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Relationship Between The Severity of Preeclampsia and Oligohydramnios

Andriyanti, Bianca Bunga Cinta Dewi, Ashon Sa'adi
Midwifery Study Programme, Department of Obstetrics and Gynecology Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia
andriyanti@fk.unair.ac.id

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Abstract
Introduction: *Preeclampsia is a pregnancy complication characterized by hypertension and organ dysfunction after 20 weeks of gestation, often associated with adverse maternal and fetal outcomes, including oligohydramnios.* ***Objective:*** *This study aims to analyze the relationship between the severity of preeclampsia and the occurrence of oligohydramnios.* ***Methods:*** *An analytical observational study with a cross-sectional approach was conducted using medical records of 105 preeclamptic patients at Dr. Soetomo General Hospital, Surabaya, in 2023. The severity of preeclampsia was the independent variable, and oligohydramnios was the dependent variable. Data were analyzed using the Fisher Exact test.* ***Result and Discussion:*** *The study sample consisted of a relatively balanced proportion of preeclampsia without severe features (50.5%) and preeclampsia with severe features (49.5%). Only 5.7% of pregnant women with preeclampsia experienced oligohydramnios. There was no significant association between the severity of preeclampsia and oligohydramnios (p=0.981). The findings showed an equal distribution of oligohydramnios cases across both groups.* ***Conclusion:*** *The severity of preeclampsia is not associated with oligohydramnios. However, these findings indicate that oligohydramnios can occur not only in cases of preeclampsia with severe features but also in those without severe features. Placental insufficiency leads to decreased uteroplacental blood flow.*

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Introduction

Preeclampsia is a pregnancy complication affecting approximately 5% of pregnant women worldwide and is one of the leading factors contributing to high morbidity and mortality rates in both mothers and fetuses (Abalos et al., 2013). Preeclampsia is a pregnancy-specific disorder defined by the development of hypertension alongside signs of organ impairment, including proteinuria, typically manifesting after the 20th week of gestation. Preeclampsia is categorized into different classifications according to the severity of the condition. The term "preeclampsia without severe features" refers to hypertension with proteinuria but without clinical symptoms or laboratory abnormalities. Preeclampsia with severe features is defined as systolic blood pressure greater than 160 mmHg or diastolic blood pressure greater than 110 mmHg, or both, accompanied by evidence of target organ dysfunction (Khalil, 2017; Tranquilli et al., 2013). The primary etiology responsible for the onset of preeclampsia remains uncertain. Several studies suggest that preeclampsia is the result of a complex interaction of various pathological mechanisms, including abnormal placentation, placental hypoxia-ischemia, and oxidative stress (Jena et al., 2020; Karacay et al., 2010; Taravati & Tohidi, 2018).

Preeclampsia is closely associated with various adverse maternal and perinatal outcomes, including increased rates of cesarean section, low Apgar scores at birth, preterm delivery, placental abruption, HELLP syndrome, eclampsia, disseminated intravascular coagulation (DIC), and a higher requirement for intensive care for both mother and fetus (Özgen et al., 2022). Women who develop preeclampsia during pregnancy face a heightened risk of cardiovascular and cerebrovascular events that may persist for several years postpartum. (Patel et al., 2021). In preeclampsia, placental insufficiency occurs, resulting in reduced uteroplacental blood flow. This reduction causes blood flow in the fetal circulation to be redirected from non-vital organs (such as the kidneys) to more vital organs like the brain and cor. Consequently, decreased renal blood flow leads to reduced urine production, which in turn causes oligohydramnios (Özgen et al., 2022).

A decrease in amniotic fluid volume, particularly during the third trimester of pregnancy, has been shown to be associated with various serious fetal complications. These complications include umbilical cord compression and musculoskeletal deformities such as facial malformations and clubfoot, as well as intrauterine growth restriction (IUGR) and fetal distress. Additionally, they include meconium aspiration syndrome, severe birth asphyxia, congenital anomalies, and intrauterine fetal demise (IUFD). Three most common etiologies contributing to the occurrence of oligohydramnios are Preeclampsia, IUGR as placental insufficiency and post-term pregnancy (Ahmar et al., 2018). The purpose of this study is to examine the association between the severity of preeclampsia and oligohydramnios. The severity of preeclampsia is suspected to play a role in causing uteroplacental perfusion disturbances, which may lead to oligohydramnios. A reduction in amniotic fluid volume is known to contribute to an increased risk of neonatal complications.

