



## A comparative study of post-operative analgesia after unilateral total knee replacement: local wound infiltration versus epidural anesthesia

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### Abstract

**Aim:** To compare the post-operative analgesic efficacy of Local Infiltration Analgesia (LIA) technique over Epidural Analgesia (EA) technique in patients undergoing unilateral total knee replacements.

**Patients and Methods:** After prior approval of the institutional ethical committee sixty patients who were posted for unilateral total knee replacement were included in this study. This prospective randomized controlled study compared analgesic efficacy in postoperative patients (initial 48 h) of total knee replacement where one group of patients are given local analgesia and the other group are given epidural analgesia. All patients received spinal anesthesia and were inserted epidural catheter. The patients were randomized into two groups by randomization. In LIA group 50mL of a mixture, containing bupivacaine, ketorolac, and epinephrine was injected in to periarticular tissue and in EA group ropivacaine was injected. In the EA group, after surgery, an epidural catheter ropivacaine top ups were given but in LIA group, the epidural catheter normal saline was given

**Results:** The pain relief on the day of surgery (day 1) was significantly better in patients who received pericapsular injection as compared to those who used the epidural injection for postoperative pain relief. At 24 hours, there was no significant difference between two groups, and pain of EA group was significantly lower than LIA group at 48 hours after the surgery. Drainage volume and hemoglobin drops were lower in LIA group.

**Conclusion:** Local infiltration analgesia was better than epidural for postoperative pain control at first 12 hours. However, epidural analgesia could control postoperative pain more effectively at 48 hours after surgery. Patients who received epidural infusion for postoperative pain control required more medications as supplements, as evidenced by higher incidence of bolus injections/increased infusion rates/tramadol injections.

**Keywords:** Epidural injection, pain scale, total knee replacement

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## INTRODUCTION

Total knee replacement (TKR) is indicated when conservative treatments fail and severe disability impairs the patient's quality of life. Joint replacement surgeries are major orthopaedic surgeries after spine in the present era. It is not intended to increase quantity of life but to improve the mobility and quality of life<sup>(1)</sup>. Post-TKR pain directly impacts postoperative physiotherapy and mobilization, which can result in stiffness and poor joint function<sup>[2]</sup>. Effective post-operative pain control is important, especially with the initiation of physiotherapy and early ambulation, which hastens recovery and reduces hospital stay. The risk of post-operative complications, such as venous thromboembolism and nosocomial infections, has also been shown to decrease with early mobilization. TKR surgery can be performed under general anesthesia, spinal anesthesia, epidural anesthesia or combined spinal epidural (CSE) anesthesia, and under peripheral nerve block.

Despite the effectiveness of TKR in the treatment of debilitating knee arthritis, postoperative pain may develop, affecting the patient's rehabilitation. It is known that inadequate postoperative analgesia is associated with poor rehabilitation, prolonged hospital stay, and increased risk of adverse events, such as pulmonary dysfunction, thromboembolism, myocardial ischemia, and urinary retention<sup>(3)</sup>. Researchers have suggested a variety of methods for postoperative pain management and confirmed their remarkable efficacy, however, complications associated with the overuse of

narcotics and nerve blockade are inevitable<sup>(4)</sup>.

Conventional pain management is a unimodal way. It usually involves the administration of opioids (injectable) with or without nonsteroidal anti-inflammatory drugs as required. This often requires higher doses of opioids, with its potential side effects.

Epidural analgesia may provide better pain relief compared to systemic drugs. There are, however, many side effects such as perioperative hypotension, urinary retention and respiratory depression with this method.

Periarticular injection at the end of surgery is a novel method for postoperative pain control. Recent studies have shown that this approach has several advantages over other methods of pain management<sup>(5)</sup>.

This study was aimed to compare the Local Infiltration Analgesia (LIA) technique over Epidural Analgesia (EA) technique in patients undergoing unilateral total knee replacements. with respect to postoperative pain relief, range of movement, ambulation, requirement of rescue analgesia and patient satisfaction.

## MATERIALS AND METHODS

This study was conducted after obtaining approval from the hospital ethical committee and informed consent from all participants. Sixty adult patients aged 50 years and above of both sexes with ASA Grade I/II posted for primary TKR were included for the study. All patients were of average height (160–170 cm) and weight (65–75 kg). After pre anaesthetic check-up (PAC), patients were kept fasting for past 8 h and premedicated with tablet ranitidine 150 mg and tablet alprazolam 0.50 mg. We excluded patients

who refused to give consent, patients for revision or bilateral TKR, those with a history of allergy to any of the test drugs, and those with collagen vascular diseases (e.g., rheumatoid arthritis), neuromuscular diseases, haematological diseases, and coagulopathy, dementia, other mental or psychiatric symptoms.

