

ISSN (E): 2708-2601

ISSN (P): 2708-2598

Medical Journal of South Punjab

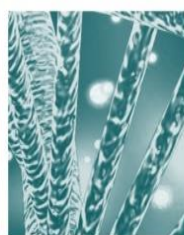
Article DOI:10.61581/MJSP.VOL07/03/03

Volume 7, Issue 3, 2026

Print ISSN: 2708-2598
Online ISSN: 2708-2605



Medical Journal
of South Punjab



Postoperative Analgesic Efficacy of Intravenous Ketorolac Compared with Placebo Following Spinal Anesthesia

Publication History

Received: May 29, 2026 Revised: June 13, 2026

Accepted: Aug 29, 2026 Published: Sep 30, 2026

Authors and Affiliation:

Muhammad Ferhan Saeed^{1*}, Farah Ahmad², Syed Hassan Danish³, Muhammad Ali Khawaja⁴, Syeda Ayesha Imtiaz Bukhari⁵, Furqan Arshad⁶

^{1,6} District Headquarter Hospital Lodhran, Pakistan

^{2,3} Ziauddin University, Karachi, Pakistan

⁴ THQ Hospital Ferozewala, Pakistan

⁵ Jhpiego Islamabad, Pakistan

Corresponding Author Email:

farhan.sameja@gmail.com

Copyright & Licensing:



Authors retain copyright and grant the journal right of first publication with the work simultaneously licensed under a [Creative Commons Attribution \(CC-BY\) 4.0 License](https://creativecommons.org/licenses/by/4.0/) that allows others to share the work with an acknowledgment of the work's authorship and initial publication in this journal.

Conflict of Interest:

Author(s) declared no conflict of interest.

Acknowledgment:

No Funding received.

Citation: Saeed MF, Ahmad F, Danish SH, Khawaja MA, Bukhari SAI, Arshad F. Postoperative Analgesic Efficacy of Intravenous Ketorolac Compared with Placebo Following Spinal Anesthesia. Medical Journal of South Punjab. 2026 Sep 30; 7(3):29-35.

Please scan me to access online.



An official publication of

Medteach Private Limited, Multan, Pakistan.

Email: farman@mjsp.com.pk, Website: <https://mjsp.com.pk/index.php/mjsp>



Postoperative Analgesic Efficacy of Intravenous Ketorolac Compared with Placebo Following Spinal Anesthesia

Muhammad Ferhan Saeed^{1*}, Farah Ahmad², Syed Hassan Danish³, Muhammad Ali Khawaja⁴, Syeda Ayesha Imtiaz Bukhari⁵, Furqan Arshad⁶

^{1,6} District Headquarter Hospital Lodhran, Pakistan

^{2,3} Ziauddin University, Karachi, Pakistan

⁴ THQ Hospital Ferozewala, Pakistan

⁵ Jhpiego Islamabad, Pakistan

Corresponding Author Email: farhan.sameja@gmail.com

ABSTRACT

Objective: To compare postoperative pain, rescue analgesic requirements, comfort, and adverse events between intravenous ketorolac and placebo after elective surgery under spinal anesthesia.

Methods: This randomized placebo-controlled trial conducted at DHQ Hospital Lodhran from December 2025 to May 2026. Study included 50 adults aged 18–45 years with American Society of Anesthesiologists physical status I–II. Patients received a single intravenous ketorolac dose or normal saline, with 25 patients in each group. Pain was assessed at 2, 8, 12, and 24 hours. Intravenous paracetamol was available as rescue analgesia. Between-group differences were reported with 95% confidence intervals.

Results: At eight hours, mean pain scores were 3.29 ± 0.83 with ketorolac and 4.70 ± 1.03 with placebo, giving a mean difference of -1.42 points (95% CI: -1.95 to -0.88 ; $p < 0.001$). Rescue analgesia was required by 12 patients (48.0%) receiving ketorolac and 21 (84.0%) receiving placebo ($p = 0.016$). The groups received 17 and 40 rescue doses, respectively. Pain scores did not differ significantly at 24 hours. Comfortable or very comfortable responses were reported by 80.0% and 48.0%, respectively.