Method

This study is an analytical observational study with a cross-sectional design. Secondary data were obtained from the medical records of patients diagnosed with preeclampsia at Dr. Soetomo General Hospital, Surabaya, in 2023. Sampling was conducted using a total sampling method, based on inclusion and exclusion criteria. The inclusion criteria were pregnant women diagnosed with preeclampsia, and gestational age

≥ 20 weeks. The exclusion criteria were preeclampsia patients with incomplete medical records. A total of 105 samples were included in this study. The independent variable was the severity of preeclampsia, and the dependent variable was oligohydramnios. Data analysis was performed using the Fisher Exact Test. Data on the severity of preeclampsia and the presence of oligohydramnios were obtained from patients' medical records. To determine the severity of preeclampsia, the researchers applied two classifications: preeclampsia without severe features; defined by elevated systolic blood pressure ≥140 mmHg or diastolic pressure ≥90 mmHg accompanied by proteinuria, without clinical symptoms or abnormal laboratory findings; preeclampsia with severe features, defined by systolic blood pressure ≥160 mmHg or diastolic pressure ≥110 mmHg accompanied by proteinuria and evidence of organ dysfunction as indicated by laboratory results documented in the medical records. Data on oligohydramnios were based on diagnoses supported by ultrasound findings showing an amniotic fluid index (AFI) of less than 5, as recorded in the medical records.

Research and Discussions

A total of 105 pregnant women diagnosed with preeclampsia were included as samples in this study. The patient characteristics data are presented in Table 1.

Table 1
Patient characteristics of preeclampsia at Dr. Soetomo General Hospital, Year 2023

Characteristic	Category	Frequency	Percentage (%)
Age	20-35 years	67	63.8
	<20 and >35 years	38	36.2
Parity	Primiparous	42	40
	Multiparous	63	60
BMI	<18.5 kg/m^2	3	2.9
	18.5-24.9 kg/m^2	14	13.2
	25-29.99 kg/m^2	15	14.3
	≥30.0 kg/m^2	73	69.5
Severity of Preeclampsia	Preeclampsia without severe features	53	50.5
	Preeclampsia with severe features	52	49.5
Oligohidramnion	No	99	94.3
	Yes	6	5.7

The results presented in Table 1 indicate that most patients with preeclampsia were within reproductive age, multiparous, and had obesity-class BMI. Additionally, the proportions of preeclampsia without severe features and preeclampsia with severe features in the studied sample were relatively balanced. However, preeclampsia without severe features can progress to severe preeclampsia if not detected and managed early. Early management of preeclampsia prevents the disease from worsening and leads to better maternal and perinatal outcomes.

In this study, only 5.7% of pregnant women with preeclampsia experienced oligohydramnios. This finding indicates a relatively low incidence of oligohydramnios among pregnancies complicated by preeclampsia in this population. Oligohydramnios is a common obstetric complication, with reported incidence ranging from 0.5% to over 5% of pregnancies. The incidence significantly increases to approximately 11% in post-term pregnancies (Sonkhya et al., 2017). Although the incidence of oligohydramnios in this study was low, the condition warrants significant clinical attention due to its close association with increased risks of obstetric complications, such as fetal growth

restriction, fetal distress, and preterm delivery. In the context of preeclampsia, the presence of oligohydramnios may reflect a more severe degree of placental insufficiency and potentially worsen both maternal and perinatal prognosis.

Table 2
Bivariate Analysis of the Severity of Preeclampsia and Oligohydramnios in Preeclampsia Patients at Dr. Soetomo General Hospital Surabaya, 2023

Variable	Category	Oligohydramnios		*p* value
		No Frequency (%)	Yes Frequency (%)	
Severity of Preeclampsia	Preeclampsia without severe features	50 (50.5)	3 (50)	0.981
	Preeclampsia with severe features	49 (49.5)	3 (50)	

Note: The Fisher Exact test results indicate a significant difference if the p-value < 0.05 and no significant difference if the p-value > 0.05.

