

## Comparison of Efficacy of Local Infiltration Analgesia and Epidural Analgesia in Patients Undergoing Total Knee Arthroplasty

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### Abstract:

**Introduction:** Total knee arthroplasty (TKA) is a common procedure for improving mobility and quality of life in patients with osteoarthritis. The present study was conducted to compare the efficacy of intra-articular infusion analgesia and epidural versus following total knee replacement

**Materials and Methods:** 60 patients were included in a randomized prospective study and distributed in 2 groups. Patients in Group 1 received LIA and Group 2 EA. Patients were assessed for visual analogue score (VAS) for pain to determine the analgesic effect. Complications such as paraesthesia in the lower limbs, hypotension, urinary retention, and abdominal distension were recorded, and rehabilitation progress was recorded

**Result:** The pain was significantly more in EA group than in LIA group. With respect to complications, Patients with epidural infusion analgesia had a significantly higher complication rate in terms of hypotension (48% vs. 28%), paraesthesia in the lower extremities (44% vs. 12%), and higher abdominal distension rate (24% vs. 4%). Patients with intra-articular infusion analgesia were able to stand/ walk (2.02 vs. 3.01 days,) and climb stairs earlier (3.96 vs. 4.12 days,) which was significant.

**Conclusion:** It was concluded that Intra-articular infusion analgesia was associated with less intensity of pain, fewer complications and earlier rehabilitation compared to epidural analgesia

**Keywords:** Total Knee Replacement, Local Infiltration Analgesia, Epidural Analgesia.

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### Introduction

Total knee arthroplasty (TKA) is a surgical procedure that involves the replacement of a knee joint with an artificial prosthesis. Its primary objectives are to alleviate pain, correct joint deformity, and restore motion to areas with restricted range of motion caused by knee osteoarthritis, rheumatoid arthritis, knee trauma, and other related conditions; restore and enhance joint mobility; and ultimately improve the quality of life for affected patients [1,2]. Managing pain after total knee arthroplasty (TKA) presents a significant challenge for medical professionals. Inadequate pain relief following TKA may impede early rehabilitation [3], cause a delay in hospital discharge [4], and have a negative impact on functional outcomes [5]. In the immediate aftermath of a total knee replacement (TKR), a

range of analgesic medication combinations, dosages, and techniques can be employed to alleviate pain. Analgesics that are optimal should possess maximal effectiveness, minimal adverse effects, and do not impede rehabilitation. Early rehabilitation difficulties, hypotension, paraesthesia, abdominal distension, and distress are all associated with epidural analgesia. [6,7] Alternatively, intra-articular analgesia may be utilized. [8–12] This study was conducted to compare the efficacy of intraarticular infusion analgesia and epidural analgesia following Total knee arthroplasty.

### Materials and Methods

This prospective randomized study was conducted at Mallareddy Institute of Medical Sciences,

Hyderabad, in the department of Orthopaedics. The approval of the Institutional Ethics Committee was obtained. Fifty patients undergoing unilateral TKA at the medical facility were chosen in total. The study included patients, regardless of gender, who were at least 50 years old and were members of American Society of Anaesthesiologists (ASA) categories I to III. Patients with valgus knee, significant systemic diseases, coagulation disorders, or contraindications for EA who declined to provide informed consent were excluded from the study. Patients were informed of the procedure and provided with written informed assent.

Patients in Group 1 were injected with a LIA mixture comprising of 300 mg ropivacaine (250 mg for patients weighing less than 55 kg), 30 mg of ketorolac, and 500 µg of epinephrine attenuated to 130-150 mL (depending on patient weight). The administration of the mixture lasted for a duration of 45-60 minutes.

Following bone incisions, a 30–50 mL LIA mixture was infused into the posterior capsule of the knee joint. Subsequently, a 35–50 mL injection was administered into the deep tissues surrounding the medial and lateral collateral ligaments, following component fixation and tourniquet release. The final 35–50 mL of infiltration occurred into the subcutaneous tissue and the anteromedial/anterolateral capsule adjacent to the knee joint. Prior to wound closure, a 19-G catheter was inserted medially onto untreated bone positioned medial to the femoral component.

This was accomplished by passing a Tuohy needle through the vastus medialis obliquus and departing subcutaneously from the incision, around 3 inches from the joint. The catheter was then secured to the skin. Antibacterial filtration was affixed to the catheter, which was encased in an individual sterile dressing.

The surgical field was reinjected with an estimated 20 mL of LIA mixture via catheterization 20 to 24 hours after the initial procedure. Subsequently, the catheter was extracted. Patients in Group 2 were administered a continuous EA pump (fitted with an antibacterial filter) containing 400 µg of fentanyl and 2000 mg of ropivacaine at a rate of 5 mL/hr (equivalent to 600 mg of ropivacaine and 80 µg of fentanyl per day). The epidural pump was discontinued on the fourth day following the operation, when the effectiveness of low molecular weight heparin had diminished. For every patient, standard postoperative protocols were adhered to. Following the operation, omeprazole 20 mg once daily for the initial five days and a combination of trypsin-chymotrypsin 10 mg thrice daily was administered to all patients. All patients were administered low molecular weight heparin for one week, commencing twenty-four hours after the operation. A visual analogue scale (VAS) assessment of pain was conducted on patients every six hours for the initial forty-eight hours following surgery in order to ascertain the analgesic effect. Hypotension, paraesthesia in the lower extremities, urinary retention, and abdominal distension were documented as complications. The rehabilitation progress was documented in terms of the number of days required to stand, ascend staircases,

**Statistics:** Data was analysed using SPSS version 21. Mean value ±SD was computed for numerical variables and compared by independent sample t-test in two groups. Frequencies and percentages were computed for categorical variables and compared by Chi-square test in two groups.  $p \leq 0.05$  was considered significant.