Conclusion: Ketorolac was associated with lower early postoperative pain, reduced paracetamol rescue use, and greater comfort. Pain scores did not differ significantly at 24 hours, and safety conclusions remained limited.

Keywords: Ketorolac; Spinal anesthesia; Randomized controlled trial, Pain, Placebo

1. INTRODUCTION

For many patients, pain is one of the main concerns surrounding surgery. Their experience depends not only on the intensity of discomfort but also on their expectations, understanding of treatment, and willingness to ask for help. Some patients hesitate to report pain because they believe it is unavoidable or worry about the adverse effects of medication. Clear communication helps them understand how pain will be assessed and when additional treatment is available.[1] Consistent postoperative care also depends on cooperation among surgeons, anesthetists, nurses, and patients.[2]

Modern perioperative pain management combines treatments that act through different mechanisms to provide relief while limiting unnecessary opioid exposure.[3] Regional anesthesia, nonopioid medication, and rescue analgesics can each contribute to this approach.[4] The choice of treatment depends on the operation, expected pain severity, patient characteristics, and contraindications.[5] Enhanced recovery pathways similarly emphasize individualized analgesia, restoration of function, and patient involvement in recovery.[6]

Spinal anesthesia provides effective anesthesia during selected lower abdominal and lower limb procedures, together with a period of early postoperative analgesia.[2] As the block wears off, however, patients may develop increasing discomfort. A low pain score immediately after surgery therefore does not guarantee adequate relief later. Repeated assessment helps identify changing needs and allows additional treatment to be given promptly. Visual analogue and numerical rating scales are practical tools, although they cannot fully capture a patient's comfort, difficulty performing activities, or desire for further analgesia.[7]

Nonsteroidal anti-inflammatory drugs inhibit cyclooxygenase activity and reduce prostaglandin synthesis, producing analgesic and anti-inflammatory effects. These properties make them useful components of postoperative pain management, but their use requires attention to renal function, gastrointestinal disease, bleeding risk, and hypersensitivity.[8] The timing of administration also matters. NSAIDs given before surgical injury, continued around surgery, or administered afterward represent different treatment approaches.[9] Dose, surgical procedure, and accompanying analgesia must therefore be considered when comparing studies.

Ketorolac is an injectable NSAID used for short-term postoperative pain relief. A Cochrane review found that intravenous ketorolac could provide substantial short-term analgesia compared with placebo, although the certainty of evidence varied across outcomes and information about serious adverse events remained limited.[10] Clear outcome definitions and consistent assessment are also important when evaluating postoperative treatment.[11] Appropriate dose selection is essential, particularly in patients with low body weight or impaired renal function.[12]

Evidence from a district hospital can help address practical questions about postoperative analgesia in Pakistan. Pain scores alone may miss differences in additional medication use or the patient's overall comfort. This study therefore compared intravenous ketorolac with placebo after elective lower abdominal or lower limb surgery under spinal anesthesia at DHQ Hospital Lodhran. Pain intensity, rescue analgesic requirements, time to first rescue medication, comfort, and adverse events were assessed during the first 24 postoperative hours.

2. METHODOLOGY

This randomized placebo-controlled trial conducted at DHQ Hospital Lodhran from December 2025 to May 2026. The institution was a 180-bed non-teaching hospital. Ethical approval was obtained from the institutional ethics review committee, and written informed consent was obtained from all patients before enrollment. The study covered three months, from April to June 2026, and patients were followed for 24 hours after surgery.

Fifty adults were enrolled and allocated equally to the ketorolac and placebo groups. The enrollment target was based on recruitment feasibility during the study period; no formal power calculation was available. Eligible patients were recruited consecutively from the surgical ward and preoperative assessment clinic. Recruitment determined who entered the study, while random allocation determined the treatment received.

Patients of either sex were eligible if they were aged 18–45 years, had American Society of Anesthesiologists physical status I or II, and underwent elective lower abdominal or lower limb surgery under spinal anesthesia. An anticipated postoperative hospital stay exceeding 24 hours was also required. Patients were excluded if they had gastrointestinal ulceration or bleeding, NSAID hypersensitivity or intolerance, bleeding disorders, anticoagulant use, renal or hepatic impairment, or severe systemic comorbidity. Patients with contraindications to paracetamol were also excluded.