The study results indicate that there is no significant association between the severity of preeclampsia and the occurrence of oligohydramnios. However, the findings show an equal distribution of oligohydramnios cases across both mild and severe preeclampsia groups. This suggests that oligohydramnios can occur not only in severe preeclampsia but also in cases without severe features. Preeclampsia is classified into several types, including mild and severe forms, both of which contribute to increased maternal morbidity. Nonetheless, their impact on maternal mortality may vary depending on the severity and clinical management provided (Dewi et al., 2024).

Sonkhya *et al.* (2017) reported that hypertension was significantly more prevalent among pregnant women with oligohydramnios (31.03%) compared to only 3.45% in the control group, indicating that hypertension and preeclampsia are significantly more frequent in pregnancies complicated by oligohydramnios. Similarly, Ndiaye *et al.* (2024) found that the prevalence of preeclampsia was seven times higher in cases with oligohydramnios compared to those without. Ngowa *et al.*, (2015) highlighted that the most frequent fetal complications in severe preeclampsia were prematurity (48.6%), intrauterine fetal death (13.1%), and oligohydramnios. Meanwhile, other study identified oligohydramnios as the most common complication in severe preeclampsia, with a total of seven cases reported (Pramana et al., 2020). These studies collectively demonstrate that preeclampsia plays a role in the development of oligohydramnios, with varying incidence rates.

Oligohydramnios is a condition characterized by a decreased volume of amniotic fluid. Amniotic fluid plays a vital role in the fetal support system. Its production begins shortly after the formation of the amniotic sac, approximately 12 days post-fertilization. Initially, amniotic fluid originates from maternal circulation transudation, but by around 20 weeks of gestation, fetal urine becomes the primary source. A pregnancy is classified as oligohydramnios when the amniotic fluid Amniotic Fluid Index (AFI) is ≤ 5 cm using ultrasonography examination (Ahmar et al., 2018). At any given time, the amniotic fluid volume reflects the balance between its production and absorption processes (Sonkhya et al., 2017). The amniotic fluid surrounding the developing fetus within the amniotic sac provides several essential benefits to the fetus.

Preeclampsia causes disruption of uteroplacental blood flow, which negatively impacts perinatal outcomes. Previous studies have identified several fetal complications resulting from uteroplacental ischemia, including Intrauterine Growth Restriction (IUGR), oligohydramnios, and placental abruption (Pramana et al., 2020; Rosser & Katz, 2013). Placental insufficiency leads to reduced uteroplacental blood flow, causing redistribution of fetal circulation away from non-vital organs (such as the kidneys, lungs, and gastrointestinal tract) toward more vital organs like the brain and heart. This redistribution reduces renal blood flow, resulting in decreased urine production and subsequently causing oligohydramnios (Özgen et al., 2022; Spinillo et al., 2015). Inadequate uteroplacental perfusion triggers mechanisms that redistribute fetal blood flow to preserve essential organs, thereby affecting amniotic fluid production.

In pregnancies complicated by growth restriction, amniotic fluid volume progressively decreases as the fetal condition deteriorates (Spinillo et al., 2015). Generally, the severity of oligohydramnios correlates with the degree of placental hypoperfusion and the severity of IUGR. The primary cause of oligohydramnios in fetuses with IUGR is decreased urine production due to impaired renal perfusion (Ahmar et al., 2018). Oligohydramnios in pregnancies with placental hypoperfusion worsens as fetal condition deteriorates and is influenced by both fetal and maternal factors.

A reduction in amniotic fluid volume, especially in the third trimester, has been linked to multiple fetal risks. These risks comprise umbilical cord compression and musculoskeletal abnormalities, including facial deformities and clubfoot. Furthermore, it is associated with intrauterine growth restriction (IUGR), low birth weight, and fetal distress during labor. Additional complications include meconium aspiration syndrome, severe birth asphyxia, congenital anomalies, and intrauterine fetal demise (IUFD). Preeclampsia, IUGR, and post-term pregnancy are the three most common etiologies contributing to this condition. Further complications such as pulmonary hypoplasia, Potter's syndrome, limb deformities, and hip dislocation can lead by prolonged oligohydramnios (Ahmar et al., 2018). Severe oligohydramnios may cause serious fetal complications and can progress to structural and functional fetal impairments if sustained over an extended period.

