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# Relationship between parity and history of hypertension with MEOWS score in early onset severe preeclampsia patients

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## Abstract

**Introduction**: Parity and a history of hypertension are some of the highest risk factors for severe preeclampsia, especially early onset. The severity of recurrent preeclampsia will increase compared to preeclampsia in the first pregnancy. Although there is a correlation between chronic hypertension and unfavorable pregnancy outcomes, several case-control studies have consistently shown that chronic hypertension is the most often acknowledged risk factor for adverse events affecting both the mother and the fetus. Women with the risk factors above can potentially fall into bad conditions, so close monitoring must be carried out. Modified Early Obstetric Warning System (MEOWS) is used for early detection, care, treatment, and referral of changes in obstetric patient parameters that are leading to worsening.

**Objective**: Analyze the relationship between parity and history of hypertension with MEOWS scores in early-onset severe preeclampsia patients.

**Methods:** A cross-sectional approach was used in this study by involving 63 patients. The population was early-onset severe preeclampsia patients treated at Dr. Soetomo Regional Public Hospital Surabaya Indonesia 2022; the sampling technique used was total sampling. This data was collected using secondary data from medical records and analyzed statistically using bivariate test, specifically the chi-square test using SPSS software.

**Results**: The majority of patients were of reproductive age (73%), the gestational age was predominantly in the very preterm (28-<32 weeks) category (49.2%), the most obstetric status was multigravida (77.8 ), and most patients had no history of hypertension (66.7%). The average MEOWS score in early-onset PEB patients was 8.11. Parity vs MEOWS score ($p>0.05$), while the history of hypertension vs MEOWS score ($p<0.05$).

**Conclusion**: Parity and MEOWS score did not have a significant relationship, while the history of hypertension had a significant relationship with MEOWS score.

**Keywords:** Health Risk; Hypertension; Modified Early Obstetric Warning System (MEOWS); Early Onset Severe Preeclampsia; Pregnancy

## 1. Introduction

Preeclampsia is a pregnancy-specific disorder characterized by increased blood pressure accompanied by urine protein and clinical features of multiorgan disorders due to poor placental implantation (1). Early-onset preeclampsia, where symptoms appear before 34 weeks of gestation, is associated with an increased risk of short-term and long-term maternal complications, as well as perinatal mortality and morbidity (2). Early onset preeclampsia is the most severe

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clinical disease variant, occurring in 5-20% of all preeclampsia cases (3). The incidence of early-onset preeclampsia is 4 in 1000 births (4).

Factors causing preeclampsia are maternal age, parity, history of complications, chronic diseases, and Antenatal Care pregnancy checks (5). Preeclampsia is the most important cause of maternal and perinatal death (6). There are various influencing factors, including the number of primigravidas, especially young primigravidas, excessive uterine distension: hydramnios, multiple pregnancies, hydatidiform moles, diseases that accompany pregnancy: diabetes mellitus, obesity, the mother's age is more than 35 years (7). Several risk factors that contribute to the incidence of preeclampsia can be seen from factors that occur more frequently in primigravidas, nulliparas, maternal age, heredity (genetics), racial and ethnic factors, low socio-economic status, obesity, obesity, hydramnios, hydrops fetalis, hydatidiform mole and maternal history such as a history of hypertension, kidney disease, liver disease and a history of diabetes mellitus (DM) are also risk factors for preeclampsia (8). The highest clinical risk factors causing preeclampsia are a history of preeclampsia in a previous pregnancy (RR 8.4; 95% CI: 7.1-9.9), and a history of chronic hypertension (RR 5.1; 95% CI: 4.0- 6.5), apart from that, the nullipara factor also has an influence (RR 2.1; 95% CI: 11.9-2.4) (9).

The severity of recurrent preeclampsia will increase compared to preeclampsia in the first pregnancy (10). Although there is a correlation between chronic hypertension and unfavorable pregnancy outcomes, a number of case-control studies have consistently shown that chronic hypertension is the most often acknowledged risk factor for adverse events affecting both the mother and the fetus (11). Women with the risk factors above can potentially fall into bad conditions, so close monitoring must be carried out. Modified Early Obstetric Warning System (MEOWS) is a modification monitoring instrument of Early Warning System (EWS) that can be used in pregnant and postpartum women to help with early detection, care, treatment, and referral for changes in parameters that lead to worsening (12). Using MEOWS accurately could help reduce the increase in maternal mortality in the United States (13). The highest sensitivity of MEOWS was in cases of preeclampsia, namely 72%, when compared with maternal infection (52%) and postpartum hemorrhage (25%), (14).