Treatment allocation followed a computer-generated sequence with randomly varying blocks of four and six. An individual who was not involved in recruitment or outcome assessment placed the assignments in sequentially numbered, opaque, sealed envelopes. A designated nurse prepared the injections according to allocation. Both preparations had a final volume of 5 mL and

were supplied in identically labeled syringes. Patients and the investigator assessing postoperative outcomes were blinded to treatment. The nurse preparing the injections did not assess outcomes.

Spinal anesthesia was administered using 0.5% hyperbaric bupivacaine. The attending anesthetist selected a dose of 10–15 mg according to the procedure and patient characteristics. Intrathecal opioids and additional peripheral nerve blocks were not used. The anesthetic dose, type of surgery, and operative duration were recorded. Any conversion to general anesthesia was documented, and subsequent care was directed by the attending anesthetist.

After surgery and confirmation of satisfactory hemostasis, patients in the intervention group received one intravenous ketorolac dose. Those weighing at least 50 kg received 30 mg, while those below 50 kg received 15 mg. Ketorolac was diluted with 0.9% normal saline to a final volume of 5 mL and administered over two minutes. Patients in the placebo group received 5 mL of 0.9% normal saline over the same period. Cannula patency was checked beforehand, and the administration time was recorded. No further ketorolac doses or other NSAIDs were given during follow-up.

Pain was assessed at rest using a 10-cm visual analogue scale, expressed from 0 to 10. The endpoints represented no pain and the worst imaginable pain. Assessments were performed at 2, 8, 12, and 24 hours after completion of surgery. Whenever possible, pain was also assessed before rescue medication, without delaying treatment. Scheduled scores reflected the study intervention together with any additional analgesia received. Outcome definitions are summarized in Table 1.

Table-1: Outcome definitions and assessment schedule

Outcome	Definition or recording method	Assessment
Pain intensity	Visual analogue score from 0 to 10, assessed at rest	2, 8, 12, and 24 hours after surgery
Pain severity	No pain: 0; mild: 1–3; moderate: 4–6; severe: 7–9; unbearable: 10	Scheduled assessments
Paracetamol rescue requirement	Receipt of at least one intravenous rescue dose	First 24 hours
Rescue frequency	Number of administered paracetamol doses	First 24 hours
Time to first rescue	Minutes from study injection to first rescue medication	Among recipients
Additional opioid rescue	Any opioid administered after anesthetist assessment	First 24 hours
Patient comfort	Very comfortable, comfortable, slight discomfort, moderate discomfort, or severe discomfort	24 hours
Adverse events	Nausea/vomiting, dizziness, injection-site pain, hypersensitivity, clinically apparent bleeding, or other events	First 24 hours

Intravenous paracetamol was given when the pain score reached four or more, or when a patient requested additional analgesia. Patients weighing at least 50 kg received 1 g, while those below 50 kg received 15 mg/kg. Each dose was infused over 15 minutes, with at least six hours between doses. Total exposure from all preparations and routes remained within 4 g daily for patients weighing at least 50 kg and 75 mg/kg daily for those below 50 kg.[13] Persistent or severe pain prompted immediate anesthetist review and monitored opioid rescue according to hospital practice. Additional treatment was recorded separately.

Time to first rescue medication was measured from administration of the study injection. Patients who did not need rescue medication remained in the full-group comparison of rescue requirements. Comfort was assessed at 24 hours using the five categories in the questionnaire. Patients were also monitored for nausea or vomiting, dizziness, injection-site pain, hypersensitivity, and clinically apparent bleeding.

Data were analyzed using descriptive statistics, Welch's *t*-test, and Fisher's exact test. Continuous variables were reported as mean±SD or median (IQR), and categorical variables as frequency (%). Mean differences were presented with 95% confidence intervals. Time to first rescue medication was summarized among recipients. Comparisons

were exploratory without adjustment for multiple testing; $p < 0.05$ was considered statistically significant.

3. RESULTS

Fifty patients were included in the analysis, with 25 in each group. Follow-up information was available for all patients through the first 24 postoperative hours. Baseline demographic and operative characteristics are presented in Table 2.

