

Original research article

Periarticular injection or epidural bupivacaine for early rehabilitation following complete knee replacement: A comparative study

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Abstract

Introduction and Objectives: The magnitude of pain experienced with major surgical procedures such as complete knee replacement is substantial. This study aims to evaluate the effectiveness of periarticular injection of a combination of analgesic medicines in reducing pain following total knee replacement surgery.

Material and Methods: This investigation was conducted using a randomized controlled trial design. The study encompassed a cohort of 20 patients. The research investigation was carried out at the Department of Orthopedics, Kakatiya Medical College / MGM hospital, located in Warangal, Telangana, India, throughout the period spanning from March 2022 to February 2023. The orthopaedic outpatient department assessed both cases and controls, providing a comprehensive explanation of the study and distributing an information sheet for further clarification.

Results: The pericapsular injection of medicines resulted in much superior pain alleviation for patients in the early postoperative period, as compared to the epidural group. The pericapsular injection resulted in a more rapid functional rehabilitation in the patients. However, on the 10th day after the operation, there was no significant difference observed in terms of functional ability or pain relief. The modality of pain control did not have a substantial impact on the range of motion. Individuals who were administered pericapsular injections experienced a reduced incidence of anaesthesia-related adverse effects, such as nausea, pruritis, vomiting, and urine retention.

Conclusion: Patients who got peri capsular injection experienced considerably superior pain relief on the day of surgery compared to those who received epidural injection for postoperative pain reduction.

Keywords: Epidural anesthesia, post-operative analgesia, and analgesic cocktail

Introduction

The amount of discomfort that is linked to major surgical procedures, such as complete knee replacement, is fairly significant. Patients who have undergone Total Knee Arthroplasty (TKA) are quite concerned about the postoperative pain that they experience, and the most effective method for managing pain is still a matter of debate. When it comes to early mobilization and a successful functional recovery, adequate pain treatment is absolutely necessary ^[1-3].

Different combinations of systemic and/or regional analgesia, with or without opioids, are among the modalities that can be utilized to alleviate pain following surgical procedures. Epidural anesthesia is the procedure that is currently being utilized at our institution for the purpose of pain management following a total knee replacement (TKR). Other medications, such as nonsteroidal anti-inflammatory medicines (NSAIDs) and subcutaneous morphine, are also utilized for the purpose of pain management. Other multi-modal techniques that offer appropriate analgesia while effectively avoiding opioid-related side effects have been proposed as a result of the adverse effects that are associated with the administration of parenteral opioids and infusions ^[4-6].

A multimodal approach that involves pericapsular injection of an anesthetic cocktail consisting of drugs such as Ropivacaine, Noradrenaline, Depomedrol, Morphine, and Ketorelac, along with oral nonsteroidal anti-inflammatory drugs (NSAIDs), intravenous paracetamol, and perioperative pregabalin, is going to be compared to the current method of pain control that involves epidural infusion of Bupivacaine. The purpose of this study is to evaluate the effectiveness of both approaches. Both the reduction of pain and the functional recovery will be monitored after the operation. The functional recovery will be monitored by observing the amount of time it takes to accomplish a core set of functional goals ^[7-9].

In order to determine whether or whether a periarticular analgesic cock tail injection is effective and safe for early rehabilitation following a total knee replacement, the purpose of this study was to investigate

them. In order to determine whether or if the periarticular injection of an analgesic cock tail is beneficial in encouraging early functional recovery, the purposes of this study were to evaluate its effectiveness [8-10].

Materials and Methods

This study employed a randomized controlled trial design. In this investigation, a cohort of 20 patients was enrolled. The research was carried out in the Department of Orthopedics, Kakatiya Medical College/ MGM hospital, Warangal, Telangana, India, from March 2022 to February 2023. The cases and controls were assessed within the orthopaedic outpatient department, where they were provided with a comprehensive explanation of the study and were handed an information sheet to seek clarification. Consent that was informed and legitimate was obtained. The patients were then admitted and scheduled for unilateral total knee arthroplasty for their treatment.