The management of early-onset severe preeclampsia, especially at early onset, is still one of the most difficult challenges in obstetric practice (15). Careful assessment, stabilization of the mother's condition, close observation, and the choice to terminate pregnancy at the right time and under the right conditions are important components in treating severe preeclampsia (16). Use of instruments MEOWS: It is hoped that this can help identify clinical deterioration so that immediate management decisions can be made.

Dr. Soetomo Regional Public Hospital Surabaya is a type A hospital, which is the main referral center in East Java, so there are many maternal referrals with difficult cases, including early-onset severe preeclampsia. This study aimed to analyze the relationship between parity and history of hypertension with scores MEOWS in early-onset severe preeclampsia patients.

## 2. Materials and method

This research was a cross-sectional retrospective study approach that uses secondary data from medical records conducted in August – September 2023. The population was early-onset severe preeclampsia patients treated at Dr. Soetomo Regional Public Hospital Surabaya in 2022 with the sampling technique used was total sampling. After applying the inclusions and exclusions criteria, we got 64 patients in this study. The inclusion criteria were complete medical record data, while the exclusion criteria were patients who have comorbidities such as heart disease, lung disease, liver disorders, kidney disorders, autoimmune diseases, and other medical diseases. Data was collected using medical records. The independent variable in the study was the MEOWS score, while the dependent variables were parity and history of hypertension in patients with early onset severe pre-eclampsia.

The quantitative data analysis was performed using SPSS 26 for Windows. Specific tests were applied based on the study's aims by Chi-Square with a significant level at $p < 0.05$

## 3. Results and discussion

### 3.1. Characteristics of Research Subjects

In this research, data was obtained from medical records of pregnant patients with early-onset severe preeclampsia who were hospitalized at Dr. Soetomo Regional Public Hospital Surabaya for the period 1 January – 31 December 2022. Of the 159 severe preeclampsia patients, there were 66 patients with a gestational age of less than 34 weeks when they

were first admitted to the hospital. The sample that met the inclusion criteria was 63 patients; 7 patients were excluded because there were comorbidities such as heart disease and asthma in 3 patients.

**Table 1** Characteristics of Research Subjects

| Characteristics | | n (%) |
|---|---|---|
| Age (years) | <20 | 1 (1,6) |
| | 20-35 | 46 (73) |
| | >35 | 16 (25,4) |
| Gestational Age | <28 | 8 (12,7) |
| | 28 - <32 | 31 (49,2) |
| | 32 - <34 | 24 (38,1) |
| Parity | Primigravida | 14 (22,2) |
| | Multigravida | 49 (77,8) |
| History of Hypertension | Yes | 21 (33,3) |
| | No | 42 (66,7) |

Based on the data in Table 1, it shows that the majority of early-onset severe preeclampsia patients are of reproductive age, namely 46 patients (73%), gestational age in the very preterm (28-<32 weeks), as many as 31 patients (49.2%) and with the highest obstetric status, namely multigravida, as many as 49 patients (77.8), and the majority of early onset early-onset severe preeclampsia patients did not have a history of chronic hypertension, namely as many as 42 patients (66 .7%).