The groups had similar distributions of sex, ASA physical status, and surgical region. Most patients were classified as ASA I, and lower abdominal procedures accounted for slightly more than half of the operations in each group. Mean surgical duration was also similar. The small sample did not permit detailed comparisons within individual surgical categories.

Table-2: Baseline demographic and operative characteristics

Characteristic	Ketorolac, n=25	Placebo, n=25
Age, years, mean±SD	30.60±7.03	33.53±7.26
Male sex, n (%)	15 (60.0)	14 (56.0)
Female sex, n (%)	10 (40.0)	11 (44.0)
ASA I, n (%)	19 (76.0)	18 (72.0)
ASA II, n (%)	6 (24.0)	7 (28.0)
Lower abdominal surgery, n (%)	14 (56.0)	13 (52.0)
Lower limb surgery, n (%)	11 (44.0)	12 (48.0)
Surgical duration, minutes, mean±SD	65.54±15.97	66.34±12.97

Patients receiving ketorolac reported lower pain scores at the early assessments, with the greatest difference at eight hours. Confidence intervals for the differences at 2, 8, and 12 hours excluded zero. At 24 hours, the interval included zero, and a between-group difference

was not demonstrated. Pain scores and their comparisons are presented in Table 3.

The difference between the groups became smaller over time. Since rescue medication was available to both groups, scheduled pain scores reflected the overall treatment received rather than the study injection alone. These time-point comparisons were interpreted as exploratory.

Table-3: Postoperative pain scores and between-group differences

Assessment	Ketorolac	Placebo	Mean difference, ketorolac minus placebo	p value
2 hours	1.88±1.14	2.79±1.22	-0.92 (-1.59 to -0.25)	0.008
8 hours	3.29±0.83	4.70±1.03	-1.42 (-1.95 to -0.88)	<0.001
12 hours	2.83±1.19	3.58±1.10	-0.76 (-1.41 to -0.10)	0.024
24 hours	2.15±1.02	2.63±1.20	-0.48 (-1.11 to 0.15)	0.135

Fewer patients receiving ketorolac required paracetamol rescue analgesia. The absolute difference between the groups was 36 percentage points, with a relative risk of 0.57 (95% CI: 0.37–0.89). Fisher's exact testing showed a significant difference. Repeated rescue doses were also less frequent in the ketorolac group.

The ketorolac group received 17 paracetamol doses compared with 40 in the placebo group. These totals were reported as dose counts rather than grams because the protocol permitted weight-based dosing for patients below 50 kg. Rescue medication outcomes are summarized in Table 4.

Table-4: Intravenous paracetamol rescue requirements during the first 24 hours

Outcome	Ketorolac, n=25	Placebo, n=25	Comparison
Required paracetamol rescue, n (%)	12 (48.0)	21 (84.0)	p=0.016
Did not require paracetamol rescue, n (%)	13 (52.0)	4 (16.0)	—
One paracetamol rescue dose, n (%)	7 (28.0)	6 (24.0)	—
Two paracetamol rescue doses, n (%)	5 (20.0)	11 (44.0)	—
Three paracetamol rescue doses, n (%)	0 (0.0)	4 (16.0)	—
Total paracetamol doses administered	17	40	Descriptive
Paracetamol doses per participant, mean±SD	0.68±0.80	1.60±0.96	Descriptive
Time to first rescue among recipients, minutes, median (IQR)	360 (270–480), n=12	210 (150–300), n=21	Descriptive

Table-5: Patient-reported comfort at 24 hours

Comfort category	Ketorolac, n (%)	Placebo, n (%)
Very comfortable	9 (36.0)	4 (16.0)
Comfortable	11 (44.0)	8 (32.0)
Slight discomfort	4 (16.0)	7 (28.0)
Moderate discomfort	1 (4.0)	5 (20.0)
Severe discomfort	0 (0.0)	1 (4.0)
Total	25 (100.0)	25 (100.0)

Table-6: Recorded adverse events during the first 24 hours

Adverse event	Ketorolac, n (%)	Placebo, n (%)	p value
Nausea or vomiting	2 (8.0)	5 (20.0)	0.417
Dizziness	1 (4.0)	3 (12.0)	0.609
Injection-site pain	1 (4.0)	0 (0.0)	1.000
Allergic reaction	0 (0.0)	0 (0.0)	—
Clinically apparent bleeding	0 (0.0)	0 (0.0)	—

