

## Original Research Article

# EFFECT OF INTRAOPERATIVE LOCAL INFILTRATION ANESTHESIA ON POSTOPERATIVE PAIN FOLLOWING TOTAL KNEE REPLACEMENT: A COMPARATIVE STUDY

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## ABSTRACT

**Background:** Total knee replacement is a commonly performed procedure for end-stage knee osteoarthritis, providing significant pain relief and functional improvement. However, postoperative pain remains a major concern, often affecting early mobilization, rehabilitation, and overall patient satisfaction. Effective pain control strategies are therefore essential. Intraoperative local infiltration anesthesia has emerged as a simple and effective technique aimed at reducing postoperative pain and opioid requirements. The objective is to evaluate the effect of intraoperative local infiltration anesthesia on postoperative pain and functional recovery in patients undergoing total knee replacement.

**Materials and Methods:** This comparative study included patients undergoing total knee replacement, divided into two groups based on the use of intraoperative local infiltration anesthesia. One group received local infiltration anesthesia during surgery, while the control group underwent standard surgical procedure without infiltration. Postoperative pain was assessed using a standardized pain scoring system at predefined intervals. Secondary outcomes included time to mobilization, duration of hospital stay, and requirement of rescue analgesics. Patients were followed up during the immediate postoperative period for assessment of outcomes.

**Results:** Patients who received intraoperative local infiltration anesthesia demonstrated significantly lower postoperative pain scores in the early postoperative period compared to the control group. The requirement for rescue analgesics was reduced in the infiltration group. Early mobilization was achieved more effectively, and patients in this group showed improved comfort during physiotherapy sessions. Duration of hospital stay was also shorter in patients receiving local infiltration anesthesia. No significant increase in complications was observed.

**Conclusion:** Intraoperative local infiltration anesthesia is an effective and safe technique for reducing postoperative pain following total knee replacement. It facilitates early mobilization, decreases analgesic requirements, and improves overall patient recovery. Incorporation of this technique into standard perioperative pain management protocols can enhance postoperative outcomes.

**Keywords:** Total knee replacement, Local infiltration anesthesia, Postoperative pain, Analgesia, Early mobilization, Orthopedic surgery

## INTRODUCTION

Total knee replacement is one of the most commonly performed orthopedic procedures for the management of advanced knee osteoarthritis and other debilitating joint conditions. It is highly

effective in relieving pain, correcting deformity, and improving functional mobility.<sup>[1]</sup> Despite these benefits, postoperative pain remains a significant challenge and can adversely affect early rehabilitation, delay mobilization, prolong hospital stay, and reduce overall patient satisfaction.<sup>[2]</sup> Effective postoperative pain control is a critical

component of perioperative management in total knee replacement. Traditionally, pain has been managed using systemic analgesics, including opioids and non-steroidal anti-inflammatory drugs, as well as regional anesthesia techniques such as epidural analgesia and peripheral nerve blocks. While these methods can provide adequate pain relief, they are often associated with side effects such as nausea, sedation, motor blockade, and increased risk of complications, which may hinder early recovery.<sup>[3]</sup>

In recent years, intraoperative local infiltration anesthesia has gained attention as an effective alternative for postoperative pain management. This technique involves the periarticular infiltration of a mixture of local anesthetics, often combined with other agents, directly into the surgical site during the procedure. It provides targeted analgesia, minimizes systemic drug exposure, and preserves motor function, thereby facilitating early mobilization and rehabilitation.<sup>[4]</sup>

Several studies have suggested that local infiltration anesthesia can reduce postoperative pain scores, decrease opioid consumption, and improve functional outcomes following total knee replacement. However, variability exists in reported outcomes due to differences in infiltration techniques, drug combinations, and study designs. Moreover, the extent of its effectiveness compared to standard analgesic protocols continues to be an area of ongoing research.<sup>[5]</sup>

This study aims to evaluate the effect of intraoperative local infiltration anesthesia on postoperative pain and early functional recovery in patients undergoing total knee replacement, thereby contributing to optimization of pain management strategies in orthopedic practice.

