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# The Role of Mean Arterial Pressure (MAP) Roll Over Test (ROT) and Body Mass Index (BMI) in Preeclampsia Screening in Indonesia

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## Abstract

**Objective:** To evaluate the role of MAP, ROT, and BMI in preeclampsia screening in low resources setting.

**Method and Material:** This is a retrospective study conducted on 1011 pregnant women who had an antenatal care at Public Health Center in Indonesia. Data taken from public health medical report. The sample groups were 45 preeclampsia patients who have had complete screening of MAP, ROT and BMI. The control groups were normal pregnant women who attained same inclusion criteria.

**Results:** The pre eclampsia group had positif MAP and obesity result respectively 95.6% and 40% of patients, but in control group only had 40% and 11.1% of patient have positive MAP and obesity respectively. Statistical test illustrates a significant association between MAP and BMI screening with the incidence of preeclampsia (p 0.0001, OR = 32.250 and p 0.002, OR = 5.333). Whereas positive ROT showed in 40% PE groups and 57.8% control group. There is no association between ROT screening and the incidence of preeclampsia (p 0.092).

**Conclusion:** MAP and BMI can be used as baseline screening tools of preeclampsia in low resources setting. But ROT is not associated with the incidence of preeclampsia.

**Keywords:** Preeclampsia Screening, MAP, ROT, BMI.

## Introduction

Preeclampsia (PE) is a complex medical disorder, who is responsible for neonatal and maternal deaths worldwide. It is also becomes the biggest cause of high Maternal Mortality Rate (MMR) in Surabaya Indonesia from 2013-2017<sup>1</sup>. Accurate prediction and aggressive prevention allowed to elude this pregnancy complication. Effective screening to predict PE in the first trimester

of pregnancy is important to identify women who are at risk of developing PE so that early enough prevention treatment could start to prevent or reduce the frequency of its occurrence.

Preeclampsia screening vary from clinical to biomolecular level depend on the resources availability. In low and middle income countries where resources are limited, variations of the first-trimester combined test can be considered but difficult to reached. The baseline test which is possible to do are combine of maternal risk factors with Mean Arterial Pressure (MAP) and Roll over Test (ROT). In the absence of other biomarker(s), risk calculation can still be done but the detection rates will be reduced .

MAP and ROT are a method to describe hemodynamic conditions in patients with preeclampsia. ROT is not a perfect predictor, but it still have advantages

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to use in populations with high PIH associated maternal and perinatal mortality, mostly in low resources setting<sup>2</sup>. It has been used in many contries but some literature shows that ROT is not related to the incidence of preeclampsia<sup>3</sup>. The purpose of this study is to determine the effectiveness of preeclampsia screening (MAP, ROT, and BMI) to the incidence of preeclampsia in Indonesia.

**Material and Method**

This is a retrospective study conducted on 1011 pregnant women who performed an antenatal care at Sidotopo Wetan Public Health Center (*Puskesmas Sidotopo Wetan*), Surabaya, Indonesia from October 2017 to October 2018. Et Data taken from public health

medical report. The sample groups were 45 preeclampsia patient during that period time who fulfilled inclusion criteria: patients in the first and second trimesters who have had complete screening of MAP, ROT and BMI. The control groups were normal pregnant women who attained same inclusion criteria. It was takenby consecutive sampling. Positive result noted if MAP is > 90 mmHg. ROT classified as positive result if there were different of diastolic pressure between supine and lateral position more than 15 mmHg<sup>3</sup>. The values on BMI screening classified as obesity if the result >30. The samples were traced retrospectively to see the MAP, ROT and BMI screening history and demographic data.

**Finding:**

**Table 1: Demographic Characteristics**

Age (Year)	PE group	Control group	Total
	n (%)	n (%)	n (%)
< 20	0 (0)	3 (6.7)	3 (3.3)
20-35	37 (82)	38 (84.4)	75 (83.3)
> 35	8 (18)	4 (8.9)	12 (13.3)
<b>Parity</b>			
Primi	9 (20)	13 (28.9)	22 (24.4)
Multips	36 (80)	32 (71.1)	68 (75.6)
<b>Risk Factor</b>			
Anemia	3 (6.7)	0 (0)	3 (3.3)
Gestational diabetes	5 (11.1)	2 (4.4)	7 (7.8)
History of Preeclampsia	1 (2.2)	0 (0)	1 (1.1)
Obesity	16 (35.6)	5 (11.1)	21 (23.3)
Tuberculosis	2 (4.4)	0 (0)	2 (2.22)
HbsAg (+)	1 (2.2)	0 (0)	1 (1.1)
History of IUFD	1 (2.2)	0 (0)	1 (1.1)
Under nutrition	1 (2.2)	6 (13.3)	7 (7.8)

Baseline demographics of study participants are presented in Table 1. Most pregnant women in both groups are in reproductive ages. It also worked on parity data, which is multipss showed have larger number than

nulips. Obesity has the highest rank in PE risk factor in this study. It counts a percentage of 35.6% obesity cases. Followed by Gestational diabetes and anemia.