4. DISCUSSION

Patients receiving ketorolac reported lower early postoperative pain and required paracetamol rescue less often than those receiving placebo. The greatest pain-score difference occurred at eight hours, while a difference was not demonstrated at 24 hours. This pattern suggested that the analgesic benefit was most apparent during the earlier observation period. A Pakistani randomized

trial following open inguinal hernia repair also evaluated ketorolac for postoperative pain, although its comparison with tramadol differed from the placebo comparison used here.[14]

The choice of comparator influenced interpretation. Amin and colleagues found similar postoperative pain outcomes with intravenous ibuprofen and ketorolac after open abdominal hysterectomy, with both groups receiving background paracetamol.[15] Their findings showed that a benefit over placebo did not necessarily establish superiority over another NSAID. Repeated dosing, the surgical procedure, and accompanying treatment also differed from the present regimen, limiting direct comparison.[15]

Rescue medication use provided information beyond pain scores alone. A meta-analysis of randomized trials in lumbar spine surgery examined ketorolac both alone and in combination with other drugs, highlighting the importance of distinguishing treatment regimens.[16] Sivasundaram and colleagues reported reduced narcotic consumption after rotator cuff repair when intravenous ketorolac was followed by oral treatment.[17] Although their regimen differed from a single injection, the reduction in additional medication use was relevant to the lower rescue requirement observed here.

Administration route and timing also affected comparability. Auwattamongkol and colleagues reported an early analgesic benefit from local ketorolac infiltration after trigger finger surgery, but local and intravenous treatment could not be considered equivalent.[18] Salehi Aliabad and colleagues assessed ketorolac combined with intravenous paracetamol after thoracotomy, making it difficult to separate the contribution of each medication.[19] Studies of pre-emptive and preventive ketorolac likewise emphasized the importance of reporting when treatment was given in relation to surgery.[20]

The smaller pain-score difference at 24 hours could have reflected postoperative recovery and additional analgesia received by both groups. Scheduled scores represented the combined effects of the study injection, residual spinal analgesia, and rescue treatment. The recipient-only time-to-rescue finding also required caution because it excluded patients who never needed additional medication. It could not establish a longer duration of analgesia for the entire randomized population.

No clinically apparent bleeding was recorded, but this finding did not establish safety in higher-risk patients. Bongiovanni and colleagues found no significant overall association between perioperative NSAIDs and several surgical bleeding outcomes across a broad evidence base.[21] The absence of bleeding in a small, short-term comparison nevertheless provided limited reassurance about uncommon adverse events.

The study was strengthened by its randomized placebo-controlled design, repeated pain assessments over 24 hours, and evaluation of rescue medication alongside patient comfort and adverse events. Its district hospital setting made the clinical question relevant to routine surgical care in Pakistan.

5. CONCLUSION

Intravenous ketorolac was associated with lower early postoperative pain scores and reduced paracetamol rescue requirements compared with placebo following spinal anesthesia. Patients receiving ketorolac also reported greater comfort. The greatest pain-score difference occurred at eight hours, while a significant difference was not demonstrated at 24 hours. These findings suggested an early analgesic benefit; however, the small sample and brief follow-up limited conclusions regarding safety.

