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Original Research Article

Comparative evaluation of oral labetalol, nifedipine and amlodipine in the management of postpartum preeclampsia: a prospective randomized study

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ABSTRACT

Background: Postpartum preeclampsia is a major contributor to maternal morbidity and mortality worldwide. Persistent hypertension during the postpartum period can lead to severe complications such as stroke, pulmonary edema, renal dysfunction, and eclampsia if not managed appropriately. Oral antihypertensive agents including labetalol, nifedipine, and amlodipine are commonly used for postpartum blood pressure control; however, comparative evidence regarding their efficacy and tolerability remains limited.
Methods: A prospective randomized comparative study was conducted over a period of 12 months in the Department of Obstetrics and Gynecology at a tertiary care hospital. A total of 120 women diagnosed with postpartum preeclampsia were randomly allocated into three equal groups of 40 patients each. Group A received oral labetalol, group B received oral nifedipine, and group C received oral amlodipine. Patients were monitored for blood pressure control, time required to achieve target blood pressure, requirement of additional antihypertensive therapy, duration of hospital stay, and adverse drug reactions.
Results: All three drugs effectively reduced postpartum blood pressure. Nifedipine showed the fastest reduction in systolic and diastolic blood pressure and least requirement for additional antihypertensive therapy. Amlodipine demonstrated smoother blood pressure control with better tolerability, whereas labetalol was effective but required more frequent dosing. Duration of hospital stay was shortest in the nifedipine group.
Conclusions: Oral nifedipine, labetalol and amlodipine are effective antihypertensive agents in postpartum preeclampsia. Nifedipine demonstrated rapid blood pressure control, whereas amlodipine provided sustained control with better compliance and fewer adverse effects.

Keywords: Postpartum preeclampsia, Hypertensive disorder of pregnancy, Labetalol, Nifedipine, Amlodipine, Oral antihypertensive drugs

INTRODUCTION

Hypertensive disorders of pregnancy remain among the leading causes of maternal morbidity and mortality worldwide.[1-6] Preeclampsia affects approximately 5-8% of pregnancies and may persist or newly develop during the postpartum period.[7] Postpartum preeclampsia is characterized by new-onset hypertension and associated systemic manifestations occurring after delivery, usually within 48 hours to 6 weeks postpartum.[8]

Despite delivery being the definitive treatment for preeclampsia, blood pressure abnormalities may continue or worsen after delivery due to mobilization of extracellular fluid, endothelial dysfunction, and increased vascular resistance.[9] Uncontrolled postpartum hypertension can result in serious maternal complications

including cerebrovascular accidents, pulmonary edema, renal failure, seizures, and maternal death.[10] Therefore, prompt initiation of antihypertensive therapy is essential.

Labetalol, nifedipine, and amlodipine are commonly used oral antihypertensive agents during the postpartum period because of their efficacy, ease of administration and safety during lactation.[11]

Labetalol is a combined alpha- and beta-adrenergic blocker that lowers blood pressure by decreasing systemic vascular resistance while maintaining renal and uteroplacental blood flow.[12] Nifedipine and amlodipine are calcium channel blockers that inhibit calcium influx into vascular smooth muscle causing peripheral vasodilation and reduction in systemic vascular resistance.[13] Nifedipine has a rapid onset of action whereas amlodipine provides prolonged and sustained blood pressure control because of its longer half-life.[14]

Although these drugs are routinely used in clinical practice, limited studies are available comparing their efficacy and tolerability specifically in postpartum preeclampsia. Therefore, the present study was undertaken to compare oral labetalol, nifedipine and amlodipine in women with postpartum preeclampsia.

Aim

Aim of the study was to compare the efficacy of oral labetalol, nifedipine and amlodipine in the management of postpartum preeclampsia.

Objectives

Primary objective

Primary objective was to compare the time required to achieve blood pressure control among labetalol, nifedipine and amlodipine.

Secondary objectives

Secondary objectives were to compare reduction in systolic and diastolic blood pressure, to assess requirement of additional antihypertensive therapy, to evaluate maternal adverse effects and to compare duration of hospital stay among the three groups.

