Preterm birth risk associated with maternal preeclampsia

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Abstract:
Preterm birth is defined as a live birth that occurs before 37 weeks of gestation and is one of the leading causes of high neonatal morbidity and mortality rates. One of the risk factors strongly associated with preterm birth is preeclampsia, a pregnancy complication characterized by hypertension and proteinuria after 20 weeks of gestation. This study aims to analyze the relationship between preeclampsia and the incidence of preterm birth at Gambiran Regional Public Hospital, Kediri City. A cross-sectional study design with a retrospective approach was used, based on medical record data. A total sampling technique was applied, involving 215 respondents. Data were analyzed using the Chi-Square test with a significance level of 0.05. The results showed a significant association between preeclampsia and preterm birth, with a p-value of 0.04. The significant p-value indicates that preeclampsia is associated with an increased risk of preterm birth. This supports the hypothesis that maternal complications such as hypertension and proteinuria can disrupt normal fetal development and trigger early labor. There is a relationship between preeclampsia and the incidence of preterm birth at Gambiran Regional Public Hospital, Kediri City. Preeclampsia should be considered an important indicator in early screening during labor and neonatal care services to prevent further complications.

Keywords:
preeclampsia; preterm birth; neonatal outcomes

INTRODUCTION

Indicators of public health and well-being can be identified through maternal mortality rates, infant mortality rates, and life expectancy. In Indonesia, maternal mortality remains a priority issue in maternal and child health. Meanwhile, a high infant mortality rate reflects the low quality of obstetric services and is a serious concern (Kementerian Kesehatan RI, 2023). One of the main causes of infant mortality is prematurity, followed by infection, neonatal asphyxia, and birth trauma. Premature infants are more susceptible to death because their organs, such as the lungs, heart, kidneys, liver, and digestive system, are not yet fully developed (Abebaw et al., 2021).

Preterm infants are babies born before reaching 37 weeks of gestation, calculated from the first day of the last menstrual period (World Health Organization, 2023). Preterm babies are more

vulnerable because their organs are not fully developed, resulting in a higher risk of morbidity and mortality. They are also more susceptible to complications such as central nervous system infections, asphyxia, and respiratory distress syndrome (Zivaljevic et al., 2024).

The issue of prematurity is a matter of concern for both the global and national communities. In 2020, it was estimated that approximately 13.4 million babies were born prematurely worldwide, with incidence rates ranging from 4% to 16% of total births across various countries (Ohuma et al., 2023). In Indonesia, the number of preterm births is considered high, with around 600,000 cases reported annually, placing a significant burden on the national healthcare system (Rohsiswatmo et al., 2023).

This condition is also reflected at the regional level. In East Java, the incidence of preterm birth in 2012 was recorded at 3.23%, with neonatal mortality due to prematurity reaching 38.03%. In Kediri City, in 2016, the stillbirth rate was 3.0 per 1,000 live births, while the infant mortality rate (IMR) was 1 per 1,000. The leading causes of neonatal death in this region were prematurity or low birth weight (56.25%), followed by asphyxia (37.5%) and infection. Data from several hospitals in Kediri showed that in 2016, the incidence of preterm birth was 8.2% at Ratih Hospital, 9.9% at Aura Syifa Hospital, and 16.1% at Gambiran Regional Public Hospital. These numbers continued to rise in 2017, reaching 9.7% at Ratih Hospital, 12.8% at Aura Syifa Hospital, and 17.2% at Gambiran Hospital.

One of the factors strongly associated with preterm birth is preeclampsia, a pregnancy complication characterized by hypertension and proteinuria after 20 weeks of gestation. Preeclampsia is caused by placental dysfunction and can restrict fetal growth as well as increase the risk of preterm birth. The global prevalence of preeclampsia ranges from 1% to 10% in certain populations (Kumsa & Mergiyaw, 2024). Uteroplacental perfusion disorders and fetal stress due to placental insufficiency are believed to be major triggers of spontaneous preterm labor (Preston et al., 2024).