The patients were randomly allocated into epidural anesthesia (EA; n=30) and local infiltration anesthesia(LIA; n=30) groups.

All the patients received spinal anesthesia with 3.5 cc hyperbaric bupivacaine 0.5%. The epidural catheter was inserted for all patients. Single surgeon performed all the operations.

In the LIA group, 50 mL of a mixture, containing bupivacaine (10 mg), ketorolac (60 mg), and epinephrine (1 mg/1000), was prepared. Before polyethylene implantation, 20 mL of the mixture was injected into a posterior joint capsule. After closing the joint capsule, the remaining mixture was injected into the periarticular tissue.

In the EA group, after surgery, an epidural catheter ropivacaine (0.2%) top ups were given but in LIA group, the epidural catheter normal saline was given.

#### **Pain assessment and management:**

Postoperative pain was assessed using VAS, which was completed by patients who were informed preoperatively. The VAS score ranges from zero (no pain) to 10 (worst pain possible), which was measured at 1, 6, 12, 24, and 48 hours postoperatively.

Blood loss assessment: hemoglobin drops (preoperatively/postoperatively) and drainage

volume 24 hours after the surgery were considered as the indices of blood loss. The need for transfusion in the two groups was also recorded.

**Functional outcomes assessment:** Regarding the functional outcomes, the patient's ability to perform SLR was examined by the surgeon one day after surgery, and the surgeon measured the knee range of motion two weeks following the surgery.

#### **Demographic characteristics and length of hospital stay:**

Demographic information, including gender, age, and body mass index (BMI), was compared between the two groups as possible factors that might affect the results. The length of hospital stay was also considered as a factor affecting the cost-effectiveness of the surgery.

**Statistical analysis:** Statistical analyses were done with SPSS software version 14 on a Microsoft Windows-based computer. Continuous variables, such as age, BMI, hospital stay, VAS score, hemoglobin drops, and drainage volume were compared by independent-sample t-tests between the two groups. Categorical variables such as gender and SLR were analyzed with Chi-square and Fisher's exact test. The P-value of less than 0.05 considered a statistically significant difference.

## **RESULTS**

**Demographic characteristics:** The demographic characteristics of all patients were compared between the two groups. The mean age of patients in the Epidural group was  $66 \pm 6.55$  and in Local group was  $65.3 \pm 7.92$ . In the epidural group, 23

females and 7 males and in the LIA group, 24 females and 6 males were assessed. No statistically significant difference was observed in the clinical characteristics, including gender,

age, and BMI, between the two groups (Table 1). The demographic characteristics of all patients (30 patients in group EA and 30 patients in group LIA) were compared (table 1).

**Table 1:** Demographic characteristics of patients in both groups.

| Study Groups |        | Epidural Anesthesia<br>(N=30) | Local Infiltration<br>Anesthesia (N=30) | P value |
|--------------|--------|-------------------------------|---|---------|
| Gender       | Male   | 7 (23.3)                      | 6 (20)                                  | 0.754   |
|              | Female | 23 (76.7)                     | 24 (80)                                 |         |
| Age          |        | 66 ± 6.55                     | 65.3 ± 7.92                             | 0.71    |
| BMI          |        | 29 ± 2.57                     | 29.5 ± 2.37                             | 0.487   |

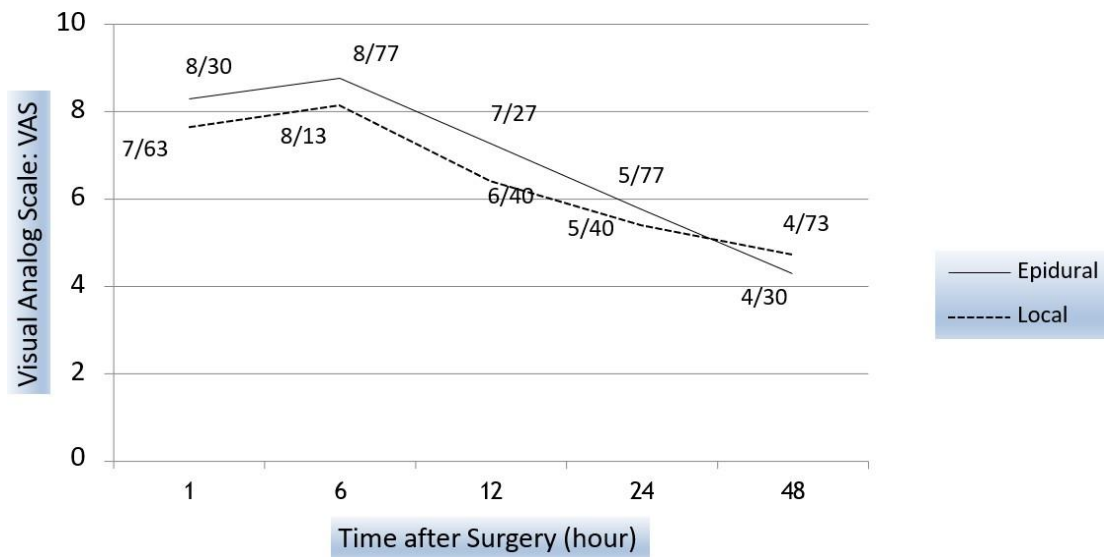
**Pain:** pain was primary outcome of this study was calculated by a VAS ruler within 48 hours after the surgery to evaluate the pain intensity experienced by the patients. The mean VAS score of EA group was significantly higher than LIA group at 1 hour (P- value=0.009), 6 hours (P-value=0.003) and 12 hours (P- value=0.0001)

