PE. PE is categorized into two types: early onset PE, which requires delivery before 34 weeks of pregnancy, and late onset PE, which requires delivery at or beyond 34 weeks of pregnancy. Early onset has been linked to a higher risk of negative mother and foetal outcomes. For

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**ABSTRACT... Objective:** To assess the diagnostic accuracy of mean arterial pressure in second trimester for prediction of pre-eclampsia in females. **Study Design:** Cross-sectional study. **Setting:** Department of Obstetrics & Gynecology Unit III, Allied hospital, Faisalabad. **Period:** October 2016 to September 2017. **Material & Methods:** Total 386 patients were enrolled after obtaining informed consent. Booked females of age 18-40 years, parity<5 presenting at gestational age >16 weeks (on LMP) for antenatal checkup were included in study. Patients with multiple gestation (on medical record and USG), Females with chronic hypertension (BP≥140/90mmHg), chronic or gestational diabetes (BSR>186mg/dl), Females having oligohydramnios (AFI<5cm) or polyhydramnios (AFI>21cm) on USG, females having abnormal placental implantation or placental abruption (on USG) were excluded. The mean age of the patients was 28.59±6.93 years. The MAP of the patients was 94.88±14.68 mmHg. **Results:** The sensitivity, specificity and diagnostic accuracy of MAP was 92.89%, 89.12% and 91.45% respectively taking preeclampsia as gold standard. **Conclusion:** The mean arterial pressure in second trimester is very effective and useful screening method for prediction of preeclampsia with high values of sensitivity, specificity and diagnostic accuracy.

**Key words:** Mean Arterial Pressure, Preeclampsia, Trimester.

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a better outcome, early detection of PE in high-risk pregnancies, as well as preventive medical treatment for disease progression and foetal and maternal surveillance, is required.<sup>5</sup>

Apart from BP monitoring, MAP calculation in the first and second trimesters is significant since the MAP is a stronger predictor of preeclampsia than SBP, DBP, or a rise in BP.<sup>6</sup> A combination of maternal demographic data, including medical and obstetric history, MAP, and a number of additional biophysical and biochemical indicators, are used to screen for PE during 11–13 weeks gestation and is highly effective in identifying pregnancies that will develop early PE.<sup>7-9</sup> According to a meta-analysis, MAP of 90mmHg has a sensitivity of 62% (35 percent to 89 percent) and specificity of 82%. (72 percent to 92 percent).<sup>10</sup>

Rationale of this study is to assess the accuracy of mean arterial pressure for diagnosis of

preeclampsia in females presenting in second trimester. According to the literature, MAP could be a good alternative for predicting preeclampsia in early pregnancy. However, disputed results have been reported in the literature, as sensitivity and specificity varied widely across investigations. Furthermore, no local evidence exists in this regard. As a result, we performed this investigation to uncover local evidence. This will improve clinical abilities as well as local guidelines for prevention and care of such cases.

## MATERIAL & METHODS

This Cross-sectional study was conducted at, Department of Obstetrics & Gynecology Unit III, Allied hospital, Faisalabad from October 2016 to September 2017 with 95% confidence interval and absolute precision of 8%. After approval from hospital Ethical committee (667/2016) total 386 patients were enrolled after obtaining informed consent. Booked females of age 18-40 years, parity<5 presenting at gestational age >16 weeks (on LMP) for antenatal checkup were included in study. Patients with multiple gestation (on medical record and USG), females with chronic hypertension (BP $\geq$ 140/90mmHg), chronic or gestational diabetes (BSR>186mg/dl), females having oligohydramnios (AFI<5cm) or polyhydramnios (AFI>21cm) on USG, having abnormal placental implantation or placental abruption (on USG) were excluded from study. MAP calculated as DBP + 1/3(SBP-DBP). MAP was considered raised and predictive of preeclampsia when MAP  $\geq$ 90mmHg during 16-23weeks of gestation. On actual preeclampsia was considered when BP $\geq$ 140/90mmHg and proteinuria  $\geq$ +1 on dipstick method after 24th weeks of gestation on LMP.

Enrolled females were followed-up in OPD till delivery. During follow-up, blood pressure noted on each visit and urine sample was obtained in sterile container. Dipstick was dipped in container and results were obtained for assessment of proteinuria. If BP $\geq$ 140/90mmHg and proteinuria $\geq$ +1, then preeclampsia was labeled. All this information was recorded on proforma.

Statistical Analysis was done on SPSS version 21. Quantitative variables like age and gestational age, SBP, DBP and MAP was calculated as mean and standard deviation. Categorical variable like parity, proteinuria and preeclampsia was calculated as frequency and percentage. Data was stratified for age, gestational age, and parity. Post-stratification, 2x2 tables was generated to calculate sensitivity, specificity, PPV, NPV and diagnostic accuracy of MAP.

## RESULTS

We enrolled 386 cases with mean age of 28.6 $\pm$ 6.9 years. The youngest patient was 18 years old and 40 years was the maximum age. The mean gestational age was 18.4 $\pm$ 1.7 weeks with minimum of 16 weeks and maximum 21 weeks. Out of total patients, 206(53.4%) patients were primigravida, 82(21.24%) patients with parity one, 46(11.9%) patients with parity two, 29(7.5%) patients with parity three and 23(5.96%) patients were with parity four. The MAP was 94.9 $\pm$ 14.7 mmHg with minimum value of 70mmHg and maximum 120 mmHg. (Table-I)

MAP was raised above 90mmHg in 238(61.66%) patients and it was below 90mmHg in 148(28.34%) patients. The mean SBP was 146.37 $\pm$ 21.05 mmHg and the mean DBP of the patients was 91.82 $\pm$ 11.88 mmHg. On follow-up, 239(61.9%) patients developed preeclampsia with proteinuria >+1. The diagnostic accuracy of MAP in preeclampsia was found to be 91.45%.