Preeclampsia reduces blood flow to the placenta, resulting in decreased oxygen supply to the uterine muscles. This makes the uterus more sensitive and prone to early contractions, thereby increasing the likelihood of preterm labor (Sovio et al., 2023). Additionally, preeclampsia triggers inflammation and the release of substances such as sFlt-1 that damage blood vessels and stimulate the production of prostaglandins—compounds that can induce uterine contractions (Bi et al., 2024). Moreover, increased expression of Piezo 1 channels in the uterine muscles can elevate calcium levels, contributing to premature contractions (Barnett et al., 2023).

To reduce the risk of preeclampsia, preventive interventions such as calcium supplementation and low-dose aspirin administration in high-risk pregnant women have been proven effective and are recommended by various international guidelines (Gomes et al., 2022). Early detection is also

crucial and can be carried out through regular monitoring of blood pressure and proteinuria during pregnancy. In addition, biomarkers such as serum uric acid, CRP, and LDH are currently being explored as supplementary indicators to predict the risk and progression of preeclampsia, especially in high-risk pregnancies (Renu et al., 2022).

Preeclampsia not only affects labor outcomes but also has long-term consequences for the baby. Infants born to mothers with preeclampsia are at higher risk for neurocognitive disorders, developmental delays, and metabolic complications due to intrauterine exposure to hypoxia and oxidative stress (Koulouraki et al., 2023). Even in adulthood, these children are more likely to develop hypertension and cardiovascular disorders (Karatza & Dimitriou, 2019). Therefore, the management of preeclampsia must be carried out through a multidisciplinary approach involving obstetrics, neonatology, and child development services to minimize long-term impacts (Socol et al., 2024).

The relationship between preeclampsia and the incidence of preterm birth still requires further exploration, especially within referral-level hospital services. This study aims to analyze the association between preeclampsia and preterm birth and to contribute to the strengthening of early detection strategies and the management of pregnancy complications to reduce maternal and infant morbidity and mortality rates.

METHODS

This research is an analytical observational study with a cross-sectional approach, conducted at Gambiran Regional Public Hospital in Kediri City, during August. The sample consisted of all pre-term infants born between January and December, totaling 215 babies. A total sampling method was used for sample selection. The inclusion criteria included medical record data of infants diagnosed with prematurity, whether born through spontaneous delivery or cesarean section, along with documented information on the mother's preeclampsia status. The exclusion criteria were unreadable or incomplete medical records or those lacking the necessary information according to the research variables. Data were obtained from medical records and analyzed using the Chi-square test (χ^2) with the assistance of statistical software.

RESULTS

Table 1. Frequency Distribution of Preterm Birth and Pre-eclampsia Incidence at Gambiran Regional Public Hospital, Kediri City (n=215)

Variable	Frequency	Percentage
Premature Level		
Extremely	27	12.6
Very premature	73	34
Moderate to late	115	53.5
Pre-eclampsia Incidence		
Preeclampsia	116	54
Non-preeclampsia	99	46

Table 1 demonstrated that most preterm infant respondents recorded in the medical records were classified as moderate to late preterm, totaling 115 infants (53.5%). Most of the respondents recorded in the medical records were diagnosed with preeclampsia, totaling 116 individuals (54%).

Table 2. Analysis of The Relationship Between Pre-eclampsia and Preterm Birth

Premature Level	Pre-eclampsia Incidence		p-value	X^2
	Preeclampsia	Non-Preeclampsia		
Extremely	9	18	0.040	7.22
Very premature	38	35		
Moderate to late premature	69	46		

Table 2 revealed that out of 215 preterm infants, 116 (54%) were born to mothers with preeclampsia, while 99 (46%) were not. The analysis showed a Chi-square (χ^2) value of 7.22, which is greater than the table value of 5.991, leading to the rejection of H_0. The Chi-square test also produced a p-value of 0.040, which is less than 0.05. This indicates a significant association between preeclampsia and preterm birth at Gambiran Regional Public Hospital, Kediri City.