after the surgery. At 24 hours, there was no significant difference between two groups regarding VAS score (P-value=0.068). VAS score was lower in the EA group (4.3 ± 0.65), compared to the LIA group (4.73 ± 0.64) at 48 hours postoperatively (P- value = 0.012) (Table 2; Figure 1).

**Table 2:** Visual analogue scale (VAS) in epidural group and Local infiltrative group

| Study Groups           | Epidural Anesthesia<br>(N=30) | Local Infiltration<br>Anesthesia (N=30) | P value |
|------------------------|-------------------------------|---|---------|
| 1 hour after Surgery   | 8.3 ± 1.02                    | 7.63 ± 0.89                             | 0.009*  |
| 6 hours after Surgery  | 8.77 ± 0.86                   | 8.13 ± 0.73                             | 0.003*  |
| 12 hours after Surgery | 7.27 ± 0.87                   | 6.4 ± 0.77                              | 0.0001* |
| 24 hours after Surgery | 5.77 ± 0.82                   | 5.4 ± 0.72                              | 0.068   |
| 48 hours after Surgery | 4.3 ± 0.65                    | 4.73 ± 0.64                             | 0.012*  |

**Figure 1.** Visual analogue scale trend in epidural group and Local infiltrative group.



**Blood loss:** Blood loss was measured by drainage volume postoperatively. It was lower in the LIA group 24 hours after the surgery, and the difference was statistically significant (P-value =

0.0001). Hemoglobin drops was also lower in LIA group compared to EA group three days after the surgery (P- value =0.0001) (Table 3).

**Table 3:** Drainage volume 24 hours after the surgery and hemoglobin drop 3 days after the surgery

| Study Groups     | Epidural Anesthesia<br>(N=30) | Local Infiltration<br>Anesthesia (N=30) | P value |
|------------------|-------------------------------|---|---------|
| Hemoglobin drops | 2.76 ± 0.28                   | 2.01 ± 0.2                              | 0.0001  |
| Drainage Volume  | 188 ± 43.5                    | 122 ± 32.9                              | 0.0001  |

**Knee range of motion:** The knee range of motion in the LIA group was not superior to that of the EA group two weeks after the surgery (P-value=0.499). The patients' ability to perform active straight leg raise was measured by the surgeon one day after the surgery. More patients in the LIA group could perform SLR one day

after the surgery but the difference between the two groups was not significantly different (P-value=0.1) (Table 4).

**Table 4:** Patient ability to perform SLR the day after the surgery and knee range of motion 2 weeks after the surgery

| Study Groups         |     | Epidural<br>Anesthesia (N=30) | Local Infiltration<br>Anesthesia (N=30) | P value |
|----------------------|-----|-------------------------------|---|---------|
| SLR                  | Yes | 7 (23.3)                      | 13 (43.3)                               | 0.1     |
|                      | No  | 23 (76.7)                     | 17 (56.7)                               |         |
| knee Range of motion |     | 94.8 ± 10.4                   | 93 ± 10.1                               | 0.499   |

Length of hospital stay: no significant difference was found in the length of hospital stay between the groups ( $4.4 \pm 0.93$  days in the EA group versus  $4.57 \pm 0.77$  days in the LIA group); (P-value=0.44).

### Discussion:

The aim of this study was to compare the functional outcomes, postoperative pain intensity, and blood loss between the LIA and EA groups, who underwent TKR under spinal anesthesia. The two groups were not different in terms of age and male-to-female ratio; therefore, these factors had no significant effects on the results. BMI was measured because it was assumed to be effective in postoperative pain and blood loss; however, the results did not confirm this assumption.

