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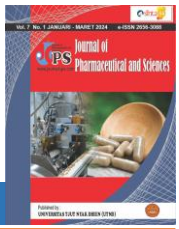

Patterns of antihypertensive therapy and clinical outcomes in preeclampsia

Pola terapi antihipertensi dan luaran klinis pada preeklamsia.

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Abstract

Introduction: Preeclampsia remains a leading cause of maternal and perinatal morbidity and mortality worldwide, necessitating effective clinical management strategies to improve pregnancy outcomes. Despite established guidelines for antihypertensive therapy in pregnancy, data on real-world treatment patterns and their associated clinical outcomes in Indonesian healthcare settings remain limited. **Objective:** This study aimed to describe sociodemographic and clinical characteristics, antihypertensive therapy patterns, blood pressure changes, and maternal and neonatal outcomes among preeclampsia patients at a tertiary referral hospital in West Sumatra, Indonesia. **Methods:** A descriptive observational study was conducted involving 80 preeclampsia patients hospitalized at Dr. M. Djamil General Hospital, Padang, from January to December 2025. Data were collected retrospectively from medical records using total sampling based on predefined inclusion and exclusion criteria. The study evaluated sociodemographic characteristics, antihypertensive therapy regimens, blood pressure changes (pre- and post-therapy), and clinical outcomes including maternal symptom resolution and neonatal status. Data were analyzed using descriptive statistics and Wilcoxon signed-rank tests with SPSS version 25. **Results:** The majority of patients were aged 20–35 years (70%), housewives (72.5%), and had completed senior high school education (61.3%). Methyldopa was the most frequently used oral monotherapy (22.5%), while the combination of methyldopa and nifedipine was the predominant regimen (68.8%). Antihypertensive therapy significantly reduced systolic blood pressure from 168.94 ± 21.21 mmHg to 134.74 ± 13.32 mmHg and diastolic blood pressure from 104.84 ± 13.80 mmHg to 83.11 ± 7.11 mmHg ($p < 0.001$). Maternal symptoms including headache and blurred vision resolved completely following treatment. However, neonatal outcomes remained concerning, with 35.0% of newborns requiring NICU admission and 16.3% resulting in intrauterine fetal death. Fetal complications including oligohydramnios (12.5%) and absent end-diastolic flow (2.5%) indicated impaired uteroplacental perfusion. **Conclusion:** Antihypertensive therapy effectively reduced blood pressure and improved maternal symptoms in preeclampsia patients. However, the persistence of adverse neonatal outcomes despite maternal hemodynamic improvement underscores the need for comprehensive management approaches that include close maternal-fetal monitoring, early detection of placental insufficiency, and optimized referral systems. Further prospective studies with larger sample sizes and extended follow-up are warranted to evaluate long-term therapeutic outcomes.

***Keywords*: Preeclampsia, Antihypertensive agent, Blood pressure, Pregnancy Complications, Clinical outcomes.**

Abstrak

Pendahuluan: Preeklamsia masih menjadi penyebab utama morbiditas dan mortalitas maternal serta perinatal di seluruh dunia, sehingga memerlukan strategi tata laksana klinis yang efektif untuk meningkatkan luaran kehamilan. Meskipun pedoman terapi antihipertensi pada kehamilan telah tersedia, data mengenai pola pengobatan di dunia nyata dan luaran klinis terkait di fasilitas kesehatan Indonesia masih terbatas. **Tujuan:** Penelitian ini bertujuan untuk mendeskripsikan karakteristik sosiodemografi dan klinis, pola terapi antihipertensi, perubahan tekanan darah, serta luaran maternal dan neonatal pada pasien preeklamsia di rumah sakit rujukan tersier di Sumatera Barat, Indonesia. **Metode:** Studi observasional deskriptif dilakukan pada 80 pasien preeklamsia yang dirawat di RSUP Dr. M. Djamil Padang periode Januari hingga Desember 2025. Data dikumpulkan secara retrospektif dari rekam medis menggunakan total sampling berdasarkan kriteria inklusi dan eksklusi yang telah ditetapkan. Penelitian mengevaluasi karakteristik sosiodemografi, regimen terapi antihipertensi, perubahan tekanan darah (sebelum dan sesudah terapi), serta luaran klinis meliputi resolusi gejala maternal dan status neonatal. Data dianalisis menggunakan statistik deskriptif dan uji Wilcoxon signed-rank dengan SPSS versi 25. **Hasil:** Mayoritas pasien berusia 20–35 tahun (70%), berstatus ibu rumah tangga (72,5%), dan berpendidikan terakhir SMA (61,3%). Metildopa merupakan monoterapi oral yang paling sering digunakan (22,5%), sedangkan kombinasi metildopa dan nifedipin menjadi regimen predominan (68,8%). Terapi antihipertensi secara signifikan menurunkan tekanan sistolik dari 168,94 ± 21,21 mmHg menjadi 134,74 ± 13,32 mmHg dan diastolik dari 104,84 ± 13,80 mmHg menjadi 83,11 ± 7,11 mmHg ($p < 0,001$). Gejala maternal seperti sakit kepala dan penglihatan kabur menghilang setelah pengobatan. Namun, luaran neonatal masih menunjukkan kondisi yang kurang baik, dengan 35,0% bayi memerlukan perawatan NICU dan 16,3% kehamilan berakhir dengan kematian janin intrauterin. Komplikasi fetal seperti oligohidramnion (12,5%) dan absent end-diastolic flow (2,5%) mengindikasikan gangguan perfusi uteroplasenta. **Kesimpulan:** Terapi antihipertensi efektif dalam menurunkan tekanan darah dan memperbaiki gejala maternal pada pasien preeklamsia. Namun, persistensi luaran neonatal yang buruk meskipun terjadi perbaikan hemodinamik maternal menekankan perlunya pendekatan tata laksana komprehensif yang mencakup pemantauan ketat maternal-fetal, deteksi dini insufisiensi plasenta, dan sistem rujukan yang dioptimalkan. Penelitian prospektif lebih lanjut dengan ukuran sampel lebih besar dan follow-up jangka panjang diperlukan untuk mengevaluasi luaran terapi jangka panjang.