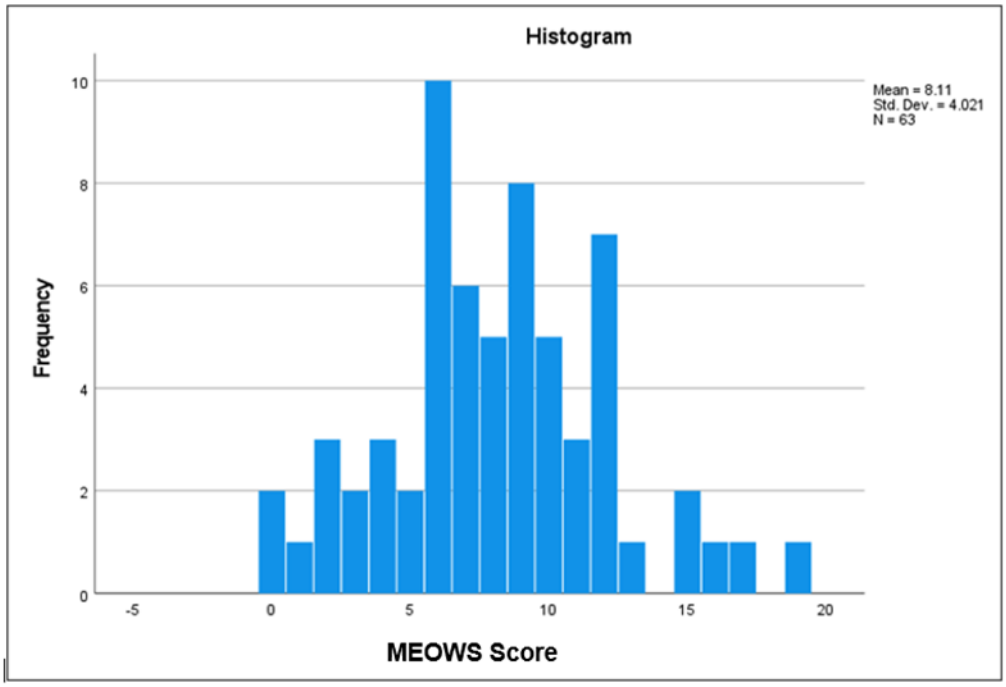


**Figure 1** Score of MEOWS

In Figure 1, it can be seen that the average score of MEOWS in early-onset severe preeclampsia patients who were hospitalized at Dr. Soetomo Regional Public Hospital Surabaya in 2022 is 8.11, with the lowest score being 0 and the highest score being 19.

### 3.2. Relationship between Parity and MEOWS Score in Early-onset Severe Preeclampsia Patients

**Table 2** Correlation of Parity with MEOWS Scores in Early-onset Severe Preeclampsia Patients

| Parity | MEOWS score | | | Total | P Value |
|---|---|---|---|---|---|
| | 0-4 | 5-6 | ≥7 | | |
| Primigravida | 5 | 1 | 8 | 14 (22,2%) | 0,095 |
| Multigravida | 6 | 10 | 33 | 49 (77,8%) | |
| Total | 11 (17,5%) | 11 (17,5%) | 41 (65,1%) | 63 (100%) | |

In Table 4, it can be seen that of the 41 early-onset severe preeclampsia patients who had a score of MEOWS high (>=7), 33 patients (80.5%) were patients with multiparity. Based on Chi Square test obtained a p-value of 0.095 (p>0.05), so it can be concluded that there is no relationship between parity and MEOWS score early-onset severe preeclampsia patients.

### 3.3. Relationship between the history of hypertension and MEOWS score in Early-onset Severe Preeclampsia Patients

**Table 3** Correlation of Parity with MEOWS Scores in Early-onset Severe Preeclampsia Patients

| History of Hypertension | MEOWS score | | | Total | P Value |
|---|---|---|---|---|---|
| | 0-4 | 5-6 | ≥7 | | |
| Yes | 0 | 4 | 17 | 21 (33,3%) | 0,034 |
| No | 11 | 7 | 24 | 42 (66,7%) | |
| Total | 11 (17,5%) | 11 (17,5%) | 41 (65,1%) | 63 (100%) | |

In Table 4, it can be seen that of the 11 early-onset severe preeclampsia patients who had a MEOWS score low (0-4), all of them were patients who did not have a history of hypertension. Meanwhile, in patients who have a history of hypertension, the majority have high MEOWS scores (≥7). Based on Chi Square test obtained a p-value of 0.035 (p<0.05), so it can be concluded that there is a relationship between the history of hypertension and the score of MEOWS early onset early-onset severe preeclampsia patients.

## 4. Discussion

Based on the research results, it was found that the majority of pregnant women with early onset severe preeclampsia were in the 20-35 years age range, namely 73%. Similar results were also obtained in other research, which shows that the age of pregnant women with early onset preeclampsia is dominated by reproductive age, namely 61.32% (17). The findings in this study are not in accordance with research by Chappell et al., who found that women under 17 years had a 2.98 times risk and women over 35 years had a 1.2 times risk of suffering from preeclampsia (9). Mothers aged <20 years and >35 years are considered to be at risk for developing preeclampsia. A woman's productive age is 20–35 years. In this study, most of the mothers were of productive age, perhaps partly due to the fact that this is the age group where women give birth most often (18). Age is not the only factor that influences the increased risk of developing preeclampsia. However, age remains an important factor in the development of this disease, so special monitoring is needed, especially for mothers at a high-risk age.