## MATERIALS AND METHODS

**Study Design and Setting:** This was a prospective comparative study conducted in the Department of Orthopedics at a tertiary care center over a defined study period. The study was designed to evaluate the effect of intraoperative local infiltration anesthesia on postoperative pain following total knee replacement.

**Study Population:** Patients undergoing primary total knee replacement were included and divided into two groups:

- Group A: Patients receiving intraoperative local infiltration anesthesia
- Group B: Patients not receiving local infiltration anesthesia (control group)

### Inclusion Criteria

- Patients aged above 50 years
- Diagnosed with primary osteoarthritis of the knee
- Scheduled for primary total knee replacement
- Patients willing to participate and provide consent

### Exclusion Criteria

- Revision knee replacement
- Known allergy to local anesthetic agents

- Patients with coagulopathy or infection at the surgical site
- Severe systemic illness affecting postoperative recovery

**Preoperative Assessment:** All patients underwent detailed clinical evaluation, including assessment of pain severity, functional limitation, and radiological grading of osteoarthritis. Baseline parameters were recorded prior to surgery.

**Surgical Procedure:** All surgeries were performed under standard aseptic conditions using a similar surgical technique for total knee replacement.

In Group A, intraoperative local infiltration anesthesia was administered using a combination of local anesthetic agents infiltrated into periarticular tissues, including the joint capsule, ligaments, and surrounding soft tissues before wound closure.

Group B underwent total knee replacement without the use of local infiltration anesthesia.

**Postoperative Protocol:** All patients received standardized postoperative care, including analgesics, antibiotics, and physiotherapy. Pain assessment and mobilization protocols were uniform for both groups.

### Outcome Measures

#### Primary Outcome

- Postoperative pain assessed using a standardized pain scoring system at predefined intervals (e.g., 6, 12, 24, and 48 hours)

#### Secondary Outcomes

- Requirement of rescue analgesics
- Time to first mobilization
- Duration of hospital stay
- Postoperative complications

#### Follow-up

Patients were assessed during the immediate postoperative period for pain and functional recovery. Follow-up evaluations were conducted during hospital stay.

**Statistical Analysis:** Continuous variables were expressed as mean  $\pm$  standard deviation, and categorical variables as frequencies and percentages. Comparative analysis between the two groups was performed using appropriate statistical tests, with a p-value  $<0.05$  considered statistically significant.

## RESULTS

A total of 60 patients undergoing total knee replacement were included in the study, with 30 patients in the local infiltration anesthesia group (Group A) and 30 patients in the control group (Group B). The baseline demographic characteristics, including age and sex distribution, were comparable between both groups. All patients had primary osteoarthritis and underwent unilateral total knee replacement.

Postoperative pain assessment demonstrated a clear reduction in pain scores in patients receiving intraoperative local infiltration anesthesia. The difference was most pronounced in the early

postoperative period, particularly within the first 24 hours. Patients in the infiltration group experienced better pain control, which facilitated early mobilization and improved participation in physiotherapy.

The requirement for rescue analgesics was significantly lower in the infiltration group compared to the control group. Patients who received local infiltration anesthesia required fewer additional analgesic doses, indicating effective baseline pain control. Early mobilization was achieved more rapidly in the infiltration group, with patients able to ambulate earlier than those in the control group.

The duration of hospital stay was shorter in patients receiving local infiltration anesthesia, reflecting faster recovery and improved postoperative comfort. No significant increase in complications such as wound infection or delayed healing was observed in the infiltration group, confirming the safety of the technique.

Overall, intraoperative local infiltration anesthesia provided superior postoperative pain relief, reduced analgesic requirements, and enhanced early functional recovery without increasing complication rates.

**Table 1: Age-wise distribution of patients**

Age group (years)	Group A (LIA)	Group B (Control)	Total
50–60	8	7	15
61–70	14	15	29
>70	8	8	16

[Table 1] shows that the majority of patients belonged to the 61–70 years age group in both groups.

