The Impact of IV Labetalol on Cardiotocographic Changes in Severe Preeclampsia

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ABSTRACT

Objective: To evaluate the impact of intravenous (IV) labetalol on cardiotocographic (CTG) findings in patients with severe preeclampsia and to determine its association, if any, with emergency caesarean section indications.

Study Design: Descriptive case series.

Place and Duration of the Study: Department of Obstetrics and Gynaecology, Lady Reading Hospital MTI, Peshawar, Pakistan, from August 2023 to January 2024.

Methodology: Seventy-six pregnant women with severe preeclampsia (BP ≥160/110 mmHg) received IV labetalol for hypertension control, with continuous CTG monitoring for foetal well-being. Labetalol dosage, number of medicines administered, time to emergency caesarean, and CTG findings were recorded. Emergency caesarean sections were performed based on obstetric indications such as non-reassuring CTG or foetal distress, not due to labetalol administration. Data were analysed using SPSS version 23, with $p < 0.05$ considered statistically significant.

Results: Out of the 76 patients, 68.4% (n = 52) had normal CTG findings, while 31.6% (n = 24) showed abnormalities. No significant association was found between labetalol dosage and CTG outcomes ($p = 0.558$). The mean time to emergency caesarean section was 10.07 ± 2.74 minutes, reflecting the clinical urgency in cases with foetal compromise rather than a direct effect of labetalol.

Conclusion: While IV labetalol is already widely recommended in guidelines, this study adds value by evaluating its impact on real-time foetal monitoring through CTG in a local clinical context. IV labetalol effectively controls blood pressure in severe preeclampsia without significantly affecting CTG findings, supporting its safety in managing maternal hypertension and foetal outcomes.

Key Words: *Preeclampsia, Hypertension, Labetalol, Cardiotocography, Foetal monitoring*.

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INTRODUCTION

Preeclampsia is a serious hypertensive disorder of pregnancy associated with risks such as eclampsia, placental abruption, intrauterine growth restriction, and maternal or foetal death.[1] It is defined by elevated blood pressure (≥160/110 mmHg) and proteinuria, contributing significantly to global maternal and neonatal morbidity and mortality.[2] Management focuses on antihypertensive agents to control blood pressure and prevent complications such as stroke and organ damage.[3]

Labetalol, a combined alpha- and beta-adrenergic blocker, is widely used for severe preeclampsia due to its ability to lower systemic vascular resistance and heart rate while maintaining uteroplacental blood flow.[4]

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Despite its effectiveness in managing maternal hypertension, its impact on foetal well-being, particularly cardiotocographic (CTG) findings, remains uncertain. CTG monitoring evaluates foetal heart rate and uterine contractions, detecting signs of foetal distress such as decelerations or reduced variability.[5] These findings guide interventions such as emergency caesarean sections.[6]

Although intravenous labetalol is a well-established antihypertensive agent for managing severe preeclampsia, there remains limited region-specific data evaluating its real-time impact on foetal well-being as assessed by CTG changes. Given the increasing emphasis on individualised maternal-foetal care, this study adds to the existing knowledge by examining whether labetalol administration influences CTG patterns in a local population. By correlating labetalol dosage, number of medicines used, and caesarean section timing with CTG findings, this study provides important clinical insight into the safety profile of labetalol from a foetal monitoring perspective. The results help clinicians in making evidence-based decisions when balancing maternal blood pressure control with foetal outcomes, especially in resource-limited settings where continuous foetal monitoring is available but underutilised in therapeutic audits.

METHODOLOGY

This descriptive case series was conducted at the Department of Obstetrics and Gynaecology, Lady Reading Hospital MTI, Peshawar, Pakistan, from August 2023 to January 2024. A total of 76 pregnant women diagnosed with severe preeclampsia were enrolled in the study. Inclusion criteria were systolic blood pressure (SBP) ≥160 mmHg and/or diastolic blood pressure (DBP) ≥110 mmHg with proteinuria (≥300 mg in 24 hours), gestational age ≥32 weeks, and singleton pregnancies. Exclusion criteria were eclampsia, known renal or hepatic dysfunction, cardiovascular diseases, or allergy to labetalol.