The very preterm gestational age category was the dominant group in this study at 49.2%. The results of this study are in line with research by Wijayanti and Ernawati in 2019, which showed that 85% of patients diagnosed with early onset preeclampsia were at 28-33 weeks of gestation—in a systematic review revealed that only six published cases reported the infrequent phenomenon of early-onset preeclampsia before the 20th week (19). Early onset preeclampsia before the 20th week correlates with typical risks, including advanced maternal age, nulliparity, multiple pregnancies, chronic hypertension, chronic kidney disease, family history of preeclampsia and in previous pregnancies, other hypertensive disorders, and vascular disease(20). The large number of gestational age categories may be related to administering corticosteroids for fetal lung maturation.

Based on the research results, it was found that the majority of participants were multigravida, namely 77.8%. The results of this study contradict the results of research by Denantika, Serudji, and Revilla, which showed that the proportion of multigravidas who did not suffer from preeclampsia was 1.3 times higher than multigravidas who suffered from preeclampsia (21). Research by Parantika et al. shows that there is no significant relationship between gravida status and the incidence of preeclampsia in mothers giving birth (22). Based on theory, primigravida have a greater risk of suffering from preeclampsia than multigravidas because this disease usually occurs in women who are first exposed to it, villi chorales. Immunological reaction with the formation of antibodies by HLA-G (human leukocyte antigen G) in nulliparas has not yet formed completely, thus disrupting trophoblast invasion into decidual tissue. Preeclampsia can happen to anyone, even if they don't have certain risk factors, because the course of this disease is influenced by many factors. The high number of multigravida women suffering from early-onset severe preeclampsia in this study could also be due to a history of hypertension or preeclampsia in previous pregnancies. Therefore, it is important to prevent recurrent preeclampsia in multigravidas by means of optimal preconception care.

The results showed that the majority (66.7%) did not have a history of hypertension. Research with similar results showed that 62.1% of women did not have a history of chronic hypertension but suffered from severe preeclampsia, and concluded that a history of chronic hypertension was associated with the occurrence of severe preeclampsia (23). This is in contrast to other research, which states that women with chronic hypertension have a ten times higher risk of suffering from early-onset preeclampsia and a 5 times higher risk of suffering from late-onset preeclampsia (24). In this study, 21 people (33.3%) had a history of hypertension before pregnancy. A study focusing on preeclampsia found that women who had a history of preeclampsia in a previous pregnancy had a two times greater risk of suffering from early-onset preeclampsia in a subsequent pregnancy (25).

The purpose of MEOWS use is to detect patient deterioration and decide on management quickly and appropriately. The scoring system of MEOWS is that when there are physiological parameters that deviate, they are given a score, and the score will increase when more deviations are found. The score is then fed into an escalation algorithm for action to be taken. Escalation path on MEOWS This can provide guidance for doctors or other health workers regarding the urgency of response, advice, and level of support from obstetrics, medical, anesthesia, and obstetric teams in accordance with the results of monitoring the patient's clinical condition. Score MEOWS 0-4 enters the green pathway, a score of 5-6 enters the orange pathway, and a score of ≥7 enters the red pathway. The action in green escalation is routine observation every 4 hours; yellow escalation is increasing the frequency of observations to once every hour, and red escalation is considering immediate action (12).

The results of this study show that the average score of MEOWS in early-onset severe preeclampsia patients is 8.11, where the score is in the red escalation algorithm, which means that the patient needs immediate intervention. Different results were shown by research by Hannola, which showed that most severe preeclampsia patients showed the color code yellow at 49% (14). Dr. Soetomo Regional Public Hospital Surabaya is a tertiary referral hospital or health facility in Eastern Indonesia, so it is always the final referral for cases with complex diagnoses that require multidisciplinary therapy that may not be available in secondary health facilities. Thus, the majority of patients who come are patients with poor conditions. The worse the conditions, the higher the score MEOWS, which then triggers a response in the form of medical action.