**Table 2: MAP, ROT, BMI and the incidence of preeclampsia**

Screening	PE Group	Control Group	Total	P	OR
	n (%)	n (%)	n (%)		
MAP (-)	2 (4.4)	27 (60)	29 (32.2)	0.0001	32.250
MAP (+)	43 (95.6)	18 (40)	61 (67.8)		
ROT (-)	27 (60)	19 (42.2)	46 (51.1)	0,092	-
ROT (+)	18 (40)	26 (57.8)	44 (48.9)		
Obesity (-)	27 (60)	40 (88.9)	67 (74.4)	0,002	5.333
Obesity (+)	18 (40)	5 (11.1)	23 (25.6)		

The MAP test in this study pointed out that 95.6% preeclampsia samples have a value of positive MAP, while only 40% samples of control groups have a positive MAP. This study in accordance with another study by Gasse et al in 2017, which is showed that first-trimester MAP is a strong predictor of gestational hypertension and preeclampsia in nulliparous women<sup>4</sup>.

Table 2 also showed that 60% preeclampsia patients have negative ROT screening and are inversely proportional to control group that most of them have positive ROT screening with p value 0.092 which means that there is no association between ROT measurement and the incidence of preeclampsia.

The results of BMI measurement and the incidence of preeclampsia in this study showed that 40% preeclampsia patient are obese but only 11.1% control group patient recorded obese. Statistical analysis noted p value 0.002 which could be explained that there is a relationship between BMI and the incidence of preeclampsia.

## Discussion

Baseline data in this study discordant with the theory of preeclampsia and other study which is reproductive ages and multips are low risk group to have hypertension in pregnancy. It could be explained that reproductive age in this study has preeclampsia risk factor ie gestational diabetes, obesity, history of preeclampsia and infection. Another study from Indonesia also pictured that more than 50% patients who experienced preeclampsia are between 20 to 35 years old<sup>5</sup>. Parous women without prior history of PE have lower risk of PE; however, this protective effect will change when they have different conception partner<sup>6</sup>.

MAP test showed strong relationship with incidence of preeclampsia in this study, it revealed odd ratio 32.25. This data inline with Poon study in 2008 which reported first study on MAP measurement using validated automated blood pressure devices according to a standardized protocol and maternal variables in 11+0 to 13+6 weeks pregnancy can predict PE. Maternal blood pressure was measured in 5590 singleton pregnant women. the detection rates for PE, at 10% false positive rate, were 38% and 63%, respectively for MAP alone and in combination with maternal history<sup>7</sup>.

MAP is a reflection of hemodynamic perfusion pressure from vital organs. Another follow-up study

on MAP measurement of more than 9000 pregnancies at 11–13 weeks of gestation compared the screening using systolic blood pressure, diastolic blood pressure, and MAP. MAP performed best as a marker, with an increasing of detection rate for early onset PE from 47% (based on maternal factors alone) to 76% (based on MAP and combination of maternal factors) at 10% false positive rate<sup>8</sup>. MAP screening in first-trimester is a strong predictor of gestational hypertension and preeclampsia<sup>9,10</sup>.

The value of roll-over test has advantages in its simplicity. It requires simple equipment and no special skill. ROT is performed by positioning the patient in a lateral state and then a blood pressure measurement is made until there is no change in blood pressure. Then, the tension is measured in the supine position and the tension results are recorded again.

Some study showed roll-over test are highly variable among different investigators and also inconsistent reproducibility in the same patient. Literature review reveals sensitivities varying between 0 to 93% and specificities between 54 – 91% and false positive results up to 90%. Walia et al study in 2015 also reported roll-over test performed at 24 weeks had negative in all study cases. So, it is clear that ROT has no role as early predictive in preeclampsia<sup>3</sup>.

The relationship between preeclampsia and obesity has been greatly studied. Obesity prevalence has increased over 25 years it is similar to preeclampsia prevalence. This study showed obesity has correlation with incidence of PE. It revealed OR 5.3 in obesity cases compare non obesity cases.

This data support substantial evidence which is show that obesity ( $BMI \geq 30 \text{ kg/m}^2$ ) confers a higher risk for PE<sup>10,11,12</sup>. Obesity also state as meta inflammation, associated with chronic stress and inflammatory response. The inflammatory response was found to increase in obese women and contribute to vascular targets and vascular changes induce endothelial dysfunction and placental ischemia in turn exaggerated maternal inflammatory response and induce preeclampsia<sup>13,14,15</sup>.

This study in line with FIGO guideline on preeclampsia screening where state that if it is not possible to measure biomarker (PLGF) and/or uterine artery doppler, combination of maternal risk factor and MAP has advantages than maternal risk factor alone. Simple method to measure in Public health will increase



awareness, access, affordability, and acceptance prenatal screening of preeclampsia<sup>16</sup>.

### Conclusion

MAP and BMI can be used as baseline screening tools of preeclampsia in low resources setting with OR = 32.250 and 5.333. But ROT is not associated with the incidence of preeclampsia.

**Conflict of Interest:** None

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**Ethical Clearance:** Approved by the Ethics Committee Medical Faculty Universitas Airlangga

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