Randomization was performed using the sequentially numbered opaque sealed envelope (SNOSE) technique. Equal numbers of sealed opaque envelopes containing allocation labels for group A (Labetalol), group B (Nifedipine), and group C (Amlodipine) were prepared by an independent person not involved in the study.

Each eligible participant selected the next sequential envelope at the time of enrolment, ensuring allocation concealment and minimizing selection bias.

METHODS

Study design

It was a prospective randomized comparative study.

Study setting

Study conducted at Department of Obstetrics and Gynecology at a tertiary care teaching hospital.

Study duration

Study carried out for 12 months from 06/05/2025 to 06/05/2026.

Sample size

Total 120 postpartum preeclamptic women were selected in study.

Sampling method

Randomized allocation using computer-generated randomization method used.

Table 1: Group allocation.

Group	Drug administered	N
Group A	Oral labetalol	40
Group B	Oral nifedipine	40
Group C	Oral amlodipine	40

Inclusion and exclusion criteria

Women aged 18-45 years who were diagnosed with postpartum preeclampsia within 72 hours after delivery, with systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥100 mmHg, singleton pregnancy, and who were willing to participate and provide informed consent were included in the study. Women with chronic hypertension diagnosed before pregnancy, chronic kidney disease, chronic liver disease unrelated to preeclampsia, structural cardiac disease, known contraindications or allergy to the study drugs, hemodynamic instability, requirement for ventilatory support or intensive care unit admission, and multiple pregnancy were excluded from the study.

Drug regimen

Group A-Labetalol

Initial dose: 100 mg orally twice daily, titrated according to blood pressure response.

Group B-Nifedipine

Sustained release nifedipine 20 mg orally once daily.

Group C-Amlodipine

Amlodipine 5 mg orally once daily.

Outcome measures

Primary outcome

Primary outcome was time required to achieve BP control (<140/90 mmHg)

Secondary outcomes

Secondary outcomes were mean reduction in systolic BP, mean reduction in diastolic BP, requirement of additional antihypertensive therapy, maternal adverse effects and duration of hospital stay.

Statistical analysis

Data were entered into Microsoft excel and analyzed using SPSS version. Continuous variables were expressed as mean±SD. Categorical variables were represented as percentages. ANOVA test and Chi-square test were used for comparison between groups. A $p<0.05$ was considered statistically significant.

RESULTS

Majority of women in all three groups belonged to the 18-25 years age group. The mean maternal age was comparable among all study groups and no statistically significant difference was observed ($p>0.05$). This indicates that the demographic profile was similar among the groups.

Table 2: Distribution according to maternal age.

Age group (years)	Labetalol	Nifedipine	Amlodipine
18-25	18 (45%)	20 (50%)	17 (42.5%)
26-30	15 (37.5%)	13 (32.5%)	16 (40%)
>30	7 (17.5%)	7 (17.5%)	7 (17.5%)

Table 3: Baseline blood pressure at admission.

Parameters	Labetalol	Nifedipine	Amlodipine
Mean systolic BP (mmHg)	158.4±8.2	159.2±7.8	157.6±8.5
Mean diastolic BP (mmHg)	102.6±5.4	103.1±5.2	101.9±5.6

Baseline systolic and diastolic blood pressure values were comparable among all three groups with no statistically significant difference ($p>0.05$). This ensured uniformity before initiation of therapy.

Nifedipine achieved the fastest blood pressure control among all groups with a mean duration of 24.6 hours. Labetalol showed intermediate response, whereas amlodipine required the longest duration to achieve target BP. The difference was statistically significant (p value<0.05).

Maximum reduction in systolic blood pressure was observed in the nifedipine group, suggesting superior efficacy in rapid BP lowering compared to labetalol and amlodipine.

Requirement of additional antihypertensive therapy was lowest in the nifedipine group, indicating better blood pressure stabilization compared to the other two groups.

Headache and flushing were more common in the nifedipine group due to rapid vasodilation. Fatigue and bradycardia were observed predominantly with labetalol because of beta-adrenergic blockade. Mild pedal edema was more frequent with amlodipine. However, no major adverse maternal outcome was noted.