Patients received intravenous (IV) labetalol to reduce SBP to ≤140 mmHg and DBP to ≤90 mmHg, with doses adjusted based on clinical response, not exceeding a total of 300 mg. Continuous cardiotocographic (CTG) monitoring was carried out throughout the management to assess foetal heart rate patterns.

Emergency caesarean section decisions were made based on obstetric indications such as non-reassuring CTG patterns, persistent foetal distress, or failure of labour progression, rather than labetalol administration itself. The observed mean time interval of approximately 10 minutes between labetalol administration and caesarean section reflects the urgency of intervention in cases where maternal or foetal compromise was imminent. Labetalol was part of the overall management strategy and not a direct cause for caesarean delivery.

Data recorded included maternal demographics, blood pressure values before and after labetalol, number of antihypertensive medicines used, labetalol dosage, time to emergency caesarean section, CTG findings, and Apgar scores. Statistical analysis was performed using SPSS version 23.0. Chi-square tests were used to explore associations between CTG findings and different variables. A p-value <0.05 was considered statistically significant.

Table I: Descriptive statistics of study (n = 76).

Numerical variables	Mean (SDs)
Age (years)	26.51 (3.63)
BMI (kg/m^2)	25.270 (1.29)
Baseline SBP (mmHg)	167.20 (4.63)
Baseline DBP (mmHg)	110.00 (0.00)
Follow-up SBP (mmHg)	135.79 (6.22)
Follow-up DBP (mmHg)	81.71 (3.79)
Number of medicines (n)	2.58 (1.22)
Doses of labetalol (mg/dL)	64.80 (30.32)
Time interval to emergency C-section (minutes)	10.07 (2.73)
Apgar score at 5 minutes (<7) after delivery	6.07 (2.50)

RESULTS

In this study, 76 pregnant women diagnosed with severe preeclampsia were analysed, with an average age of 26.51 ± 3.63 years and a mean BMI of 25.27 ± 1.30 kg/m^2. Baseline systolic and diastolic blood pressures were 167.20 ± 4.64 mmHg and 110.00 mmHg, respectively. After IV labetalol administration, the mean SBP to 135.79 ± 6.22 mmHg and DBP to 81.71 ± 3.79 mmHg as shown in Table I.

Of the patients, 68.4% (n = 52) exhibited normal CTG findings while 31.6% (n = 24) had abnormal patterns. Analysis showed no statistically significant association between the number of antihypertensive medicines administered and CTG findings (p = 0.558). The average number of labetalol doses was 2.58 ± 1.23, with a mean dosage of 64.80 ± 30.33 mg/dL, and there was no significant impact of labetalol dosage on CTG outcomes (p = 0.558) as shown in Table II.

The mean time from labetalol administration to emergency caesarean section was 10.07 ± 2.74 minutes, and this interval showed no significant correlation with CTG outcomes (p = 0.558). Additionally, Apgar scores at 5 minutes averaged 6.07 ± 2.50, with no significant differences observed between infants of mothers with normal *versus* abnormal CTG findings (p >0.05) as shown in Table III.

DISCUSSION

This study aimed to assess the impact of IV labetalol on CTG findings in patients with severe preeclampsia. The findings revealed that labetalol effectively controlled blood pressure without significantly affecting foetal heart rate patterns on CTG. These results align with several national and international studies that have evaluated the safety profile of labetalol in hypertensive pregnancies.

Grivell *et al*. emphasised the role of antenatal CTG in foetal assessment and highlighted that maternal hypotension or medication effects can alter foetal heart patterns. However, the present study found no significant CTG abnormalities related to labetalol administration, echoing the findings of Wasim *et al*., who also reported minimal foetal impact when comparing oral nifedipine and IV labetalol in preeclampsia patients.[4-6]

Table II: Association of CTG findings with number of medicines (n = 76).