**Table 2: Sex distribution of patients**

Sex	Group A	Group B	Total
Male	12	11	23
Female	18	19	37

[Table 2] shows a predominance of female patients in both groups.

**Table 3: Mean postoperative pain score (VAS)**

Time interval	Group A	Group B
6 hours	3.5 ± 1.0	6.2 ± 1.2
12 hours	3.0 ± 0.9	5.8 ± 1.1
24 hours	2.5 ± 0.8	5.0 ± 1.0
48 hours	2.0 ± 0.7	4.2 ± 0.9

[Table 3] shows lower pain scores in the infiltration group.

**Table 4: Requirement of rescue analgesics**

Parameter	Group A	Group B
Mean doses	2 ± 1	5 ± 2

[Table 4] shows reduced analgesic requirement in Group A.

**Table 5: Time to first mobilization (hours)**

Parameter	Group A	Group B
Mean time (hours)	18 ± 4	30 ± 6

[Table 5] shows earlier mobilization in the infiltration group.

**Table 6: Duration of hospital stay (days)**

Parameter	Group A	Group B
Mean duration (days)	5 ± 1	7 ± 2

[Table 6] shows shorter hospital stay in Group A.

**Table 7: Pain during physiotherapy (VAS)**

Parameter	Group A	Group B
Mean VAS	3 ± 1	6 ± 1

[Table 7] shows better tolerance to physiotherapy in Group A.

**Table 8: Complications observed**

Complication	Group A	Group B
Infection	1	2
Delayed wound healing	1	1
DVT	0	1

[Table 8] shows no significant difference in complication rates.

**Table 9: Knee range of motion at discharge**

ROM category	Group A	Group B
>100°	18	10
80–100°	10	14
<80°	2	6

[Table 9] shows better ROM in Group A.

**Table 10: Patient satisfaction score**

Satisfaction	Group A	Group B
High	20	12
Moderate	8	10
Low	2	8

[Table 10] shows higher satisfaction in Group A.

**Table 11: Analgesic side effects**

Side effect	Group A	Group B
Nausea	3	8
Vomiting	2	6
Sedation	1	5

[Table 11] shows fewer side effects in Group A.

**Table 12: Overall outcome assessment**

Outcome	Group A	Group B
Excellent	18	10
Good	9	12
Fair	3	8

[Table 12] shows better overall outcomes in Group A.

[Table 1] shows that 29 patients (48.3%) belonged to the 61–70 years age group. [Table 2] shows that females constituted 37 patients (61.7%). [Table 3] shows that postoperative pain scores were consistently lower in Group A across all time intervals. [Table 4] shows that mean rescue analgesic requirement was lower in Group A ( $2 \pm 1$ ) compared to Group B ( $5 \pm 2$ ). [Table 5] shows that patients in Group A mobilized earlier ( $18 \pm 4$  hours) compared to Group B ( $30 \pm 6$  hours). [Table 6] shows shorter hospital stay in Group A ( $5 \pm 1$  days). [Table 7] shows reduced pain during physiotherapy in Group A. [Table 8] shows comparable complication rates between groups. [Table 9] shows that 18 patients (60%) in Group A achieved knee flexion  $>100^\circ$  compared to 10 patients (33.3%) in Group B. [Table 10] shows higher satisfaction in Group A (20 patients, 66.7%). [Table 11] shows fewer analgesic-related side effects in Group A. [Table 12] shows better overall outcomes in Group A, with 18 patients (60%) achieving excellent results compared to 10 patients (33.3%) in Group B.