Kata Kunci: Preeklamsia, Agen antihipertensi, Tekanan darah, Komplikasi kehamilan, Luaran klinis.

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Introduction

Preeclampsia is a pregnancy-specific hypertensive disorder characterized by blood pressure ≥140/90 mmHg after 20 weeks of gestation, with or without proteinuria, and is associated with serious maternal and fetal complications. As a multisystem disorder, preeclampsia may lead to severe complications including eclampsia, HELLP syndrome (hemolysis, elevated liver enzymes, and low platelet count), organ damage involving the kidneys, liver, and brain, placental abruption, preterm birth, fetal growth restriction, and maternal as well as fetal death [1]. These complications contribute substantially to perinatal morbidity and mortality, including low birth weight and intrauterine growth restriction [2].

Globally, preeclampsia affects approximately 2–8% of pregnancies and accounts for nearly 46,000 maternal deaths annually [1]. The burden remains high in Indonesia, where hypertensive disorders of pregnancy, particularly preeclampsia and eclampsia, are the second leading cause of maternal mortality after non-obstetric conditions, with 988 maternal deaths reported in 2024 [3]. At the regional level, a similar pattern is observed in West Sumatra, where hypertensive disorders of pregnancy, including preeclampsia, are reported as one of the leading causes of maternal mortality in Padang City, with 17 maternal deaths [4]. These findings highlight that preeclampsia is not only a clinical challenge but also a significant public health issue at global, national, and regional levels.

Management of preeclampsia primarily focuses on blood pressure control to prevent disease progression and reduce maternal and fetal complications. According to the Indonesian Ministry of Health National Clinical Practice Guideline for pregnancy complications, recommended antihypertensive agents include calcium channel blockers such as nifedipine and nicardipine, beta-blockers such as labetalol or atenolol, and centrally acting agents such as methyldopa [2]. These medications are widely used because of their effectiveness and safety profiles during pregnancy. However, treatment patterns in clinical practice may vary depending on disease severity, patient characteristics, and institutional protocols.

Despite the central role of antihypertensive therapy in preeclampsia management, evidence regarding therapeutic patterns and associated maternal and neonatal outcomes in routine clinical practice remains limited, particularly in Indonesian healthcare settings. Therefore, this study aimed to describe antihypertensive therapy patterns and clinical outcomes among patients with preeclampsia.

Methods

A descriptive observational study was conducted at the Medical Record Installation of RSUP Dr. M. Djamil Padang from December 2025 to March 2026. Data were obtained from the medical records of preeclampsia patients hospitalized in the Obstetrics and Gynecology Inpatient Ward during January to December 2025. Samples were selected using total sampling based on predefined inclusion and exclusion criteria. The inclusion criteria were pregnant women diagnosed with preeclampsia who received antihypertensive therapy during hospitalization. The exclusion criteria included patients who underwent cesarean section before or on the first day of admission without receiving antihypertensive therapy. A total of 80 patients met the study criteria. The study evaluated sociodemographic and clinical characteristics, antihypertensive therapy patterns, blood pressure changes, and maternal and neonatal outcomes. Ethical approval was obtained from the Ethics Committee of RSUP Dr. M. Djamil Padang No. DP.04.03/D.XVI.10.1/537/202, and data were analyzed descriptively using SPSS version 25.