6. REFERENCES

- Walton LL, Duff E, Arora RC, McMillan DE. Surgery patients' perspectives of their role in postoperative pain: a scoping review. *Int J Nurs Stud Adv.* 2023;5:100124.
- Hyland SJ, Brockhaus KK, Vincent WR, Spence NZ, Lucki MM, Howkins MJ, et al. Perioperative pain management and opioid stewardship: a practical guide. *Healthcare (Basel).* 2021;9(3):333.
- Joshi GP. Rational multimodal analgesia for perioperative pain management. *Curr Pain Headache Rep.* 2023;27(8):227–237.
- Kianian S, Bansal J, Lee C, Zhang K, Bergese SD. Perioperative multimodal analgesia: a review of efficacy and safety of the treatment options. *Anesthesiol Perioper Sci.* 2024;2:9.
- Deshler BJ, Rockenbach E, Patel T, Monahan BV, Poggio JL. Current update on multimodal analgesia and nonopioid surgical pain management. *Curr Probl Surg.* 2023;60(6):101332.
- Chen Q, Chen E, Qian X. A narrative review on perioperative pain management strategies in enhanced recovery pathways—the past, present and future. *J Clin Med.* 2021;10(12):2568.
- Baamer RM, Iqbal A, Lobo DN, Knaggs RD, Levy NA, Toh LS. Utility of unidimensional and functional pain assessment tools in adult postoperative patients: a systematic review. *Br J Anaesth.* 2022;128(5):874–888.
- Halvey EJ, Haslam N, Mariano ER. Non-steroidal anti-inflammatory drugs in the perioperative period. *BJA Educ.* 2023;23(11):440–447.
- Doleman B, Leonardi-Bee J, Heinink TP, Boyd-Carson H, Carrick L, Mandalia R, et al. Pre-emptive and preventive NSAIDs for postoperative pain in adults undergoing all types of surgery. *Cochrane Database Syst Rev.* 2021;6:CD012978.
- McNicol ED, Ferguson MC, Schumann R. Single-dose intravenous ketorolac for acute postoperative pain in adults. *Cochrane Database Syst Rev.* 2021;5:CD013263.
- Joseph JM, Gori D, Curtin C, Hah J, Ho VT, Asch SM, et al. Gaps in standardized postoperative pain management quality measures: a systematic review. *Surgery.* 2022;171(2):453–458.
- National Library of Medicine. Ketorolac tromethamine injection, solution [Internet]. DailyMed [cited 2026 Sep 30].
- National Library of Medicine. Acetaminophen injection, solution [Internet]. DailyMed [cited 2026 Sep 30].
- Ahmed SM, Shabbir S, Rana NA, Khatoon A, Ghani UF, Basharat I, et al. Comparing the postoperative analgesic efficacy of ketorolac and tramadol after open inguinal hernia mesh repair: a randomized controlled trial. *Cureus.* 2024;16(10):e71363.
- Amin S, Hasanin A, Attia OA, Mostafa M, Elzayat NS, Elsherbiny M, et al. Intravenous ibuprofen versus ketorolac for perioperative pain control in open abdominal hysterectomy: a randomized controlled trial. *BMC Anesthesiol.* 2024;24:202.
- Guan J, Feng N, Yang K, Abudouaini H, Liu P. The efficacy and safety of ketorolac for postoperative pain management in lumbar spine surgery: a meta-analysis of randomized controlled trials. *Syst Rev.* 2024;13:275.
- Sivasundaram L, Mengers S, Trivedi NN, Strony J, Salata MJ, Voos JE, et al. Oral ketorolac as an adjuvant agent for postoperative pain control after arthroscopic rotator cuff repair: a

- prospective, randomized, controlled study. *J Am AcadOrthop Surg*. 2021;29(24):e1407–e1416.
18. Auwattanamongkol T, Laohaprasitiporn P, Monteerarat Y, Limthongthang R, Vathana T. Local ketorolac infiltration for postoperative pain in open trigger finger surgery: a randomized controlled trial. *BMC MusculoskeletDisord*. 2024;25:746.
 19. Salehi Aliabad M, Sheybani S, Mehrad-Majd H, Sharifian Attar A. Comparison of analgesic effects of ketorolac plus Apotel to meperidine in patients undergoing right thoracotomy: a double-blind randomized clinical trial. *Anesth Pain Med*. 2023;13(4):e136822.
 20. Pakniyat S, Mousavi G, Jarineshin H, Fekrat F, Sabet N, Abdollahzadeh-Baghaei A. Comparison of the preemptive/preventive effect of dexmedetomidine and ketorolac on post-operative pain of appendectomy patients: a randomized clinical trial. *Anesth Pain Med*. 2024;14(6):e146868.
 21. Bongiovanni T, Lancaster E, Ledesma Y, Whitaker E, Steinman MA, Allen IE, et al. Systematic review and meta-analysis of the association between non-steroidal anti-inflammatory drugs and operative bleeding in the perioperative period. *J Am Coll Surg*. 2021;232(5):765–790.e1.