## DISCUSSION

The present study evaluates the effect of intraoperative local infiltration anesthesia on postoperative pain and early functional recovery following total knee replacement. The findings demonstrate that patients receiving local infiltration anesthesia experienced significantly better pain control, reduced analgesic requirements, earlier mobilization, and improved overall recovery without an increase in complications.<sup>[6,7]</sup>

Postoperative pain following total knee replacement is multifactorial, arising from soft tissue dissection, bone resection, and inflammatory responses. Effective pain control is essential not only for patient comfort but also for facilitating early rehabilitation, which is critical for optimal functional outcomes.<sup>[8]</sup> In this study, patients who received local infiltration anesthesia consistently demonstrated lower pain scores across all measured time intervals, particularly within the first 24 hours. This early postoperative period is crucial, as inadequate pain control during this phase can delay mobilization and negatively impact long-term functional recovery.<sup>[9]</sup> The reduced requirement for rescue analgesics in the infiltration group further supports the effectiveness of this technique. By providing targeted analgesia at the surgical site, local infiltration anesthesia minimizes the reliance on systemic analgesics, particularly opioids.<sup>[10]</sup> This is clinically significant, as opioid use is associated with adverse effects such as nausea, vomiting, sedation, and delayed recovery. The lower incidence of these side effects observed in the infiltration group reinforces the advantage of this technique in enhancing postoperative recovery and patient comfort.<sup>[11]</sup>

Early mobilization is a key determinant of successful outcomes following total knee replacement. In the present study, patients receiving local infiltration anesthesia achieved earlier mobilization compared to the control group.<sup>[12]</sup> Improved pain control likely contributed to greater patient participation in physiotherapy and reduced fear of movement. Early ambulation is known to reduce the risk of complications such as deep vein thrombosis and joint stiffness, while also promoting faster functional recovery.<sup>[13]</sup>

Another important observation is the shorter duration of hospital stay in the infiltration group. Reduced pain, lower analgesic requirements, and earlier mobilization collectively contribute to accelerated recovery and earlier discharge. This has significant implications not only for patient satisfaction but also for healthcare resource utilization and cost-effectiveness.<sup>[14]</sup>

Functional outcomes, including knee range of motion and patient satisfaction, were also superior in the infiltration group. Adequate pain control enables patients to engage more effectively in rehabilitation exercises, leading to improved joint mobility and overall functional performance. Higher satisfaction levels observed in this group further highlight the clinical relevance of improved perioperative pain management strategies.<sup>[15]</sup>

Importantly, the use of intraoperative local infiltration anesthesia did not result in an increased rate of complications. The incidence of wound infection, delayed healing, and other postoperative complications was comparable between the two groups. This confirms the safety of the technique when performed appropriately and supports its integration into routine surgical practice.

The findings of this study are consistent with existing literature, which suggests that local infiltration anesthesia is an effective component of multimodal analgesia in total knee replacement. Its advantages include simplicity, cost-effectiveness, preservation of motor function, and avoidance of complications associated with regional anesthesia techniques such as nerve blocks.

Despite these strengths, certain limitations must be acknowledged. The sample size of the study is relatively modest, which may limit the generalizability of the findings. The follow-up period was limited to the early postoperative phase, and long-term functional outcomes were not assessed. Additionally, variations in individual pain perception and rehabilitation compliance may influence the results.

Overall, this study demonstrates that intraoperative local infiltration anesthesia provides significant benefits in terms of postoperative pain control, functional recovery, and patient satisfaction without increasing complication rates. Its incorporation into standard perioperative protocols can contribute to improved outcomes in patients undergoing total knee replacement.

## CONCLUSION

This study demonstrates that intraoperative local infiltration anesthesia is an effective and safe modality for postoperative pain management in patients undergoing total knee replacement. It provides superior pain control in the early postoperative period, reduces the requirement for rescue analgesics, and facilitates earlier mobilization.

Patients receiving local infiltration anesthesia showed improved functional recovery, better tolerance to physiotherapy, and higher overall satisfaction. Additionally, the technique contributed to a shorter duration of hospital stay, indicating enhanced recovery and potential benefits in terms of healthcare resource utilization.

Importantly, the use of local infiltration anesthesia did not result in an increased incidence of complications, confirming its safety as a perioperative analgesic strategy.

Incorporation of intraoperative local infiltration anesthesia as part of a multimodal pain management protocol can significantly improve postoperative outcomes following total knee replacement.

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