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Results and Discussion

The sociodemographic characteristics showed that most preeclampsia patients were aged 20–35 years (70%), followed by those aged ≥35 years (30%), with no patients aged <20 years. The majority were housewives (72.5%), while 26.3% were employed and a small proportion were students. In terms of education, most patients had completed senior high school (61.3%), indicating a predominance of moderate educational background among the study population.

Table 1. Sociodemographic Characteristics of Preeclamptic Patients (n = 80)

Sociodemographic Characteristics	Number of respondents	Percentage (%)
Maternal Age		
a. < 20 years old	0	0
b. 20-35 years old	56	70
c. 35 years old	24	30
Occupation		
a. Housewife	58	72.50
b. Employed	21	26.30
c. Student	1	1.30
Education		
a. No formal education	1	1.30
b. Elementary school	1	1.30
c. Junior high school	7	8.80
d. Senior high school	49	61.30
e. Diploma	8	10.00
f. Bachelor's degree	13	16.30
g. Master's degree	1	1.30

Based on Table 1, most preeclampsia patients were aged 20–35 years, indicating that cases predominantly occurred within the reproductive age group. However, this finding differs from evidence suggesting a higher risk of preeclampsia among women aged ≥40 years or at maternal ages <20 years and >35 years [2,5]. Nevertheless, similar findings have been reported in previous studies showing that most preeclampsia patients were within younger reproductive age groups [6]. This pattern may also be influenced by the higher fertility rates among women aged 20–34 years reported in LFSP 2020 data and the predominance of women in this age group in West Sumatra [7,8].

The predominance of housewives in this study may reflect the characteristics of the patient population at Dr. M. Djamil General Hospital, rather than serving as an independent risk factor for preeclampsia. This finding is consistent with previous studies showing that most pregnant women are housewives [9,10]. Limited financial independence, access to health information, and utilization of healthcare services among non-working women may contribute to adverse pregnancy outcomes, including preeclampsia [11]. However, on the other hand, occupational stress and additional workload among employed women may also be potential factors that increase the risk of preeclampsia [10]. Therefore, the relationship between occupation and preeclampsia is multifactorial and influenced by both socioeconomic and clinical factors.

In terms of education, most patients had completed senior high school education, followed by higher education levels (diploma and bachelor's degrees). This finding indicates that preeclampsia is not limited to individuals with low educational backgrounds and can occur across different educational and socioeconomic levels. This result differs from previous studies, which reported that most pregnant women had basic education (elementary and junior high school) [9]. In general, educational level is associated with health literacy and decision-making ability during pregnancy. However, health knowledge can also be obtained through non-formal education such as posyandu services, community activities, and media information. Therefore, the influence of formal education on the occurrence of preeclampsia is not singular and is likely influenced by other more dominant clinical factors [9].

Based on Table 2, most preeclampsia patients were in the third trimester (28–42 weeks) (70%). Preeclampsia commonly develops after 20 weeks of gestation due to impaired placental perfusion and becomes more apparent in the third trimester, when increased maternal body weight and blood volume contribute to elevated blood pressure [6,12].

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Table 2. Clinical Characteristics of Preeclamptic Patients (n = 80)

Clinical Characteristics	Number of respondents	Percentage (%)
Gestational Age		
a. (0–12 weeks)	0	0
b. (13–27 weeks)	24	30
c. (28–42 weeks)	56	70
Parity		
a. Nullipara (0)	27	33.80
b. Primipara (1)	27	33.80
c. Multipara (2-4)	17	21.30
d. Grand Multipara (≥5)	9	11.30
History of Previous Preeclampsia		
a. No history of preeclampsia	70	87.50
b. History of preeclampsia	10	12.50
Comorbid Diseases		
a. No comorbid diseases	43	53.80
b. Comorbid diseases present	37	46.30
Body Mass Index (BMI)		
a. Underweight (< 18.5 kg/m²)	1	1.30
b. Normal (18.5–24.9 kg/m²)	12	15.00
c. Overweight/Obese	67	83.80

The parity distribution showed an equal proportion between nulliparous and primiparous women, each accounting for 33.8% of cases. This finding is consistent with previous studies reporting a higher incidence of preeclampsia among primiparous women, although other studies have found that most cases occur in multiparous women [13,14]. These differences may be influenced by variations in population characteristics and study settings. Parity is considered one of the factors affecting the risk of preeclampsia, with primiparity often associated with a higher risk due to immunological adaptation in the first pregnancy.