CTG Findings	Number of medicines		Total	p-value
	<3 Medicines	>3 Medicines		
Normal	44 (69.8%)	8 (61.5%)	52 (68.4%)	0.558
Abnormal	19 (30.2%)	5 (38.5%)	24 (31.6%)	
Total	63 (100.0%)	13 (100.0%)	76 (100.0%)	

Table III: Association of CTG findings with doses of labetalol (n = 76).

CTG Findings	Doses of labetalol		Total	p-value
	<75 mg/dL	>75 mg/dL		
Normal	44 (69.8%)	8 (61.5%)	52 (68.4%)	0.558
Abnormal	19 (30.2%)	5 (38.5%)	24 (31.6%)	
Total	63 (100.0%)	13 (100.0%)	76 (100.0%)	

Similarly, Sridharan and Sequeira concluded in a network meta-analysis that labetalol is among the safest agents in managing severe hypertension during pregnancy, with negligible foetal compromise.[7] Ghi *et al*. supported the use of Doppler ultrasonography to assess foetal well-being during antihypertensive therapy.[8] Magee *et al*. further demonstrated that tighter blood pressure control in pregnancy, often achieved with agents such as labetalol, does not adversely affect perinatal outcomes.[9]

International trials such as that by Vigil-De Gracia *et al*. compared labetalol and hydralazine and found both medicines equally effective in BP control, but labetalol had fewer side effects and better maternal-foetal tolerance, consistent with the current results.[10] Baggio *et al*. also evaluated maternal-foetal Doppler parameters during acute hypertension treatment and reported that labetalol did not negatively affect uteroplacental flow.[11]

Despite labetalol being widely used in the management of pregnancy-induced hypertension (PIH) and preeclampsia, this study contributes by specifically assessing its impact on real-time foetal monitoring *via* CTG — a parameter that provides critical insight into foetal well-being. Regional data, collected in a resource-limited tertiary care setting, add to the global understanding of labetalol's clinical safety and support its use without concerns for foetal distress when monitored with CTG.[12,13]

The average time from labetalol administration to emergency caesarean section and the Apgar scores observed in this study were also not significantly different between patients with normal and abnormal CTG patterns, supporting the conclusion that labetalol does not negatively impact short-term neonatal outcomes.[14,15]

However, the study is limited by its descriptive design and relatively small sample size. Further large-scale, multicentric randomised trials are recommended to confirm these findings and explore long-term neonatal outcomes following labetalol use.

CONCLUSION

This study reinforces the safety and efficacy of IV labetalol in managing severe preeclampsia. While not an indication for caesarean section itself, its use in cases requiring urgent obstetric intervention demonstrates that blood pressure control can be achieved rapidly without negatively impacting CTG findings or immediate neonatal outcomes. Although IV labetalol is already guideline-recommended, this study adds to current literature by evaluating its foetal safety through real-time CTG in a resource-limited setting. The findings provide additional reassurance to clinicians managing severe preeclampsia and contribute local data that support global clinical practices.

ETHICAL APPROVAL:

This study was approved by the Institutional Research and Ethics Committee of MTI-Lady Reading Hospital, Peshawar, Pakistan (Approval No: IRB/OG/2023/176). Ethical approval was obtained prior to the initiation of the research and all procedures conformed to the principles outlined in the Declaration of Helsinki.

PATIENTS' CONSENT:

Written informed consent was obtained from all participants prior to inclusion in the study. Patients were informed about the purpose of the research, and their data were anonymised to ensure confidentiality.

COMPETING INTEREST:

The authors declared no conflict of interest.

AUTHORS' CONTRIBUTION:

SAS: Conceptualisation, data collection, and manuscript writing.
FZ: Study design, statistical analysis, and manuscript revision.
GA: Literature review, CTG interpretation, and final proofing of the manuscript.
All authors approved the final version of the manuscript to be published.

