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Association Between Preeclampsia Onset During Pregnancy and the Risk of Postpartum Preeclampsia

Ivon Diah Wittiarika[1*], Hesty Katarina Tahu[1], Budi Prasetyo[2], Andriyanti[1], Astika Gita Ningrum[1]

[1]Midwifery Study Programme, [2]Department of Obstetrics and Gynecology, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia
Email: ivon.diah@fk.unair.ac.id,

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**Correspondence: Ivon Diah Wittiarika*
ivon.diah@fk.unair.ac.id
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Abstract

Preeclampsia is recognized as a significant cause of maternal mortality in Indonesia as well as globally. Approximately 40% of maternal deaths occur during the postpartum period. Preeclampsia during pregnancy can continue into the postpartum period. The onset of preeclampsia has an impact on maternal outcomes. Studies on postpartum preeclampsia have not been widely conducted. The objective of this study is to investigate the relationship between preeclampsia onset and the occurrence of postpartum preeclampsia. The study design is an observational analytical study using a case-control approach (retrospective). The population in this study consisted of all medical records of postpartum mothers who gave birth and were treated at Regional General Hospital, East Nusa Tenggara, the period from January to December 2023. The sample consisted of 42 case groups and 42 control groups selected using simple random sampling. The analysis used was the Chi-Square test. There was no significant association between the onset of preeclampsia and the occurrence of postpartum preeclampsia based on the Chi-square test ($p = 0.178$) with a significance level of $p < 0.05$. However, patients who experienced early-onset preeclampsia demonstrated a greater tendency toward postpartum preeclampsia. Preeclampsia during pregnancy increases the incidence of postpartum preeclampsia, with pathophysiology occurring in endothelial dysfunction, systemic inflammation, and failure of spiral artery remodeling. The impact of this process does not always stop after the placenta is delivered. Some clinical evidence shows that markers in the body can still cause postpartum clinical manifestations.

Keywords: *preeclampsia postpartum, early onset, late onset*

INTRODUCTION

Preeclampsia is recognized as the second leading cause of maternal mortality worldwide. The global maternal mortality ratio (MMR) is estimated at 189 per 100,000 live births. At the national level, Indonesia's MMR remains relatively high compared to other Southeast Asian countries and is still well above the Sustainable Development Goals (SDGs) target for reducing maternal mortality to fewer than 70 per 100,000 live births by 2030. Approximately 76% of maternal deaths occur during childbirth and the postpartum period, with 24% occurring during pregnancy, 36% during delivery, and 40% in the postpartum period (Kemeterian Kesehatan RI, 2024; WHO, 2025).

Current data illustrates the overall prevalence of preeclampsia, both antepartum and postpartum, with the Indonesian Health Profile stating that the leading causes of maternal mortality in 2023 were hypertension in pregnancy and preeclampsia with 412 cases, obstetric hemorrhage with 360 cases, and other obstetric complications with 204 cases. Preeclampsia is the second leading cause of maternal death in Indonesia. In 2023, the maternal mortality rate was 120 per 100,000 live births, with hypertension and preeclampsia responsible for 12.71% of these cases. (Dinas Kesehatan Provinsi Nusa Tenggara Timur, 2024).

Preeclampsia is classified into two types based on its onset: early preeclampsia and late preeclampsia. Early preeclampsia occurs at less than 34 weeks of gestation, while late preeclampsia occurs at 34 weeks or more (Teka et al., 2023). The prevalence of early onset preeclampsia is lower than that of late-onset preeclampsia, at 20%. However, the outcomes of early onset preeclampsia are worse and are associated with fetal growth restriction. Maternal outcomes such as eclampsia, placental abruption, pulmonary edema, and acute renal failure are more common in early onset preeclampsia. Meanwhile, HELLP syndrome (Hemolysis, Elevated Liver enzymes, low Platelets) and postpartum hemorrhage are more common in late-onset preeclampsia. Adverse perinatal outcomes, including low birth weight, small for gestational age, asphyxia, and perinatal mortality, are more frequently observed in cases of early-onset preeclampsia. In such cases, new borns often require admission to the Neonatal Intensive Care Unit (NICU) for further management and monitoring (Burton et al., 2019; Wadhwani et al., 2020).