The mean VAS score of the EA group was significantly higher than the LIA group at 1 hour, 6 hours and 12 hours after the surgery. At 24 hours, there was no significant difference between the two groups regarding the VAS score. However, the VAS score was lower in the EA group, compared to the LIA group at 48 hours postoperatively. Bupivacaine is typically used for intra-articular (IA) analgesia because of its extended period of effectiveness (4–7 h) or long-lasting anaesthetic properties. There are different methods for the decrease of postoperative pain after total knee replacement.

The LIA method is suitable for pain control due to its simplicity, unlike epidural catheter insertion, which requires equipment. In addition, LIA can be performed faster and easier compared with the epidural catheter placement. Moreover, it is associated with less motor function impairment, compared with

cases of epidural anaesthesia. Although there are numerous studies confirming the effectiveness of LIA in postoperative pain management following TKR<sup>(6-8)</sup>, studies comparing EA with LIA are scarce. In this regard, Li et al. reviewed the results of seven studies in a systematic review and reported similar efficacy to EPA in terms of pain control after TKA; on the other hand, a reduction in nausea and length of hospital stay, besides an increase in the range of motion, was observed in LIA group<sup>(9)</sup>, epidural analgesia had multiple side effects, such as urinary retention, perioperative hypotension, respiratory depression, pruritus and moreover, in the non-operated leg, ambulation and sensation seem to be affected; accordingly, early physiotherapy may be interrupted after TKR due to these adverse effects. In addition, anticoagulation therapy, which is used to prevent thromboembolic events, may be delayed due to epidural analgesia.

Increased bleeding is associated with delayed recovery, increased complications, increased costs, and decreased patient satisfaction. In our study drainage volume and hemoglobin drops was significantly lower in the LIA group. The difference might be related to the vasoconstrictive effects of epinephrine employed in the local injection cocktail.

Analgesic drugs were infiltrated in the periarticular soft tissue in the LIA group. Therefore, the intraarticular drain could not decrease the volume of analgesic drugs. Knee function was assessed by straight leg raise ability and knee range of motion, as mentioned previously. In this regard, LIA group had a

greater ability to perform active straight leg raise on the first postoperative day.

### Conclusion

Based on the results of this study, local infiltration analgesia is a better alternative to epidural analgesia for postoperative pain control in the first 12 hours. In LIA group the advantages noted were early ambulation, lesser blood loss, less expensive, no urinary retention or hypotension. However, epidural analgesia could control postoperative pain more effectively at 48 postoperative hours.

### REFERENCES

1. Tetzalaff J. Lower-extremity joint replacement clinical orthopedic. In: Tetzalaff J, editor. *Clinical Orthopedic Anaesthesia*. 3rd ed. Oxford: Butterworth Heinemann; 1995. p. 218.
2. Kehlet H. The stress response to surgery: Release mechanisms and the modifying effect of pain relief. *Acta Chir Scand Suppl* 1989;550:22-
3. Moucha CS, Weiser MC, Levin EJ. Current strategies in anesthesia and analgesia for total knee arthroplasty. *J Am Acad Orthop Surg*.2016;24(2):60-73.
4. Sharma S, Iorio R, Specht LM, Davies-Lepie S, Healy WL. Complications of Femoral Nerve Block for Total Knee Arthroplasty. *Clin Orthop Relat Res*. 2010;468(1):135-40.
5. Fajardo M, Collins J, Landa J, Adler E, Meere P, Di Cesare PE. Effect of a perioperative intra-articular injection on pain control and early range of motion following bilateral TKA. *Orthopedics*.2011;34(5):354.
6. Kerr DR, Kohan L. Local infiltration analgesia: a technique for the control of acute postoperative pain following knee and hip surgery: a case study of 325 patients. *Acta Orthop*. 2008;79(2):174- 83.
7. Moghtadaei M, Farahini H, Faiz SH, Mokarami F, Safari S. Pain Management for Total Knee Arthroplasty: Single-Injection Femoral Nerve Block versus Local Infiltration Analgesia. *Iran Red Crescent Med J*. 2014;16(1):e13247.
8. Quinn M, Deakin AH, McDonald DA, Cunningham IK, Payne AP, Picard F. An anatomic study of local infiltration analgesia in total knee arthroplasty. *Knee*. 2013;20(5):319-23
9. Li C, Qu J, Pan S, Qu Y. Local infiltration anesthesia versus epidural analgesia for postoperative pain control in total knee arthroplasty: a systematic review and meta-analysis. *J Orthop Surg Res*.2018;13(1):112.