REFERENCES

1. Abalos E, Duley L, Steyn DW, Gialdini C. Antihypertensive drug therapy for mild to moderate hypertension during pregnancy. *Cochrane Database Syst Rev* 2018; **10(10)**: CD002252. doi: 10.1002/14651858.CD002252.pub4.
2. Awaludin A, Rahayu C, Daud NAA, Zakiyah N. Antihypertensive medications for severe hypertension in pregnancy: A systematic review and meta-analysis. *Healthc (Basel)* 2022; **10(2)**:325. doi: 10.3390/healthcare10020325.
3. Duley L, Meher S, Jones L. Drugs for treatment of very high blood pressure during pregnancy. *Cochrane Database Syst Rev* 2013; **9(9)**:CD001449. doi: 10.1002/14651858.CD001449.pub3.
4. Grivell RM, Alfirevic Z, Gyte GM, Devane D. Antenatal cardiotocography for foetal assessment. *Cochrane Database Syst Rev* 2015; **2015(9)**:CD007863. doi: 10.1002/14651858.CD007863.pub4.
5. Wasim T, Agha S, Saeed K, Riaz A. Oral nifedipine *versus* IV labetalol in severe preeclampsia: A randomized control trial. *Pak J Med Sci* 2020; **36(6)**:1147-52. doi: 10.12669/pjms.36.6.2591.
6. Baqai SM, Rahim R, Ala H, Tarar SH, Waqar F, Yasmeen H, *et al*. Society of obstetricians and gynaecologists Pakistan (SOGP) - Hypertensive disorders in pregnancy guidelines 2022. *Pak Armed Forces Med J* 2022; **72(3)**:731-53.
7. Sridharan K, Sequeira RP. Drugs for treating severe hypertension in pregnancy: A network meta-analysis and trial sequential analysis of randomized clinical trials. *Br J Clin Pharmacol* 2018; **84(9)**:1906-16. doi: 10.1111/bcp.13649.

8. Ghi T, Eggebo TM, Lees C, Marlow N, Visser GH, ISUOG clinical standards committee. ISUOG practice guidelines: Use of Doppler ultrasonography in obstetrics. *Ultrasound Obstet Gynecol* 2013; **41(2)**:233-9. doi: 10.1002/uog.12371.
9. Magee LA, von Dadelszen P, Rey E, Ross S, Asztalos E, Murphy KE, *et al*. Less-tight *versus* tight control of hypertension in pregnancy. *N Engl J Med* 2015; **372(5)**:407-17. doi: 10.1056/NEJMoa1404595.
10. Vigil-De Gracia P, Lasso M, Ruiz E, Vega-Malek JC, de Mena FT, Lopez JC. Severe hypertension in pregnancy: Hydralazine or labetalol. A randomized clinical trial. *Eur J Obstet Gynecol Reprod Biol* 2006; **128(1-2)**:157-62. doi: 10.1016/j.ejogrb.2006.02.015.
11. Baggio MR, Martins WP, Calderon AC, Berezowski AT, Marcolin AC, Duarte G, *et al*. Changes in foetal and maternal Doppler parameters observed during acute severe hypertension treatment with hydralazine or labetalol: A randomized controlled trial. *Ultrasound Med Biol* 2011; **37(1)**:53-8. doi: 10.1016/j.ultrasmedbio.2010.10.002.
12. Belfort MA, Saade GR, Moise KJ Jr. The effect of magnesium sulfate on maternal and foetal blood flow in pregnancy-induced hypertension. *Acta Obstet Gynecol Scand* 1993; **72(7)**:526-30. doi: 10.3109/00016349309021153.
13. Magee LA, Abalos E, von Dadelszen P, Sibai B, Easterling T, Walkinshaw S. How to manage hypertension in pregnancy effectively. *Br J Clin Pharmacol* 2011; **72(3)**:394-401. doi: 10.1111/j.1365-2125.2011.04002.x.
14. Nombur LI, Agida ET, Isah AY, Ekele BA. A comparison of hydralazine and labetalol in the management of severe preeclampsia. *J Womens Health Care* 2014; **3(6)**:1-4. doi: 10.4172/2167-0420.1000186.
15. Cantarutti A, Porcu G, Locatelli A, Corrao G. Association between hypertensive medication during pregnancy and risk of several maternal and neonatal outcomes in women with chronic hypertension: A population-based study. *Expert Rev Clin Pharmacol* 2022; **15(5)**:637-45. doi: 10.1080/17512433.2022.2072292.