Childbirth can eliminate some symptoms, but preeclampsia may continue or recur in the postpartum period. This condition has been identified as an important risk factor for peripartum morbidity. However, attention and research on cases of postpartum preeclampsia are still relatively limited, especially in terms of evaluation, management, and complications in mothers who are readmitted after giving birth (Rana et al., 2019). Although preeclampsia has been extensively studied as a major contributor to maternal morbidity and mortality, limited attention has been given to its progression into the postpartum period. Many previous

studies have focused on the distinction between early and late preeclampsia during pregnancy and their impact on the mother and newborn. Meanwhile, postpartum preeclampsia is discussed as a separate clinical condition, and there has been little research to clearly determine whether its onset during pregnancy influences postpartum outcomes. Evidence regarding a potential association between the onset of preeclampsia during pregnancy and postpartum preeclampsia is still limited, necessitating further research to explore this relationship and support improved postpartum monitoring and management. This study aims to evaluate the association between the onset of preeclampsia during pregnancy and the occurrence of postpartum preeclampsia. Healthcare workers play a crucial role in preventing, detecting, managing, and referring patients effectively. These efforts are expected to improve the quality of care, thereby reducing morbidity and mortality caused by preeclampsia during pregnancy, childbirth, and the postpartum period.

METHODS

This study used an analytical observational research design with a case-control (retrospective) approach. The population in this study was all medical records of postpartum mothers who gave birth and were treated at Prof. Dr. W. Z. Johanes Kupang Regional General Hospital Nusa Tenggara Timur during the period from January to December 2023. Postpartum preeclampsia is defined as the presence of hypertension (≥ 140/90 mmHg) and proteinuria (dipstick > +1 or > 300 mg/24 hours), with or without seizures, occurring up to 4 weeks after delivery. Preeclampsia can occur before, during, or after pregnancy. Postpartum preeclampsia may be associated with persistent gestational hypertension, chronic hypertension, or may develop after delivery due to other causes.

The sample consisted of 84 people with a 1:1 ratio, namely 42 postpartum mothers with preeclampsia in the case group and 42 postpartum mothers without preeclampsia in the control group, who met the inclusion criteria is mothers with a complete diagnosis of postpartum preeclampsia in their medical record and did not meet the exclusion criteria (having comorbidities such as heart disease, pulmonary tuberculosis, and HIV/AIDS, as well as multiple pregnancies). The sampling technique used was simple random sampling. The analysis used was the Chi-Square test to examine the relationship between independent variables and the occurrence of postpartum preeclampsia, with a significance level of $p < 0.05$. This research has obtained ethical approval from the Airlangga University Faculty of Medicine Ethics Committee No. 15/EC/KEPK/FKUA/2025.

FINDINGS AND DISCUSSION

Table 1. Characteristics of Preeclampsia in Postpartum at Prof. Dr. W. Z. Johanes Kupang Regional General Hospital, East Nusa Tenggara.

Respondent Characteristics	Postpartum Preeclampsia		Not Postpartum Preeclampsia		Total	
	F	%	F	%	F	%
Age						
≥ 35 years	23	54,8	12	28,6	35	41,7
< 35 years	19	45,2	30	71,4	49	58,3
Parity						
Primiparous	12	28,6	12	28,6	24	28,6
Multiparous	22	52,4	16	38,1	38	45,2
Grandemultiparous	8	19,0	14	33,3	22	26,2
Obesity						
Yes	12	28,6	4	9	16	19,0
Not	30	71,4	38	91	68	81,0
Chronic hypertension						
Yes	22	52,4	0	0	22	26,2
Not	20	47,6	42	100	62	73,8
History of preeklamsia						
Yes	12	28,6	0	0	12	14,3
Not	30	71,4	42	100	72	85,7

Based on Table 1, most respondents who experienced postpartum preeclampsia (case group) were aged 35 years or older, while most in the control group were younger than 35 years. Most of the case group and control group were multiparous. In the case group, most were not obese before pregnancy, had chronic hypertension, and had no previous history of preeclampsia.

The age distribution of respondents demonstrates that the majority of cases occurred in women aged 35 years and older. Previous studies have established a significant association between maternal age and the incidence of postpartum preeclampsia. Advanced maternal age, particularly pregnancies at 35 years or older, is consistently linked to an increased risk of preeclampsia. In older women, especially those with a history of hypertension or other comorbidities, advanced maternal age remains a critical risk factor, particularly for early-onset cases. Pregnancy at an older age is associated with impaired vascular function, endothelial cell damage, and increased oxidative stress, which may result in placental dysfunction and subsequently poorer maternal and perinatal outcomes (American College of Obstetricians and Gynecologists (ACOG), 2020; You et al., 2018).

Parity is often considered a risk factor for preeclampsia. In this study, most participants in both groups were multiparous. Clinically, preeclampsia is more frequently linked to nulliparity, especially in first-time mothers. However, factors such as advanced maternal age, chronic hypertension, obesity, and gestational diabetes appear to have a greater impact on postpartum preeclampsia risk. These maternal comorbidities may be more significant than parity alone. In the postpartum period, preeclampsia is primarily influenced by pre-existing vascular, inflammatory, and endothelial dysfunctions rather than the number of previous pregnancies. Thus, higher parity does not necessarily increase risk when other factors are more prominent (Cunningham et al., 2022).