Statistical analysis shows that there is no relationship between parity and the MEOWS score (0.095>0.05). As many as 80.5% of patients who had a high MEOWS score (>=7) were multigravida. The same results were obtained in research by Umar et al., which researches validation of use Obstetric early warning system (OEWS) in low-resource areas in Nigeria, shows that there is no significant difference in terms of parity in prediction of Several maternal outcomes (SMO) (26). However, contradictory results show that primigravida will increase the risk of patients being treated in the ICU by 2.19 times higher than multigravida based on assessment using MEOWS with a cut point >=8 in patients with severe preeclampsia (27). Also, research by Faiza et al. shows that 76% of patients who experience eclampsia are primigravidae, where eclampsia is the most serious complication of severe preeclampsia (28).

Preeclampsia is a placental disease that develops in 2 stages, namely: (1) abnormal placentation at the beginning of the first trimester followed by (2) "maternal syndrome" at the end of the second and third trimesters characterized by an excess of antiangiogenic factors (29). The two-stage paradigm causes many risk factors for preeclampsia; immunological involvement is the proposed reason why nulliparity is a risk factor (9). Immune maladaptation is involved in causing shallow trophoblast vasculature in the spiral arteries, resulting in placental dysfunction and Intrauterine growth restriction (IUGR); early onset preeclampsia is usually associated with IUGR (30). Women with a history of preeclampsia in a previous pregnancy are four times more likely to suffer from both early-onset and late-onset preeclampsia compared to women who have never been pregnant before (25). The severity of recurrent preeclampsia will increase compared to preeclampsia in the first pregnancy (10).

The above can explain why nulliparas do not show high MEOWS scores because the pathophysiology of early-onset preeclampsia is usually related to abnormal placentation in stage 1, so it does not yet show a maternal syndrome that can be assessed using MEOWS. Meanwhile, multiparas may have a history of early onset preeclampsia in a previous pregnancy, so this pregnancy shows more severe symptoms.

Statistical analysis for the relationship between the history of hypertension and MEOWS score showed a P value of 0.035 (<0.05), which means that there is a significant relationship. MEOWS scores were low (0-4) in all patients who had no history of hypertension, whereas in patients with a history of hypertension, the majority (81%) had high MEOWS scores (≥7). The risk factors that can develop into preeclampsia have been studied by many studies. The main risk factors include a history of preeclampsia, chronic hypertension, pregestational diabetes mellitus, antiphospholipid syndrome, obesity, etc. (31). A history of chronic hypertension is a significant risk factor for early preeclampsia (3). Chronic hypertension can cause end-organ damage and vascular complications; this may be the reason why chronic hypertension is associated with early-onset preeclampsia (32).

Women with chronic hypertension experience one of the organ dysfunctions consistent with preeclampsia syndrome. An increase in blood pressure alone is not enough to diagnose superimposed preeclampsia; a proteinuria examination needs to be added (33). Patients with chronic hypertension have a 5.4 times risk of developing preeclampsia and the earlier the onset of preeclampsia, the more severe the condition and the higher the risk of other cardiovascular diseases (25).

MEOWS is a tool designed to detect maternal morbidity, which is mainly caused by bleeding, sepsis, hypertension in pregnancy, and cardiovascular disorders (34). From the MEOWS development model, the risk of severe maternal outcomes is five times greater in women with high systolic blood pressure (>140 mmHg) and tachycardia (HR>120 beats/minute) (26). Patients who trigger the red trigger have a higher risk of kidney injury, premature birth, and measurement results. This result may be a consequence of uncontrolled hypertension, and the decision to intervene may not be independent of the severity of hypertension (35).

Sufferers of superimposed preeclampsia are at risk of increasing the severity of the disease. The more severe the disease, the more physiological parameters will deviate, which will affect the resulting MEOWS score.

## 5. Conclusion

Parity and MEOWS score did not have a significant relationship, while the history of hypertension had a significant relationship with MEOWS score. Differences in the pathophysiology of preeclampsia that occur in primiparas and multiparas cause differences in maternal outcomes, which can be assessed in MEOWS so that it can show that there is no significant relationship between parity and MEOWS scores. A history of hypertension will increase the severity of the disease in preeclampsia, resulting in many parameter deviations and affecting the MEOWS score.

## Compliance with ethical standards

### *Acknowledgments*

### *Disclosure of conflict of interest*

The authors declared no conflict of interest.

### *Statement of ethical approval*

Ethical clearance was approved by the Ethics Committee of Dr. Soetomo Regional Public Hospital Surabaya with Number 1345/LOE/301.4.2/VI/2023.

### *Statement of informed consent*

Informed consent was obtained from Dr. Soetomo Regional Public Hospital Surabaya.

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