SSR Institute of International Journal of Life Sciences
ISSN (O): 2581-8740 | ISSN (P): 2581-8732
Borade *et al*., 2025
doi: 10.21276/SSR-IIJLS.2025.11.4.32

Original Article

open access

Evaluate the Efficacy and Safety of Tramadol in Post-LSCS Pain Management in Patients with Preeclampsia

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Received: 13 Mar 2025/ Revised: 19 Apr 2025/ Accepted: 24 Jun 2025

ABSTRACT

Background: Preeclampsia (PE) is a multisystem obstetric disorder that complicates cesarean delivery due to altered hemodynamic and renal physiology. Effective postoperative analgesia is essential, yet many analgesics pose risks in this vulnerable population. This study aimed to evaluate the efficacy and safety of tramadol for postoperative pain management in PE patients undergoing lower-segment cesarean section (LSCS).

Methods: A prospective clinical study was undertaken over 12 months in a tertiary care teaching hospital. One hundred patients with preeclampsia scheduled for LSCS received postoperative tramadol. Outcomes were evaluated on postoperative days 2, 5, and 7 using the Visual Analogue Scale (VAS) for pain, blood pressure monitoring, weight changes, edema grading, renal function tests, and scar tenderness assessment.

Results: There was statistically significant pain relief, with 97 % of patients reporting mild or no pain by day 7. Tramadol treatment was associated with stable blood pressure, a reduction in edema, minimal scar tenderness, and the successful initiation of exclusive breastfeeding by day 2. No major adverse drug reactions occurred. Hemodynamic and renal parameters remained within safe limits throughout the postoperative period.

Conclusion: Tramadol proved to be an effective and well-tolerated analgesic for postoperative pain in preeclamptic women undergoing LSCS. Its opioid receptor agonism combined with inhibition of norepinephrine and serotonin reuptake provided substantial pain relief without compromising maternal safety. Tramadol represents a viable analgesic option for this specific high-risk patient group.

Key-words: Preeclampsia (PE), Post-op Analgesia, Efficacy, Safety, Pain, Opioid, Tramadol

INTRODUCTION

Preeclampsia (PE) is a multifactorial syndrome in obstetrics affecting 3–5% of pregnancies, in which there is recent-onset hypertension after 20 weeks of gestation.[1] This is characterized by dysfunction that occurs in renal, hepatic, hematologic, neurologic, and feto-placental systems.[2] In India, the incidence of PE in hospital settings ranges from 5% to 15% and eclampsia occurs in approximately 1.5% of cases.[3] Its clinical spectrum ranges from mild to severe, with life-threatening complications for both mother and baby and requires prompt intervention. (4) Pregnant woman with a history of PE has an increased risk of obstetric complications like IUGR, oligohydramnios, placental abruption and due to some of the reasons, they end up in caesarean section delivery.[5] Long-term effects observed in PE are hypertension, cardiovascular disease,

How to cite this article
Borade SB, Sarang G, Jahagirdar S, Junghare P. Evaluate the Efficacy and Safety of Tramadol in Post-LSCS Pain Management in Patients with Preeclampsia. SSR Inst Int J Life Sci., 2025; 11(4): 8013-8018.

Access this article online
https://iijls.com/

doi: 10.21276/SSR-IIJLS.2025.11.4.32

stroke, metabolic syndrome, cognitive decline, and end-stage renal disease.

These critical complications underscore the importance of early and prompt diagnosis and management, utilising a range of pharmacological and non-pharmacological interventions.[6]Non-pharmacological approaches include lifestyle modifications, including diet (like salt restricted, increased fruits consumption, high protein diet, eliminating unhealthy habits and adequate rest) [7]. Pharmacological interventions include iron, folic acid, and calcium supplementation, antihypertensive agents in ANC, NO donor agents like L-carnitine and Arginine compounds [8].

For pain management in post-LSCS patients with PE, routine Pharmacological interventions include non-steroidal anti-inflammatory agents such as diclofenac, tramadol, paracetamol, ibuprofen, etc. Tramadol is a synthetic derivative of codeine. [9] It has a strong ability to bind μ opioid receptors and act as an agonist, and a weak affinity for κ and δ receptors. It primarily acts by modulating the spinal descending inhibitory pain pathways.[10] This is achieved by the inhibition of neuronal reuptake of norepinephrine and 5-hydroxytryptamine (serotonin), thereby prolonging their synaptic availability. Additionally, tramadol facilitates pre-synaptic stimulation of serotonin (5-HT) release, further enhancing its analgesic efficacy by augmenting inhibitory neurotransmission within the central nervous system.[11-13] To date, pain management during the lower segment caesarean section (LSCS with tramadol is still not very common. Thus, we are probably the first to demonstrate the efficacy and safety of tramadol for analgesia in post-LSCS patients of PE.