## Results

A total of 50 patients were recruited for the study. 25 patients were assigned to Group A and 25 patients to Group B. Baseline characteristics of the patients were shown in table 1.

**Table 1: Baseline characteristics**

characteristic	Group A (Mean S.D)	Group B (Mean S.D)	p value
Sex (M/F) (n)	10/20	7/23	0.182
Age (years)	66.8 ± 8.6	65.1 ± 8.3	0.174
BMI (Kg/m <sup>2</sup> )	27.4 ± 1.76	28.2 ± 1.82	0.09

Pain scores were recorded for the first 3 post-operative days. There was a significant difference in average pain score in the LIA group compared to EA group as shown in table 2.

**Table 2: comparison of pain score (VAS) at various time intervals**

Pain score (VAS) at	Group A (Mean± S.D)	Group B (Mean ± S.D)	p value
6 hours	3.52 ±0.77	3.58 ±0.65	0.003*
24 hours	2.82 ±	2.86 ±	0.004*
48 hours	2.54 ±	2.64±	0.02*
72 hours	2.14 ±	2.32 ±	0.01*

\*significant

Patients with epidural infusion analgesia had a higher complication rate in terms of hypotension, paraesthesia in the lower extremities, and abdominal distension which is significant statistically as shown in Table 3.

**Table 3: Complications**

Complications	Group A (n=25) n (%)	Group B (n=25) n (%)	p value
Hypotension	7 (28)	12 (48)	0.001*
Parasthesia in the lower extremities	3 (12)	11 (44)	0.02*
Abdominal distension	1 (4)	6 (24)	0.003*

\*significant

Patients with intra articular infusion analgesia were able to stand/walk and climb stairs Earlier which was significant statistically as show in Table 4.

**Table 4: Days required for rehabilitation**

No. of days required for rehabilitation	Group A (n=25) Mean±SD	Group B (n=25) Mean±SD	p value
Stand/walk	3.01 ±0.31	2.02 ±0.28	0.01*
Climb stairs	4.12 ±0.39	3.96 ±0.31	0.02*

\*significant

### Discussion

Post-operative pain control after TKR offers a clinical challenge. Pain contributes to immobility related complications, prolonged hospital stay and interferes with optimal post-operative knee rehabilitation. Arthrofibrosis and diminished range of movements are closely related to degree of post-operative pain.[13,14]

The most common method used is epidural analgesia that offers good pain relief, has several complications such as motor weakness, urinary retention and hypotonia. Even complications such as epidural haematoma, spinal infection have recently led to questioning of its routine use, specifically in older women.[15]

Continuous epidural analgesia using pump has inherent disadvantages- hypotension, urinary retention.[16,17] Epidural catheter complications, DVT, delayed ambulation, need to use anticoagulants, more expensive equipment and prolonged hospital stay.[18,19]

LIA overcomes some of these disadvantages. It is cheaper, allows early mobilisation and ambulation, thereby obviating requirement of anticoagulants, preventing systemic complications and early discharge from hospital. It also decreases blood loss and need for rescue analgesia.[20] The benefits of the LIA technique are good post-operative pain control, fast mobilisation and early discharge from hospital.[21-24].

Our study revealed that after TKR, LIA group was associated with significantly less intensity of pain, significantly fewer complications and significantly earlier rehabilitation.

### Conclusion

It is concluded that LIA is better alternative to epidural analgesia as it is associated with significantly less intensity of pain, significantly fewer complications and significantly earlier rehabilitation