It was further evaluated that MAP in patients of younger age (<30years), with primiparity and with advancing pregnancy was more predictive of Preeclampsia later in pregnancy. Stratification was done according to age, parity and gestational age. MAP has higher sensitivity for the diagnosis of preeclampsia in age <30, primiparity and gestational age 18-21weeks. Diagnostic accuracy was also better in age <30 years and gestational age 18 to 21 weeks. The Sensitivity, specificity, Positive predictive value and negative predictive value of MAP for the prediction of preeclampsia in each stratified group is shown in table. (Table-II)

Characteristics	n=81
Age (years)	28.59± 6.93
Gestational Age (weeks)	18.38±1.68
MAP (mmHg)	94.88±14.68
SBP	146.37±21.05
DBP	91.82±11.88
Proteinuria (> +1)	61.9%(239)
Proteinuria (< +1)	38.1%(147)
MAP Preeclampsia (positive)	61.66%(238)
Preeclampsia (positive)	61.9%(239)

**Table-I. Risk factors for metabolic syndrome with gender specification.**

## DISCUSSION

In antenatal care, blood pressure monitoring is commonly used to diagnose hypertensive disorders during pregnancy. Because the findings of these studies are mixed, it's unclear if blood pressure monitoring should be used frequently as a predictive test or only to evaluate suspected hypertensive problems in pregnancy. Pre-eclampsia is accurately predicted by mean arterial pressure, while it is weakly predicted by SBP and DBP.<sup>11</sup>

In our study the sensitivity and diagnostic accuracy of MAP for diagnosing Preeclampsia

was 92.89% and 91.45% respectively. A study by Jeltsje S Crossen et al<sup>12</sup> found that in the first and second trimesters, mean arterial pressure is a stronger predictor of pre-eclampsia than a rise in blood pressure. A positive likelihood ratio of 3.5 (95 percent confidence interval 2.0 to 5.0) and a negative likelihood ratio of 0.46 were found for second trimester mean arterial pressure of 90 mm Hg or greater (0.16 to 0.75). According to a meta-analysis, MAP of 90mmHg had a pooled sensitivity of 62% (35 percent to 89 percent) and a pooled specificity of 82%. (72 percent to 92 percent). CA Walsh et al<sup>13</sup> found comparable findings in low-risk women.

Ahmed Al-Amin et al<sup>14</sup> found that screening for preterm preeclampsia in the second trimester using a combination of maternal history, mean arterial pressure, and mean uterine artery Doppler pulsatility index (FMF algorithm) was superior to screening using maternal variables alone. The detection rates for preterm preeclampsia were predicted to be 75 percent (95 percent CI 34.9–96.8) and 87 percent (95 percent CI 47.3–99.6) by NICE guidelines and ACOG recommendations, respectively, whereas it was 100 percent for both the FMF algorithm with a 1:100 cut-off and the FMF algorithm with a 1:60 cut-off.

				Preeclampsia		Sensitivity	Specificity	PPV	NPV	Diagnostic Accuracy
				Positive	Negative					
		MAP Preeclampsia	Positive	222	16	92.89%	89.12%	93.28%	88.51%	91.45%
			Negative	17	131					
Stratified by Age (years)	Age ≤30	MAP Preeclampsia	Positive	117	16	100%	85.19%	87.97%	100%	92.89%
			Negative	0	92					
	Age >30	MAP Preeclampsia	Positive	105	0	86.07%	100%	100%	69.64%	89.44%
			Negative	17	39					
Stratified by Gestational age (weeks)	16-18	MAP Preeclampsia	Positive	105	9	91.3%	88.89%	92.11%	87.8%	90.31%
			Negative	10	72					
	19-21	MAP Preeclampsia	Positive	117	7	94.35%	89.39%	94.35%	89.4%	92.63%
			Negative	7	59					
Stratified by parity	Primary	MAP Preeclampsia	Positive	114	16	98.28%	82.22%	87.7%	97.4%	91.26%
			Negative	2	74					
	Multiple	MAP Preeclampsia	Positive	108	0	87.8%	100%	100%	79.2%	91.67%
			Negative	15	57					

**Table-II. Comparison of MAP preeclampsia with preeclampsia.**

At 11–13 weeks gestation, a combination of maternal demographic variables, such as medical and obstetric history, MAP, and a range of additional biophysical and biochemical indicators is highly successful in predicting pregnancies that would develop early PE rather than intermediate or late PE.<sup>7-9</sup> Maternal history, mean arterial pressure (MAP), serum pregnancy-associated PPA, placental growth factor, and uterine artery pulsatile index were found to be particularly efficient in predicting early preeclampsia at 11 to 13 weeks of pregnancy. Previous Preeclampsia and MAP >95 mmHg were linked to an increased risk of superimposed PE in essential chronic hypertensive women treated before pregnancy, according to Lecarpentier et al.<sup>15</sup>

According to Leona C. Poon and Kypros H. Nicolaides<sup>16</sup>, screening for early onset PE using maternal risk factors, uterine artery Doppler, maternal serum pregnancy-associated plasma protein-A, placental growth factor, and mean arterial pressure detects about 95% of cases with a 10% false-positive rate.

## CONCLUSION

The mean arterial pressure in second trimester is very effective and useful screening method for prediction of preeclampsia with high values of sensitivity, specificity and diagnostic accuracy.





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