Obesity represents a global health concern, and Indonesia follows a similar increasing trend. Previous studies have reported that women with a history of preeclampsia have a five- to eightfold higher risk of developing metabolic syndrome, a condition that may be influenced not only by prior preeclampsia but also by pre-pregnancy obesity. However, in evaluations conducted at six months postpartum, preeclampsia itself was not identified as an independent risk factor, with the observed risk being more strongly explained by obesity and excessive body weight before pregnancy. Both obesity and overweight, in conjunction with preeclampsia, are strongly associated with the development of hypertension and metabolic syndrome within the first year after childbirth (Pizano-Zarate et al., 2023). While the majority of cases and controls in this study did not have obesity, other risk factors also played a role in the onset of preeclampsia complications during both pregnancy and the period of postpartum.

Based on the data regarding respondents' history of chronic hypertension, most women in this group developed postpartum preeclampsia, whereas none of the participants in the control group had chronic hypertension. Women with pre-existing chronic hypertension were found to have approximately a twofold higher risk of developing preeclampsia (Kassa et al., 2023). Despite there has been no further research on the relationship between the mechanism of chronic hypertension and postpartum preeclampsia, various sources explain the link between these risk factors.

From this study, respondents with a history of preeclampsia previously experienced postpartum preeclampsia, and no respondents in the control group had a history of preeclampsia in previous pregnancies. The history of preeclampsia is a major risk factor for the occurrence of preeclampsia in the next pregnancy and in the postpartum period. Women who have had preeclampsia in a previous pregnancy or who have had high blood pressure for about four years are at higher risk for preeclampsia. A prior history of preeclampsia is associated with a 20–40% likelihood of recurrence, influenced by the severity of the earlier condition and coexisting comorbidities, including chronic hypertension. The mechanisms underlying this risk of recurrence include immunological predisposition, genetic factors, and persistent endothelial dysfunction (Sibai, 2012)

Tabel 2. Descriptive analysis variable preeclampsia postpartum and preeclampsia onset.

Variable	F	%
Preeclampsia Postpartum		
Case	42	50
Control	42	50
Preeclampsia Onset		
Early	10	11,9
Late	74	88,1

The results show from Table 2 that most respondents had a history of late onset preeclampsia during pregnancy. A study conducted in Taiwan from 2001 to 2014 involving 32,742 respondents with preeclampsia explained that 13,833 (42.3%) experienced early onset and 8,909 (57.6%) experienced late onset. Maternal age and chronic hypertension have been shown to increase the likelihood of early-onset preeclampsia, while parity is more commonly associated with late-onset preeclampsia, especially in primiparous women (You et al., 2018).

Tabel 3. Analisis bivariat variable preeclampsia postpartum and preeclampsia onset.

Variable	Category	Preeclampsia Postpartum				Total		p-Value
		Yes		Not				
		F	%	%	F	%		
Preeclampsia Onset	**Early**	7	6,7	7,1	10	11,9		0,178
	Late	35	83,3	92,9	74	88,1		

Based on Table 3, association early-onset preeclampsia and postpartum preeclampsia was not statistically significant (p = 0.178). This finding suggests a tendency toward increased risk, although the relationship was not conclusive in this study.

Preeclampsia during pregnancy increases the incidence of postpartum preeclampsia, which is supported by the pathophysiological theory of endothelial dysfunction, systemic inflammation, and failure of spiral artery remodeling. The effects of this process do not always stop after the placenta is delivered. Some clinical evidence shows that markers in the body can still cause clinical manifestations after delivery (Hauspurg & Jeyabalan, 2022). Preeclampsia may develop between 48 hours and up to six weeks after delivery, a condition known as postpartum preeclampsia. This condition can occur both in women who had preeclampsia during pregnancy and in those without a prior history of the disease. Previous studies have reported that more than half of postpartum preeclampsia cases occurred in women who did not experience preeclampsia during pregnancy. Seizures occurring within 72 hours after delivery are considered indicative of postpartum eclampsia. Early recognition and appropriate management of postpartum preeclampsia and eclampsia are essential, as the risk of complications may be higher than during pregnancy. Without timely treatment, these

conditions can progress rapidly and are associated with substantial maternal morbidity and mortality (American College of Obstetricians and Gynecologists, 2019; American College of Obstetricians and Gynecologists (ACOG), 2020).