Eligibility criteria

Individuals receiving TKR unilaterally.

Exclusion Criteria

- Elderly with bilateral TKR >80 years.
- Updated TKR Arrhythmia/Cardiac.

Results

The study encompassed a cohort of 20 patients. A total of 15 cases of osteoarthritis, 4 cases of rheumatoid arthritis, and 1 case of gouty arthritis were seen. The control study group primarily consisted of individuals with osteoarthritis. The additional knee conditions examined in the study encompassed rheumatoid and gouty arthritis. A total of 12 knees exhibited epidural infiltration, while 14 knees displayed an analgesic cocktail. All patients who were administered an analgesic cocktail exhibited osteoarthritis in their knees.

Sex and age distribution population

The control population consisted of 11 males and 15 females, with females comprising 58% of the individuals included in the study. Out of the total sample size, five males and seven females underwent epidural injection, whereas six males and eight females received peri capsular injection of the cocktail. The study population consisted of 42% males. The majority of the study group consisted of individuals in the middle age range. The study population had an average age of 58 years. The average age of patients who underwent epidural infiltration was 56 years, while the average age of patients who got the analgesic cocktail was 59 years. The minimum age group examined was 29 years, while the maximum age was 71 years.

Complaints presented

The primary complaint reported by all patients in the research group was pain and deformity, although the duration of these symptoms varied. Additional symptoms included challenges in performing routine tasks, as well as stiffness and locking. The variability in the duration of deformity and pain was observed.

Afflicted sides

The left knees were seen to be more frequently afflicted compared to the right knee. Two-thirds of the 26 knees examined were left, while the remaining knees were right. The study involved the administration of epidural infiltration to eight left knees and four right knees, as well as the administration of an analgesic cocktail to ten left knees and four right knees.

Additional medical conditions

The study population had a prevalence rate of 34% for diabetes. Diabetes was present in 4 out of 20 patients. Out of the total of 20, 06 individuals received an epidural, while the remaining individuals received an analgesic cocktail, however there was no statistically significant difference.

Table 1: Diabetes prevalence

Sr. No.	Diabetes	Epidural	Per capsular injection
1.	Yes	04	02
2.	No	06	08
	Total	10	10

Distance to walk

The average distance covered by the study group prior to undergoing surgery. The average walking distance for the group receiving epidural analgesia was 413 meters, whereas for the group receiving analgesic cocktail. The walking distance of the epidural group was much more affected compared to the

cocktail group, suggesting a more severe illness process. However, this difference was not statistically significant.

Table 2: Analysis of distance to walk

Sr. No.	Variables	Epidural	Per capsular injection
1.	Walking distance	460±516	719±1061

Aids employed

42% of the study population utilized ambulatory assistance prior to surgery. 50% of individuals in the epidural group did not utilize any assistance for ambulation. One patient was confined to a wheelchair, while another patient relied on the assistance of two individuals to ambulate. The remainder relied on a walking stick for assistance.

Table 3: Aids employed

Sr. No.	Aids used	Epidural	Per capsular injection
1.	Yes	4	5
2.	No	6	5

Score for pain prior to surgery

The mean preoperative pain score of the epidural group was 6.25, while the analgesic cocktail had an average score of 5.4. The epidural group reported a maximum pain level of 10, while the analgesic cocktail group reported a maximum pain level of nine. The pain score ranges from a minimum of two to zero. Upon analysis, no statistically significant difference was observed in the preoperative pain assessments between the two groups.

Table 4: Analysis on pain prior to surgery

Sr. No.	Variables	Epidural	Per capsular injection
1.	Pre-operative pain score	6.46±2.35	5.62±2.74

Use of analgesics

50% of individuals in the epidural group utilized analgesics on a daily basis to manage pain during their everyday activities, whereas only five out of the 14 participants in the analgesic cocktail group did so. Only 50% of the patients receiving epidural treatment and 64% of those receiving analgesic cocktails did not use any analgesic drugs for walking, while a small number of patient's utilized painkillers as needed for severe pain. There was no statistically significant difference observed in the utilization of analgesics.