Regarding the variables of previous history of preeclampsia and prior medical history, most patients had no history of preeclampsia (87.5%) or comorbid diseases (72.5%), while only 12.5% had experienced preeclampsia in a previous pregnancy. These findings differ from guidelines stating that a history of preeclampsia significantly increases the risk of recurrence due to genetic predisposition [2]. The results suggest that preeclampsia is influenced not only by previous history or comorbidities, but also by factors such as maternal age, body mass index, clinical condition, and environmental factors.

Although previous preeclampsia history is recognized as a major risk factor, most patients in this study had no prior history of preeclampsia or comorbid diseases, suggesting that preeclampsia may also be influenced by age, BMI, clinical conditions, and genetic or environmental factors. Several patients presented with comorbidities, including type 2 diabetes mellitus, asthma, SLE, breast carcinoma, hyperthyroidism, and urinary tract infection. Conditions such as diabetes mellitus and autoimmune diseases may increase preeclampsia severity through endothelial dysfunction, inflammation, and impaired uteroplacental perfusion.

Most patients were classified as overweight or obese, supporting the established role of elevated BMI as a risk factor for preeclampsia. Obesity has been linked to insulin resistance and endothelial dysfunction involved in preeclampsia pathogenesis, with risk increasing alongside BMI elevation. This finding is consistent with previous studies reporting a high prevalence of obesity among pregnant women with hypertension and overweight to obese BMI profiles among preeclampsia patients.Most patients were classified as overweight or obese, supporting the established role of elevated BMI as a risk factor for preeclampsia. Obesity has been linked to insulin resistance and endothelial dysfunction involved in preeclampsia pathogenesis, with risk increasing alongside BMI elevation [2]. This finding is consistent with previous studies reporting a high prevalence of obesity among pregnant women with hypertension and overweight to obese BMI profiles among preeclampsia patients [13,15].

Based on Table 3, the combination of methyldopa and nifedipine was the predominant oral combination therapy, consistent with previous findings by Difta [6]. This regimen is generally used when monotherapy is insufficient to achieve adequate blood pressure control or in more severe cases of

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preeclampsia. The synergistic effect of these two drugs with different mechanisms improves blood pressure control and reduces the risk of therapeutic resistance.

Table 3. Antihypertensive Therapy in Preeclamptic Patients

Antihypertensive Therapy	N	Percentage (%)
Oral Monotherapy		
a. Methyldopa	18	22.50
a. Nifedipine	3	3.80
Oral combination therapy (Methyldopa + Nifedipine)	55	68.80
Oral + IV combination therapy (Methyldopa, Nifedipine, and IV Nicardipine)	4	5.0

Methyldopa was the most frequently used oral monotherapy, followed by nifedipine. Similar findings were reported in previous studies, which also showed that methyldopa and nifedipine are commonly used antihypertensive agents in pregnant patients [16]. Methyldopa is widely used due to its favorable safety profile during pregnancy and its gradual antihypertensive effect, which helps maintain maternal hemodynamic stability and uteroplacental perfusion. This reduces the risk of sudden hypotension that may compromise fetal circulation. Methyldopa acts as a central α2-adrenergic agonist, whereas nifedipine, a calcium channel blocker, induces vasodilation by inhibiting calcium influx into vascular smooth muscle cells [16]. Meanwhile, intravenous nicardipine was used in a limited number of patients, indicating that its use is reserved for more severe or resistant hypertension requiring rapid and controlled blood pressure reduction. Nicardipine is effective in acute management due to its rapid onset of action in severe hypertensive conditions [17].

Based on Table 4, Blood pressure showed a significant reduction following antihypertensive therapy in preeclamptic patients. Based on the Wilcoxon signed-rank test, both systolic and diastolic blood pressure decreased significantly after treatment ($Z = -7.332$ and -7.554, respectively; $p < 0.001$).

Table 4. Blood pressure before and after antihypertensive therapy (n= 80)

Parameter	Before Therapy Mean ± SD	After Therapy Mean ± SD	P- Value	Z
Systolic blood pressure (mmHg)	168.94 ± 21.21	134.74 ± 13.32	<0.001	-7.332
Diastolic blood pressure (mmHg)	104.84 ± 13.80	83.11 ± 7.11	<0.001	-7.554

These findings are supported by previous studies reporting that antihypertensive agents such as methyldopa, nifedipine, and nicardipine, either as monotherapy or combination therapy, are effective in reducing blood pressure and achieving target levels in preeclampsia management [15, 16].