One possible reason for the insignificant relationship is the relatively limited sample size, which reduces the statistical power of the study. In addition, postpartum preeclampsia itself is a complex and multifactorial condition. Several studies have shown that risk factors for postpartum preeclampsia are not only related to conditions during pregnancy, but are also influenced by other maternal factors such as maternal age, obesity, chronic hypertension, diabetes, and parity. A large cohort study found that factors such as maternal age, obesity, nulliparity, diabetes, and hypertension have similar associations with both intrapartum and postpartum preeclampsia, suggesting that postpartum preeclampsia may be a continuation of hypertension disorders during pregnancy and is influenced by various maternal risk factors simultaneously (Shalev-Ram et al., 2025). Several studies have shown that women with a history of preeclampsia have a higher risk of developing hypertension or cardiovascular disease after pregnancy, indicating persistent vascular dysfunction after delivery. This condition can influence the development of postpartum hypertension, but it does not always depend on the time of onset of preeclampsia during pregnancy (Haßdenteufel et al., 2022)

In a normal pregnancy, maternal immune cells generate inflammatory signals that initiate uterine contractions, and after delivery, these immune cells retain a memory of fetal antigens that may facilitate subsequent pregnancies. In early-onset preeclampsia, proinflammatory immune cells, including macrophages, dendritic cells, natural killer (NK) cells, and T helper (Th) cells, disrupt spiral artery remodeling, resulting in placental hypoxia. This hypoxic state promotes cellular injury and death, leading to placental dysfunction and the release of fetal antigens. Subsequently, activated Th cells stimulate the production of inflammatory and antiangiogenic factors from the placenta and other immune cells, causing placental, vascular, and renal dysfunction and contributing to the development of hypertension during pregnancy. Importantly, inflammatory immune cells associated with preeclampsia may persist after delivery and retain immunological memory, thereby increasing the risk of preeclampsia in subsequent pregnancies. In contrast, in late-onset preeclampsia, spiral artery remodeling generally occurs normally; however, placental metabolic demands eventually exceed uterine perfusion capacity, leading to relative placental hypoxia and an inflammatory milieu similar to that observed in early-onset disease (Herrock et al., 2023).

Several cohort studies have investigated risk factors for postpartum preeclampsia and have generally identified profiles similar to those associated with preeclampsia during pregnancy. Advanced maternal age, Black race, and maternal obesity have consistently been linked to an increased risk of postpartum

preeclampsia. Maternal age of 35 years or older has been associated with approximately a twofold higher risk of developing postpartum preeclampsia. Pre-pregnancy obesity is also a well-established risk factor, with women who have a body mass index (BMI) greater than 40 kg/m² experiencing up to a 7.7-fold higher risk. In addition, Black women have been reported to have a two- to fourfold greater risk of postpartum preeclampsia compared with women of other racial groups (Skurnik et al., 2017).

Women with hypertension during pregnancy, especially preeclampsia, have a higher risk of developing masked hypertension. Routine examinations include blood pressure measurements (which should include out-of-clinic blood pressure measurements, urinalysis, and cardiovascular disease risk assessment), carried out at least 6-12 weeks, 6 months, and 12 months after delivery, and annually thereafter. Antihypertensive therapy is recommended, such as propranolol, atenolol, acebutolol, and nifedipine. Most of these drugs are secreted in very low concentrations into breast milk. Long-term follow-up after delivery in patients with peripartum hypertension is very important. The risk of complications of chronic hypertension, cardio-cerebrovascular disease, and kidney disease is an important consideration in postpartum management (Perhimpunan Dokter Hipertensi Indonesia, 2025).

Further research is required to clarify whether new-onset postpartum preeclampsia or eclampsia represents a distinct clinical entity from antepartum-onset preeclampsia. In addition, greater emphasis on this condition in both national and international guidelines is warranted, as it is frequently underrecognized by healthcare providers. This study has limitations, including dependence on the completeness of medical records, a sample that only included preeclampsia that continued from pregnancy, and a research location that was limited to one hospital. For future development, a prospective study with a larger sample size is recommended, focusing on postpartum preeclampsia and involving several service centers.

CONCLUSIONS

This study concluded that the onset of preeclampsia during pregnancy has no significant relationship with postpartum preeclampsia, but awareness of early onset preeclampsia needs to be increased because it has an approximately 2 times higher risk of postpartum preeclampsia. The findings of this study emphasize the importance of early screening by identifying several risk factors such as age, body mass index, history of chronic hypertension, and history of previous preeclampsia. Preventive measures are also very important, such as planning a healthy pregnancy and improving lifestyle. Increased synergy between hospitals and primary health facilities for continued monitoring is very important. Research on preeclampsia has not been widely discussed, so it needs to be further developed with related cohort (longitudinal) designs, mechanisms, complications, and management.

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