Knee society rating

There are two components to the Knee Society Score, namely the Knee Score and the Functional Score. The assessment was conducted for all participants in the study. The study individuals exhibited a mean average score of 50. The analgesic mixture had a higher score compared to the epidural group. The analgesic cocktail achieved a score of 53, whereas the epidural group obtained a score of 46. The study group exhibited a mean average functional score of 53. The analgesic cocktail group had somewhat higher scores, although the observed difference did not reach statistical significance.

Discussion

Among the many types of arthroplasty procedures performed annually, total knee arthroplasty ranks high. Patients' main concern and the subject of multiple recent study articles is postoperative pain following total knee replacement surgery. Various methods have been documented, including patient-controlled analgesia, epidural analgesia, femoral nerve blocks, and periarticular injection of medicines. Degenerative arthritis is believed to strike middle-aged men more frequently, especially those who have worked as manual laborers or in physically demanding occupations [11-13].

Patients arriving to a tertiary hospital with degenerative arthritis were the subjects of our trial, and we hoped to learn how well a mixture of medications administered by periarticular infiltration might manage pain and facilitate early functional recovery following total knee arthroplasty. The 26 patients who underwent total knee replacement surgery were the subjects of our study. Compared to an epidural injection, periarticular infiltration is far more effective in the first day following surgery, according to the study. Compared to the epidural group, those receiving peri articular injections reported consistently lower pain scores even after the first two days, when the injections' analgesic effects are typically expected to wear off. The group that received peri-articular injections also had considerably greater functional ability on the first day [14-16].

The decreased occurrence of adverse effects including vomiting, nausea, and pruritis is another benefit of the peri articular injection over the epidural anesthesia. Furthermore, without catheters limiting the

patient, mobilization becomes much easier. Periarticular injections of a combination of opioids, corticosteroids, and a local anesthetic in patients having bilateral total knee replacements and their efficacy^[15-17]. The medication combination was injected into one of the two knees. After the periarticular injection of the anesthetic cocktail, they noted a marked improvement in quadriceps recovery and a marked decrease in pain levels compared to the non-injected side. Patients who underwent total knee arthroplasty with local infiltration anesthesia compared to those who received epidural anaesthesia with ropivacaine, ketorolac, or adrenaline showed faster mobilization times. After comparing this method to epidural anesthesia, they came to the conclusion that it provided superior postoperative pain reduction while simultaneously improving patient satisfaction^[18-20].

How intrathecal morphine and other multimodal injections for pain management during total knee arthroplasty affect individuals. After 12-16 hours after surgery, the intrathecal group took much more Ketorolac and had more nausea and vomiting than the group that received multimodal drug injections, even though there was no difference between the two modalities at the beginning^[21-23]. Compared the two types of anesthesia used to treat total knee arthroplasty, researchers found that epidural anaesthesia was more effective in reducing postoperative pain within the first 24 hours, while local infiltration anaesthesia was more effective beyond that time^[24-26].

These findings go counter to our research, which indicated that periarticular injection provided superior pain alleviation during the first day. Even during the rest of the hospital stay, the analgesic level was much better. It was feasible to achieve early functional recovery with peri articular injection; yet, both groups managed to ascend fourteen steps by the fifth day after the operation. No one has yet adequately explained why the peri articular injection has such a long-lasting positive impact. There are a number of hypotheses. Possible mitigation of neural sensitization is attributable to the substantial alleviation of pain seen immediately following surgery. It is possible that the steroid in the cocktail can help alleviate the inflammatory pain that patients experience after surgery. In all groups, patients were able to participate in the physiotherapy program earlier and achieve functional independence within four to five days after pain management was satisfactory^[27-29].