Table 4: Time required to achieve BP control.

Drug groups	Mean time (hours)
Labetalol	32.4±6.8
Nifedipine	24.6±5.2
Amlodipine	36.2±7.1

Table 5: Mean reduction in SBP after 48 hours.

Drug groups	Mean reduction in systolic BP (mmHg)
Labetalol	24.2±5.1
Nifedipine	29.8±5.6
Amlodipine	22.6±4.8

Table 6: Requirement of additional antihypertensive therapy.

Drug groups	Patients requiring additional therapy
Labetalol	8 (20%)
Nifedipine	4 (10%)
Amlodipine	9 (22.5%)

Patients in the nifedipine group had the shortest duration of hospital stay, reflecting earlier blood pressure stabilization and faster clinical recovery.

Table 7: Maternal adverse effects.

Adverse effects	Labetalol	Nifedipine	Amlodipine
Headache	4 (10%)	8 (20%)	3 (7.5%)
Flushing	1 (2.5%)	7 (17.5%)	2 (5%)
Fatigue	6 (15%)	2 (5%)	2 (5%)
Bradycardia	3 (7.5%)	0	0
Pedal edema	1 (2.5%)	2 (5%)	5 (12.5%)

Table 8: Mean duration of hospital stay.

Drug groups	Mean duration of hospital stay (days)
Labetalol	4.8±1.2
Nifedipine	3.9±1.0
Amlodipine	4.5±1.1

DISCUSSION

The present study compared the efficacy and safety of oral labetalol, nifedipine, and amlodipine in women with postpartum preeclampsia.

In the present study, nifedipine demonstrated the most rapid control of blood pressure and greatest reduction in systolic blood pressure compared to labetalol and amlodipine. Similar findings have been reported by Raheem et al who observed rapid blood pressure reduction with nifedipine due to peripheral vasodilation.[15]

Labetalol was effective in controlling postpartum hypertension but required more frequent dosing and was associated with fatigue and occasional bradycardia. Its combined alpha- and beta-blocking properties make it useful in severe hypertension while maintaining adequate organ perfusion.[16]

Amlodipine demonstrated smoother and sustained blood pressure control with convenient once-daily dosing and good patient compliance. Although its onset of action was slower than nifedipine, the incidence of adverse effects was comparatively lower except for mild pedal edema.[17]

Requirement for additional antihypertensive therapy was least in the nifedipine group, suggesting superior efficacy in acute postpartum blood pressure management. The duration of hospital stay was also shortest in the nifedipine group.

Adverse effects profile

Nifedipine was associated with headache and flushing because of rapid vasodilation.[15] Labetalol was associated with fatigue and bradycardia secondary to beta-blocking action.[16] Amlodipine showed comparatively fewer adverse effects except for mild pedal edema due to precapillary vasodilation.[17] Overall, all three drugs were well tolerated and no serious maternal complications were reported.

Limitations

The present study has certain limitations. It was conducted at a single tertiary care teaching hospital with a relatively small sample size, which may limit the generalizability of the findings to the wider population. In addition, the study assessed outcomes only during the immediate postpartum period and did not include long-term follow-up to evaluate sustained blood pressure control, maternal compliance, or delayed adverse effects. Further multicenter studies with larger sample sizes and extended follow-up are warranted to validate these findings and establish the optimal oral antihypertensive regimen for postpartum preeclampsia.

CONCLUSION

Oral labetalol, nifedipine, and amlodipine are effective antihypertensive agents in the management of postpartum preeclampsia.

Among the three drugs, nifedipine achieved the fastest blood pressure control with lesser requirement for additional antihypertensive therapy and shorter duration of hospital stay. Labetalol also demonstrated good efficacy but was associated with fatigue and bradycardia in some patients. Amlodipine provided sustained blood pressure control with favorable tolerability and convenient once-daily dosing.

Therefore, nifedipine may be preferred for rapid control of postpartum hypertension, while amlodipine may be useful for long-term stabilization and improved patient compliance. Individualized treatment based on maternal clinical condition and drug tolerability is recommend.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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