MATERIALS AND METHODS

Study Design and Setting- This prospective clinical study was conducted over 12 months at a tertiary care teaching hospital in central India. The research was carried out in the Postnatal Care (PNC) ward of the Department of Obstetrics and Gynecology in collaboration with the Department of Pharmacology.

Study Population- The study included post-LSCS patients with preeclampsia admitted to the PNC ward of the Obstetrics and Gynecology Department. All enrolled patients were monitored clinically and biochemically during the postoperative period.

Intervention Protocol- Eligible participants received tramadol for postoperative analgesia as per standardized institutional protocol. Monitoring was carried out on the 2nd, 5th, and 7th postoperative days. Tramadol administration route, dose, and frequency were consistent across all participants.

Inclusion Criteria

- Post-LSCS patients with preeclampsia
- Age 18–40 years
- Hemodynamically stable
- Gave informed consent

Exclusion Criteria

- Eclampsia or major organ dysfunction
- LSCS for non-preeclampsia indications
- Allergy to tramadol
- On chronic opioid or steroid therapy

Outcome Measures- The primary outcome was pain control, assessed using both the Visual Analogue Scale (VAS) and Verbal Response Scale (VRS). Secondary parameters included blood pressure readings, weight changes, presence and degree of pedal edema, renal and liver function tests, urine analysis, scar tenderness, and breastfeeding initiation.

Statistical Analysis- Descriptive and inferential statistics were applied using SPSS version 20. Continuous data were expressed as mean±standard deviation, while categorical data were presented as frequency and percentages. Chi-square tests were used for categorical comparisons, and a p-value less than 0.05 was considered statistically significant.

Ethical Considerations- Approval was obtained from the Institutional Ethics Committee (CTRI Registration No: CTRI/2013/02/003395). Written informed consent was collected from all eligible participants before inclusion in the trial.

RESULTS

Table 1 shows the demographic characteristics of the patients. The mean age was 27.27±4.99 years, with 64% being multigravida. Tramadol was found effective and the average hospital stay was 9.97 days.

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Table 1: Demographic characteristics

Parameters	N
Age (Years)	27.27±4.99
Gestational age (Weeks)	39.77±36.08
Gravida	
Primi	36 (36.00%)
Multi	64 (64.00%)
Duration of stay (days)	9.97±3.35

Tramadol, 30% had PIH-related indications, 16% had severe PIH, 22% had fetal distress, 23% had previous LSCS, and 9% had other maternal complications, as depicted in Table 2.

Table 2: Indications for LSCS

Indications for LSCS	N (%)
PIH-related indications	30 (30%)
Severe PIH-related indications	16 (16%)
Fetal distress-related indications	22 (22%)
Previous LSCS-related indications	23 (23%)
Other maternal complications	9 (9%)

Table 3 shows acceptable outcomes with tramadol for the above variables. There was a consistent reduction in weight, systolic and diastolic blood pressure from preoperative to postoperative days, indicating effective recovery with tramadol.

Table 3: Clinical course and variables of patients

Weight	N
Pre. OP	66.02±7.81
2nd PO	62.17±7.91
7th PO	60.65±7.54
p-value	<0.0001
SBP	
Pre. OP	146.92±15.00
2nd PO	134.64±14.44
7th PO	136.40±16.85
p-value	<0.0001
DBP	
Pre. OP	98.10±10.61
2nd PO	89.5±9.25
7th PO	89.98±9.92
p-value	<0.0001

Table 4 shows that tramadol provided significant pain relief in post-LSCS patients with preeclampsia. On the 2nd postoperative day, 73% of patients experienced moderate pain while 27% had mild pain. By the 7th postoperative day, pain scores improved drastically with 97% of patients reporting only mild pain and 3% reporting no pain, indicating effective and sustained analgesia with tramadol.

Table 4: Pain appreciation using VAS score

Pain scale (VAS Score)	2nd Post-operative	7th Post-operative
No (0)	0 (0%)	3 (3%)
Mild (1-3)	27 (27%)	97 (97%)
Moderate (4-6)	73 (73%)	0 (0%)
Severe (7-10)	0 (0%)	0 (0%)
p-value	<0.0001	

Table 5 shows the progression of edema in post-LSCS patients treated with tramadol. Initially, 21% had severe edema and 70% had mild edema. By the 7th postoperative day, 100% of patients had only mild edema, indicating effective clinical improvement with tramadol use.

Table 5: Progression of Edema in Post-LSCS Patients Receiving Tramadol

Edema	Pre Op.	(2nd PO)	(7th PO)
No	0 (0%)	0 (0%)	0 (0%)
Mild	70 (70%)	76 (76%)	100 (100%)
Moderate	9 (9%)	15 (15%)	0 (0%)
Severe	21 (21%)	9 (9%)	0 (0%)

Table 6 shows the distribution of scar tenderness and breastfeeding status. At 48 hours postoperatively, 69% of patients had no tenderness and 31% had mild tenderness, which improved to 78% with mild tenderness and 22% with none by the 7th day. Exclusive breastfeeding was successfully established in 100% of patients by the 2nd postoperative day.