### References

- Hong KH, Pan JK, Xie H, Guo D, Yang WY, Su HT, et al. Review: Autologous blood transfusion drainage compared with no drainage in total knee arthroplasty: A meta-analysis and systematic review. *Pak J Pharm Sci* 2017; 30:2321-7.
- Ahmed W, Lakdawala RH, Mohib Y, Qureshi A, Rashid RH. Does obesity affects early infection after total knee arthroplasty. A comparison of obese vs. non-obese patients. *J Pak Med Assoc* 2016; 66:S96-8.
- H. Wang, B. Boctor, and J. Verner, "The effect of single-injection femoral nerve block on rehabilitation and length of hospital stay after total knee replacement," *Regional Anesthesia and Pain Medicine*, vol. 27, no. 2, pp. 139–144, 2002.
- H. Husted, T. H. Lunn, A. Troelsen, L. Gaarn-Larsen, B. B. Kristensen, and H. Kehlet, "Why still in hospital after fast-track hip and knee arthroplasty?" *Acta Orthopaedica*, vol. 82, no. 6, pp. 679–684, 2011.
- J. Ryu, S. Saito, K. Yamamoto, and S. Sano, "Factors influencing the postoperative range of motion in total knee arthroplasty," *Bulletin of the NYU Hospital for Joint Diseases*, vol. 53, pp. 35–40, 1993
- Dalury DF, Lieberman JR, MacDonald SJ. Current and innovative pain management techniques in total knee arthroplasty. *J Bone Joint Surg Am* 2011; 93:1938–43.
- Andersen KV, Bak M, Christensen BV, Harazuk J, Pedersen NA, Søballe K. A randomized, controlled trial comparing local infiltration analgesia with epidural infusion for total knee arthroplasty. *Acta Orthop* 2010; 81:606–10.
- Spreng UJ, Dahl V, Hjøll A, Fagerland MW, Ræder J. High-volume local infiltration analgesia combined with intravenous or local ketorolac+morphine compared with epidural an-

- algnesia after total knee arthroplasty. *Br J Anaesth* 2010; 105:675–82.
9. Gómez-Cardero P, Rodríguez-Merchán EC. Postoperative analgesia in TKA: ropivacaine continuous intraarticular infusion. *Clin Orthop Relat Res* 2010; 468:1242–7.
  10. Essving P, Axelsson K, Kjellberg J, Wallgren O, Gupta A, Lundin A. Reduced morphine consumption and pain intensity with local infiltration analgesia (LIA) following total knee arthroplasty. *Acta Orthop* 2010; 81:354–60.
  11. Ikeuchi M, Kamimoto Y, Izumi M, Sugimura N, Takemura M, Fukunaga K, et al. Local infusion analgesia using intraarticular double lumen catheter after total knee arthroplasty: a double blinded randomized control study. *Knee Surg Sports Traumatol Arthrosc* 2013; 21:2680–4.
  12. Zhang S, Wang F, Lu ZD, Li YP, Zhang L, Jin QH. Effect of single-injection versus continuous local infiltration analgesia after total knee arthroplasty: a randomized, double-blind, placebo-controlled study. *J Int Med Res* 2011; 39:1369–80.
  13. Ranawat CS, Ranawat AS, Mehta A. Total knee arthroplasty rehabilitation protocol: what makes the difference? *J Arthroplasty* 2003; 18(3 Suppl 1):27-30.
  14. Singelyn FJ, Deyaert M, Joris D, et al. Effects of intravenous patient-controlled analgesia with morphine, continuous epidural analgesia, and continuous three-in-one block on postoperative pain and knee rehabilitation after unilateral total knee arthroplasty. *Anesth Analg* 1998; 87(1):88-92.
  15. Moen V, Dahlgren N, Irestedt L. Severe neurological complications after central neuraxial blockade in Sweden 1990-1999. *Anesthesiology* 2004; 101(4): 950-9.
  16. Imbelloni LE, Gouveia MA, Cordeiro JA. Continuous spinal anesthesia versus combined spinal epidural block for major orthopedic surgery: prospective randomized study. *Sao Paulo Med J* 2009; 127(1):7-11.
  17. Campbell A, McCormick M, McKinlay K, et al. Epidural vs. lumbar plexus infusions following total knee arthroplasty: randomized controlled trial. *Eur J Anaesthesiol* 2008; 25(6):502-7.
  18. Thorsell M, Holst P, Hyldal HC, et al. Pain control after total knee arthroplasty: a prospective study comparing local infiltration anesthesia and epidural anesthesia. *Orthopedics* 2010; 33(2):75-80.
  19. Bianconi M, Ferraro L, Traina GC, et al. Pharmacokinetics and efficacy of ropivacaine continuous wound instillation after joint replacement surgery. *Br J Anaesth* 2003; 91(6): 830-5.
  20. Lombardi AV, Berend KR, Mallory TH, et al. Soft tissue and intra-articular injection of bupivacaine, epinephrine, and morphine has a beneficial effect after total knee arthroplasty. *Clin Orthop Relat Res* 2004; (428):125-30.
  21. Rasmussen S, Kramhoft MU, Sperling KP, et al. Increased flexion and reduced hospital stay with continuous intraarticular morphine and ropivacaine after primary total knee replacement: open intervention study of efficacy and safety in 154 patients. *Acta Orthop Scand* 2004; 75(5):606-9.
  22. Anderson KV, Bak M, Christensen BV, et al. A randomized control trial comparing local infiltration analgesia with epidural infusion for total knee arthroplasty. *Acta Orthop* 2010; 81(5):606-10.
  23. Liu W, Cong R, Li X, et al. Reduced opioid consumption and improved early rehabilitation with local and intra articular cocktail analgesic injection in total hip arthroplasty: a randomized controlled clinical trial. *Pain Med* 2011; 12(3):387-93.
  24. Spreng UJ, Dahl V, Hjal A, et al. High-volume local infiltration analgesia combined with intravenous or local ketorolac plus morphine compared with epidural analgesia after total knee arthroplasty. *Br J Anaesth* 2010; 105(5):675-82.