Conclusion

Patients who got peri capsular injections for postoperative pain treatment had far better results than those who got epidurals on the day of surgery. Although there was no statistically significant difference, patients who got peri capsular injection for pain control reported less discomfort in the days following knee replacement. Patients who got peri capsular injections for pain treatment performed far better than those who got epidural infusions when it came to doing a straight leg raise with a brace on the first day after surgery. After the second day, this disparity ceased to be statistically significant.

Funding

None.

Conflict of Interest

None.

References

1. Scott CE, Streit J, Biant LC, Breusch SJ. Periarticular infiltration in total hip replacement: Effect on heterotopic ossification, analgesic requirements and outcome. *Arch Orthop. Trauma Surg.* 2012;132:703-709.
2. Yuenyongviwat V, Pornrattanamanee Wong C, Chinachoti T, Chareancholvanich K. Periarticular injection with bupivacaine for postoperative pain control in total knee replacement: A prospective randomized double-blind controlled trial. *Adv. Orthop.* 2012;2012:107309.
3. Tammachote N, Kanitnate S, Manuwong S, Yakumpor T, Panichkul P. Is pain after TKA better with periarticular injection or intrathecal morphine? *Clin. Orthop. Relat. Res* 2013;471:1992-1999.
4. Chaumeron A, Audy D, Drolet P, Lavigne M, Vendittoli PA. Periarticular injection in knee arthroplasty improves quadriceps function: *Clin. Orthop. Relat. Res.* 2013 Jul;471(7):2284-2295.
5. 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 Apr;79(2):174-183.
6. Aditya V, Maheshwari MD, Yossef C, Blum MD, Laghvendu Shekhar MD, Amar S, *et al.* Multimodal Pain Management after Total Hip and Knee *Clin. Orthop. Relat. Res.* 2009;467:1418-1423.
7. Crowley C, Dowsey MM, Quinn C, Barrington M, Choong PF. Impact of regional and local anaesthetics on length of stay in knee arthroplasty. *ANZ J Surg.* 2012;82:207-214.
8. Gibbs DM, Green TP, Esler CN. The local infiltration of analgesia following total knee replacement: A review of current literature. *J Bone Joint Surg. Br.* 2012;94:1154-1159.
9. Wylde V, Gooberman-Hill R, Horwood J, Beswick A, Noble S, Brookes S, *et al.* The effect of local