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Table 6: Scar Tenderness and Breastfeeding Status Following Tramadol Administration

Scar tenderness		
	48th hour	7th day
No	69 (69.00%)	22 (22.00%)
Mild	31 (31.00%)	78 ()78.00%
Severe	0 (0.00%)	0 (0.00%)
Breastfeeding (2nd PO)		
EBF	100 (100.00%)	100 (100.00%)
Mild	0 (0.00%)	0 (0.00%)

Tramadol was administered to 69% of patients, who had mild or no tenderness at 48 hours and were exclusively breastfeeding on the 2nd postoperative day.

DISCUSSION

Postoperative pain following cesarean section is a well-recognized clinical challenge and significantly impacts maternal comfort, mobility, emotional well-being, and the ability to initiate newborn care, particularly breastfeeding. The pain results from both the surgical incision and the ensuing inflammatory response, often requiring prompt and sustained analgesic control to optimize recovery [14,15]. Among patients with preeclampsia (PE), the management of post-LSCS pain becomes even more complex due to their underlying cardiovascular, renal, and hepatic vulnerabilities.

In our study, we investigated the effectiveness and safety profile of tramadol in post-LSCS patients diagnosed with preeclampsia. The demographic characteristics revealed a predominance of multigravida patients, with hypertensive disorders and fetal distress being leading indications for cesarean delivery [3,5]. These obstetric risk factors reflect the high-risk status of the study population and justify the need for a balanced analgesic approach that ensures both efficacy and physiological safety.

Tramadol use resulted in substantial clinical improvement. By the 7th postoperative day, 97% of the patients reported either mild or no pain, with VAS scores demonstrating significant reductions from baseline. In addition to pain relief, key recovery markers such as body weight, systolic and diastolic blood pressure, and lower limb edema showed favorable trends [12]. Edema, which was moderate to severe preoperatively in some patients, resolved to mild in all cases by day 7. Scar tenderness, a direct indicator of local wound healing and pain perception, was minimal, with 69% of patients reporting no tenderness as early as 48 hours post-surgery. Importantly, these improvements were achieved without compromising maternal functions such as urination, gastrointestinal motility, or hemodynamic stability.

Furthermore, early and successful establishment of exclusive breastfeeding in 100% of cases by the 2nd postoperative day emphasizes the role of effective analgesia in enabling maternal–infant bonding and early lactation. Pain and physical discomfort are major barriers to breastfeeding initiation, and the results indicate that tramadol's central action offered a comfortable recovery phase for these mothers [13].

From a clinical pharmacology perspective, patients with preeclampsia represent a fragile subgroup where inappropriate drug selection can disturb already deranged renal, hepatic, and cardiovascular parameters. In such settings, tramadol's dual mechanism—weak μ-opioid receptor agonism combined with inhibition of serotonin and norepinephrine reuptake—offers effective pain control with a relatively lower risk of respiratory depression or hemodynamic compromise. This makes it especially suitable for PE patients in the immediate postpartum phase [11].

Our findings align with previous work by Sahmeddini *et al*. [16], who demonstrated that local infiltration of tramadol at the cesarean incision site provided superior analgesia compared to plain bupivacaine, without significant adverse effects. Their study showed that tramadol, even when administered locally, maintained a strong safety profile, with no reported cases of respiratory depression, nausea, or vomiting—side effects typically associated with systemic opioids. The absence of such complications in our systemic tramadol cohort further supports its tolerability in the obstetric postoperative setting.

In summary, tramadol proved to be an effective, well-tolerated, and clinically safe analgesic for post-cesarean pain management in preeclamptic patients. Its role in stabilizing pain scores, minimizing systemic disturbance, promoting early breastfeeding, and aiding recovery strongly advocates its integration into standard postoperative protocols for this high-risk population.

doi: 10.21276/SSR-IIJLS.2025.11.4.32

CONCLUSIONS

This study concluded that tramadol administration for postoperative analgesia in LSCS patients with preeclampsia provided satisfactory pain relief and enhanced recovery. Patients receiving tramadol experienced significantly lower pain scores, better stabilization of hemodynamic (haematological and biochemical) parameters, reduced edema and scar tenderness, and early establishment of breastfeeding. These findings highlight tramadol's efficacy in postoperative pain management without notable adverse effects, making it a promising drug for expediting maternal recovery and comfort after cesarean delivery in PE.

CONTRIBUTION OF AUTHORS

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Supervision- Pushpa Junghare
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