DISCUSSION

Table 1 shows that most preterm infants recorded in the medical records were classified as moderate to late preterm (53.5%). A meta-analysis reported that moderate to late preterm infants have a higher likelihood of experiencing mild intellectual impairment in adulthood (Fernández de Gamarra-Oca et al., 2021). A case-control study identified pre-eclampsia, premature rupture of membranes, and placental abruption as significant risk factors for preterm birth (Jafarpour et al., 2025).

These findings align with a systematic review confirming that various maternal conditions, such as chronic hypertension, anemia, infections, and placental disorders, consistently increase the risk of preterm birth. Moreover, disruptions in maternal circadian rhythm have also been shown to contribute to both preeclampsia and preterm birth (Mitrogiannis et al., 2023).

Table 1 also shows that 116 respondents (54%) in this study experienced preeclampsia. Preeclampsia is a condition that emerges after 20 weeks of gestation and is characterized by high blood pressure and the presence of protein in the urine. It results from vascular abnormalities caused by poor placental development and function. Recent research suggests that preeclampsia is associated with endothelial dysfunction, resulting in vasoconstriction, reduced blood flow to organs, and systemic inflammation (Torres-Torres et al., 2024).

Additionally, preeclampsia is associated with oxidative stress and placental mitochondrial dysfunction, which further aggravate maternal vascular damage (Jahan et al., 2023). Although nearly half of the respondents experienced preeclampsia, the precise cause remains unclear. However, one notable predisposing factor is primiparity, with 129 respondents identified as first-time mothers. A heightened maternal immune response to fetal and placental antigens is thought to play a significant role in the development of preeclampsia (Kornacki et al., 2024).

According to Table 2, the results of the analysis show a significant relationship between preeclampsia and preterm birth. Prematurity due to pre-eclampsia affects not only the neonatal period but also long-term health outcomes, particularly cardiovascular development. Infants born prematurely due to placental complications such as pre-eclampsia often experience impaired organ development in utero. As a result, the heart and blood vessels may not develop optimally (Stolfi et al., 2025). These findings highlight the importance of addressing preeclampsia not only as an acute pregnancy complication but also as a factor that can influence a child's future health. Therefore, optimal prevention and management of preeclampsia during pregnancy are essential to reduce long-term risks associated with pre-term birth.

Preventing preeclampsia is a key strategy in reducing the risk of preterm birth and its associated consequences for infants. One proven intervention is the administration of low-dose aspirin (approximately 75 mg daily), starting between 12 and 16 weeks of gestation. A recent meta-analysis involving more than 20,000 women found that initiating aspirin therapy before 16 weeks significantly reduced the incidence of preeclampsia by 38% to 50% in high-risk mothers (Wang et al., 2022). In addition, calcium supplementation of more than 1 gram per day has also been shown to reduce the risk of preeclampsia by up to 47%, especially in women with low calcium intake, with stronger effects observed in high-risk populations (Woo Kinshella et al., 2022).

CONCLUSION

This study revealed that most preterm newborns at Gambiran General Hospital, Kediri, were classified as moderate to late premature, and most mothers had preeclampsia as a risk factor. The analysis also demonstrated a significant relationship between preeclampsia and preterm birth, indicating that preeclampsia is one of the contributing factors to the increased risk of preterm delivery at the hospital.

This research is expected to inform Gambiran General Hospital's consideration of screening for pre-eclampsia risk factors, aiming to improve the quality of care for newborns at risk of prematurity. Future researchers are encouraged to explore broader risk factors for preterm birth, including those related to maternal health, labor processes, and placental conditions, to enrich and complement the findings of this study

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CONFLICT OF INTEREST

The authors declare that they have no financial or personal conflicts of interest related to this study.

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