- anaesthetic wound infiltration on chronic pain after lower limb joint replacement: A protocol for a double-blind randomised controlled trial. *BMC Musculoskelet Disord.* 2011;12:53.
10. Lamplot JD, Wagner ER, Manning DW. Multimodal pain management in total knee arthroplasty: A prospective randomized controlled trial. *J Arthroplasty* 2014;29:329-334.
 11. Mullaji A, Kanna R, Shetty GM, Chavda V, Singh DP. Efficacy of periarticular injection of bupivacaine, fentanyl, and methylprednisolone in total knee arthroplasty: A prospective, randomized trial. *J Arthroplasty.* 2010 Sep;25(6):851-857.
 12. Thorsell M, Holst P, Hyldahl HC, Weidenhielm L. Pain control after total knee arthroplasty: A prospective study comparing local infiltration anesthesia and epidural anesthesia. *Orthopedics.* 2010 Feb;33(2):75-80.
 13. Spreng UJ, Dahl V, Hjal A, Fagerland MW, Raeder J. High volume local infiltration analgesia combined with intravenous or local ketorolac + morphine compared with epidural analgesia after total knee arthroplasty: *Br J Anaesth.* 2010 Nov; 105(5):675-682.
 14. Sean VW, Chin PL, Chia SL, Yang KY, Lo NN, Yeo SJ, *et al.* Single-dose periarticular steroid infiltration for pain management in total knee arthroplasty: A prospective, double-blind, randomized controlled trial. *Singapore Med J.* 2011 Jan;52(1):19-23.
 15. Scott CE, Streit J, Biant LC, Breusch SJ. Periarticular infiltration in total hip replacement: effect on heterotopic ossification, analgesic requirements and Outcome: *Arch Orthop. Trauma Surg.* 2012 May;132(5):703-709.
 16. Yuenyongviwat V, Pornrattanamaneewong C, Chinachoti T, Chareancholvanich K. Periarticular injection with bupivacaine for postoperative pain control in total knee replacement: A prospective randomized double-blind controlled trial. *Adv. Orthop.* 2012;2012:107309.
 17. Tammachote N, Kanitnate S, Manuwong S, Yakumpor T, Panichkul P. Is Pain After TKA Better with Periarticular Injection or Intrathecal Morphine? *Clin. Orthop. Relat. Res.* 2013;471:1992-1999.
 18. Spangehl MJ, Clarke HD, Hentz JG, Misra L, Blocher JL, Seamans DP, *et al.* The Chitranjan Ranawat Award: Periarticular injections and femoral and sciatic blocks provide similar pain relief after TKA: A randomized clinical trial. *Clin. Orthop. Relat. Res.* 2015;473:45-53.
 19. Stathellis A, Fitz W, Schnurr C, Koeck FX, Gebauer M, Huth J, *et al.* Periarticular injections with continuous perfusion of local anaesthetics provide better pain relief and better function compared to femoral and sciatic blocks after TKA: A randomized clinical trial. *Knee Surg. Sports Traumatol. Arthrosc.* 2017;25:2702-2707.
 20. Gibbs DM, Green TP, Esler CN. The local infiltration of analgesia following total knee replacement: a review of current literature. *J Bone Joint Surg. Br.* 2012 Sep;94(9):1154-1159.
 21. Wylde V, Gooberman-Hill R, Horwood J, Beswick A, Noble S, Brookes S, *et al.* The effect of local anaesthetic infiltration on chronic pain after lower limb replacement: a protocol for a double blind randomized controlled trial: *BMC Musculoskelet. Disord.* 2011 Feb 26;12:53.
 22. Noble PC, Scuderi GR, Brekke AC, Sikorskii A, Benjamin JB, Lonner JH, *et al.* Development of a Knee Society Knee Scoring system. *Clin. Orthop. Relat. Res.* 2012;470:20-32.
 23. Schumer G, Mann JW, Stover MD, Sloboda JF, Cdebaca CS, Woods GM, *et al.* Liposomal bupivacaine utilization in total knee replacement does not decrease length of hospital stay. *J Knee Surg.* 2019;32:934-939.
 24. 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;79:174-183.
 25. Busch CA, Shore BJ, Bhandari R, Ganapathy S, MacDonald SJ, Bourne RB, *et al.* Efficacy of periarticular multimodal drug injection in total knee arthroplasty. A randomized trial. *J Bone Joint Surg. Am.* 2006;88:959-963.
 26. Vendittoli PA, Makinen P, Drolet P, Lavigne M, Fallaha M, Guertin MC, *et al.* A multimodal analgesia protocol for total knee arthroplasty. A randomized, controlled study. *J Bone Joint Surg. Am.* 2006;88:282-289.
 27. Toftdahl K, Nikolajsen L, Haraldsted V, Madsen F, Tønnesen EK, Søballe K, *et al.* Comparison of peri- and intraarticular analgesia with femoral nerve block after total knee arthroplasty: A randomized clinical trial. *Acta. Orthop.* 2007;78:172-179.
 28. Amundson AW, Johnson RL, Abdel MP, Mantilla CB, Panchamia JK, Taunton MJ, *et al.* A three - arm randomized clinical trial comparing continuous femoral plus single-injection sciatic peripheral nerve blocks versus Periarticular injection with ropivacaine or liposomal bupivacaine for patients undergoing total knee arthroplasty. *Anesthesiology.* 2017;126:1139-1150.
 29. Alijanipour P, Tan TL, Matthews CN, Viola JR, Purtill JJ, Rothman RH, *et al.* Periarticular injection of liposomal bupivacaine offers no benefit over standard bupivacaine in total knee arthroplasty: A prospective, randomized, controlled trial. *J Arthroplasty.* 2017;32:628-34.