Table 5. Maternal Symptoms Before and After Antihypertensive Therapy

Parameter	Before Therapy n (%)		After Therapy n (%)	
	Present	Absent	Present	Absent
Headache	22 (27.50)	58 (72.50)	0 (0)	80 (100)
Blurred vision	11 (13.80)	69 (86.30)	0 (0)	80 (100)

Maternal clinical manifestations showed improvement after antihypertensive therapy, as headache and blurred vision were no longer observed after treatment. This finding suggests that antihypertensive therapy contributed to improved blood pressure control and symptomatic improvement in preeclampsia patients. Based on Table 6, although maternal blood pressure significantly decreased after antihypertensive therapy, neonatal outcomes remained suboptimal. A proportion of neonates required NICU admission, and intrauterine fetal death (IUFD) was still observed, indicating a persistently high perinatal risk despite improved maternal hemodynamic status.

Compared with the study by Muhammad (2025), which reported a lower IUFD rate (approximately 1.9%), this study found a higher rate [18]. This difference may reflect variations in disease severity, referral timing, access to antenatal monitoring, and healthcare facility characteristics. As a tertiary referral hospital, the cases managed tend to be more severe and complex, contributing to poorer perinatal outcomes. Maternal factors such as obesity and comorbidities identified in this study may also have influenced neonatal outcomes.

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In addition, delayed hospital admission or advanced clinical condition at presentation may have worsened fetal prognosis.

Table 6. Pregnancy Status, Neonatal Outcomes, and Fetal Complications in Preeclamptic Patients

Outcomes	n	%
Pregnancy status and neonatal outcomes		
Live birth requiring NICU admission	28	35.00
Pregnancy ongoing at discharge	22	27.50
Live birth without complications	17	21.30
Intrauterine fetal death (IUFD)	13	16.30
Fetal complications		
No fetal complications	61	76.30
Oligohydramnios	10	12.50
Anhydramnios	3	3.80
Absent end-diastolic flow (AEDF)	2	2.50
Oligohydramnios + AEDF	2	2.50
Intrauterine growth restriction (IUGR)	1	1.30
Oligohydramnios + bilateral hydronephrosis	1	1.30

Fetal abnormalities such as oligohydramnios and absent end-diastolic flow (AEDF) support the presence of placental insufficiency with impaired oxygen and nutrient delivery to the fetus, increasing the risk of hypoxia, fetal growth restriction, prematurity, and fetal death. These findings indicate that blood pressure control alone is not sufficient to prevent adverse neonatal outcomes, and close maternal and fetal monitoring remains essential in the management of preeclampsia [19].

This study had several limitations related to its retrospective design and reliance on medical record data. Severe maternal outcomes, such as eclampsia, HELLP syndrome, renal dysfunction, and placental abruption, were not evaluated due to limited data availability. In addition, causal relationships between antihypertensive regimens and clinical outcomes could not be established. Further prospective studies are needed to confirm these findings.

Conclusions

This study showed that preeclampsia patients were predominantly women aged 20–35 years, housewives, and those with senior high school educational backgrounds, with most cases occurring during the third trimester of pregnancy. In terms of treatment profile, the combination of methyldopa and nifedipine was the most frequently used regimen, while oral monotherapy was still dominated by methyldopa. Meanwhile, intravenous nicardipine was used in a smaller proportion of patients, indicating that this therapy is generally reserved for conditions requiring more rapid and controlled blood pressure reduction. Overall, antihypertensive therapy was effective in reducing blood pressure and improving maternal clinical manifestations.

Fetal outcomes were generally without complications; however, some cases still required NICU admission and experienced intrauterine fetal death. Conditions such as oligohydramnios and absent end-diastolic flow reflect impaired uteroplacental perfusion associated with preeclampsia, indicating the need for a more comprehensive approach, including early detection and optimization of referral systems to improve perinatal outcomes. These findings emphasize the importance of appropriate therapy combined with close maternal and fetal monitoring to achieve better clinical outcomes. Further studies with larger sample sizes and longer observation periods are needed to evaluate the long-term effectiveness and safety of therapy. Future research should also use a retrospective design with more comprehensive clinical variables, including dose variation analysis, maternal complications (eclampsia, HELLP syndrome, renal dysfunction, placental abruption), and relevant laboratory parameters, to provide a more complete understanding of preeclampsia management.

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Conflict of Interest

The author declares that there are no conflicts of interest regarding the design, implementation, analysis, or reporting of this study. All research processes were conducted objectively and independently, without any external interference.

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