Although this study did not demonstrate a significant association, several factors may explain these findings. As a tertiary referral hospital, Dr. Soetomo General Hospital may receive a higher proportion of severe preeclampsia cases with more immediately life-threatening complications, while mild or moderate oligohydramnios cases could still be managed at secondary referral hospital through selective referral. This may reduce the proportion of preeclamptic patients with oligohydramnios recorded at this hospital. The assessment of preeclampsia severity and the degree of oligohydramnios may vary among medical practitioners, depending on their clinical experience and understanding. Differences in diagnostic criteria and clinical interpretation can influence patient classification. The diagnosis of oligohydramnios relies on the documentation of ultrasound findings and the physician's interpretation, which may vary. If the diagnosis is not clearly recorded or if patients are transferred from other healthcare facilities without complete documentation, cases may be missed in research records.

Furthermore, the low incidence of oligohydramnios among preeclamptic patients (5.7%) observed in this study should be interpreted with caution. This relatively low rate may partly reflect underdiagnosis or delayed ultrasound evaluation, potentially resulting in missed detection of mild cases. In primary healthcare settings, ultrasonography is often performed only when complications are suspected rather than routinely, which may lead

to an underestimation of the true incidence of oligohydramnios. Not all patients undergo routine ultrasonographic examination. According to antenatal care standards, ultrasound examinations are typically conducted only in the first and third trimesters by general practitioners, not obstetricians. Mild oligohydramnios may be overlooked if ultrasound is performed solely based on specific clinical indications. Patients presenting late or without clear symptoms may remain undetected. A study by Kibona et al. (2025) demonstrated a higher incidence of oligohydramnios in populations with limited access to routine ultrasonography, potentially resulting in underdiagnosis in resource-limited populations. Routine ultrasonographic evaluation for early detection of oligohydramnios is therefore important, especially in countries with constrained resources, where limited access may contribute to the low recorded incidence. Assessment of the amniotic fluid index during pregnancy should be performed for all pregnant women in the third trimester using ultrasonography, in both complicated and uncomplicated pregnancies, to enable early detection of oligohydramnios.

Early detection of oligohydramnios and appropriate management can help reduce perinatal morbidity and mortality, as well as decrease the rate of cesarean deliveries. Oligohydramnios is also associated with various conditions. Preeclampsia, IUGR, and post-term pregnancy are the most common causes of oligohydramnios (Ahmar et al., 2018). Amniotic fluid index is considered an important marker of adequate placental function. Understanding the significance of amniotic fluid volume as an indicator of fetal status, as well as oligohydramnios as a marker of chronic fetal hypoxia, is a crucial focus during pregnancy (Sonkhya et al., 2017). Oligohydramnios serves as a key indicator of placental dysfunction and chronic fetal hypoxia; therefore, early detection and proper management are essential to reduce the risks of perinatal morbidity and mortality. Midwives can perform early detection of preeclampsia by monitoring fundal height, assessing fetal well-being, and initiating timely, planned referrals to ensure that pregnant women with preeclampsia receive more comprehensive management. These efforts aim to minimize the risk of severe maternal and neonatal complications. Although this study did not find a significant relationship between preeclampsia severity and the occurrence of oligohydramnios, it may serve as a reference for future research. Further studies with larger sample sizes, prospective designs, and standardized ultrasound evaluation protocols are recommended to provide stronger evidence regarding this association.

Conclusion

The results of this study indicate that there is no significant association between the severity of preeclampsia and oligohydramnios. However, the findings demonstrate that the occurrence of oligohydramnios is evenly distributed across both groups. This suggests that oligohydramnios is not limited to cases of severe preeclampsia but can also be present in cases of preeclampsia without severe symptoms. Based on these findings, it is essential to implement close monitoring for pregnant women diagnosed with preeclampsia. Early screening for the detection of preeclampsia and timely referral for the early identification of oligohydramnios are highly recommended. Routine antenatal care and regular ultrasound examinations should be emphasized, particularly for patients with preeclampsia. Midwives are encouraged to conduct comprehensive antenatal monitoring to facilitate the early identification of complications and ensure timely and appropriate management in order to prevent adverse maternal and fetal outcomes.

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