

Comparative Analysis of Efficacy of Epidural Analgesia vs Intra-operative Cocktail for Post-operative Pain Management in Total Knee Replacement (TKR) Patients

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ABSTRACT

Background: TKR is among the most excruciating surgical procedures available. Early knee joint rehabilitation is hampered by inadequate postoperative pain management. Capsular contractures, muscular atrophy, and spasms in the quadriceps muscles bring on pain. As one of the most crucial elements for the best possible postoperative knee rehabilitation, this prevents early, intensive physical treatment.

Methods: This study compares the effectiveness of epidural analgesia and intraoperative periarticular cocktail for the early post-operative control of pain after total knee replacement. The study comprised 52 patients in total. Patients were split into two groups using simple randomization: Group A received epidural anesthesia for 22 patients, while Group B received periarticular cocktail for 30 patients. Cocktail ingredients include 20 ml of injection bupivacaine 0.5%, 2 ml of methylprednisolone, 1.5 gm of cefuroxime, and 10 ml of normal saline. Then, it infiltrates the patellar tendon, posterior capsule, quadriceps muscle, medial retinaculum, lateral retinaculum, medial collateral ligament and capsular attachment, and lateral collateral ligament and capsular attachment. Group A patients received an epidural top-up six hours after surgery, consisting of 8cc of 0.125% Bupivacaine. The visual analog scale was utilized to document postoperative discomfort, and the duration required to attain 90° of knee flexion was documented.

Results: The knee that received the cocktail injection experienced less discomfort in the first 48 hours, requiring a noticeably shorter time to reach 90° of knee flexion.

Conclusion: An intraoperative periarticular cocktail injection improves early knee motion and dramatically lowers post-operative discomfort.

Key-words: Analgesia, Cocktail, Epidural analgesia, Intra-operative cocktail, Knee replacement, Post-operative pain treatment

INTRODUCTION

Total Knee Replacement (TKR), also known as total knee arthroplasty, is a surgical treatment commonly used to improve function and reduce pain in patients suffering

from advanced knee joint degradation caused by conditions such as rheumatoid arthritis, osteoarthritis, or traumatic injuries ^[1]. Even though total TKR is regarded as a very difficult surgical operations, particularly in the early postoperative phase, it can significantly relieve pain and enhance patients' quality of life ^[2].

A key component of the early rehabilitation of the knee joint is the efficient management of postoperative pain following TKR ^[3,4]. The most detrimental effects of inadequately managing postoperative pain are that it may prevent early and intensive physical therapy from starting, which is essential for the best possible postoperative knee rehabilitation ^[5].

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Several physiological and anatomical factors can be linked to the multifactorial causes of postoperative pain after total knee replacement surgery. These include capsular contractures, muscular atrophy, and spasms in the quadriceps muscles. These factors all contribute to the patient's pain and discomfort. These factors make it more difficult to recover quickly after surgery and more difficult to engage in intensive physical therapy, which is widely acknowledged as one of the most important factors in successful postoperative knee rehabilitation [6,7].

Medications and substances such as bupivacaine, methylprednisolone, cefuroxime, and saline are injected into specific anatomical sites surrounding the knee joint during an intraoperative periarticular cocktail injection. This technique addresses pain at its source by targeting key structures like the medial and lateral retinacula, collateral ligaments, capsular attachments, patellar tendon, posterior capsule, and quadriceps muscle [6,8-13].

Epidural analgesia, on the other hand, involves the anesthetic agent's administration through an epidural catheter placed in the spine's epidural space [14]. This technique provides comprehensive pain relief by blocking nerve signals, effectively numbing the lower extremities and the surgical site [15-17].

The comparative analysis of these two pain management methods in TKR is essential to ascertain their respective efficacies, safety profiles, and impact on early postoperative recovery. This study aims to contribute valuable insights into the optimal approach for managing postoperative pain in TKR patients, focusing on enhancing early knee rehabilitation and improving patient outcomes.

MATERIALS AND METHODS

Study Design- This study employed a prospective comparative design to assess the efficacy of two different pain management techniques, intra-operative periarticular cocktail injection and epidural analgesia, in the early postoperative period following TKR surgery.

Participants- A total of 52 TKR patients were enrolled in the study. Patients were recruited from the orthopaedic department of a tertiary care hospital between January 2023 and December 2023.

Inclusion criteria Adults aged 18-80 diagnosed with knee osteoarthritis necessitating TKR.

Exclusion criteria- Contraindications to either pain management technique, history of opioid allergy, etc.

Randomization- Patients were randomly assigned to one of two groups using simple randomization techniques. Group A consisted of 22 patients who received epidural analgesia, while Group B consisted of 30 patients, who received the periarticular cocktail injection.

Interventions

Epidural Analgesia (Group A)- An epidural catheter was placed preoperatively under aseptic conditions. Epidural top-up of 8cc of 0.125% Bupivacaine was administered 6 hourly after surgery. Monitoring for complications related to epidural analgesia was performed throughout the study period.

Periarticular Cocktail Injection (Group B)- The cocktail mixture consisted of the following Bupivacaine injection 0.5% (20 ml), Methylprednisolone (2 ml), Cefuroxime (1.5 gm), Normal saline (10 ml). The medial, lateral, medial collateral ligament and capsular attachment, lateral collateral ligament and capsular attachment, posterior capsule, patellar tendon, and quadriceps muscle were among the specific anatomical sites surrounding the knee joint where the cocktail was infiltrated.

Outcome Measures

Postoperative Pain Assessment- Pain levels were assessed using the Visual Analog Scale (VAS) at regular intervals during the first 48 hrs post-surgery. The VAS is a 0-10 scale where 0 represents no pain, and 10 represents the worst imaginable pain. Pain assessments were performed at [specified time points, e.g., 2 hrs, 6 hrs, 12 hrs, 24 hrs, and 48 hrs] after surgery.

Knee Flexion Measurement- The time taken to achieve 90 degrees of knee flexion was recorded for each patient. This measurement was used to indicate early postoperative knee mobility and rehabilitation progress. Knee flexion assessments were conducted at (specify time points, e.g., 24 hrs, 48 hrs) post-surgery.

Statistical Analysis- Appropriate statistical techniques were used to analyze the data. Patient characteristics and outcomes were summarized using descriptive statistics, such as mean, standard deviation, and frequency distributions. Comparative analyses between Group A (epidural analgesia) and Group B (periarticular cocktail injection) were performed using t-tests or non-

parametric tests, Using SPSS ver-26. A p-value<0.05 was considered statistically significant.

Ethical Consideration- The approval of the institutional ethics committee was done. Before being included in the study, all individuals gave their informed consent.

RESULTS

Demographic Characteristics- In Group A (Epidural Analgesia), the average age of the participants was 61.24 ± 8.22 years. On the other hand, in Group B (Periarticular Cocktail), the mean age was slightly higher at 63.45 ± 6.98 years. The p-value associated with

comparing mean ages between the two groups was calculated to be 0.421. This p-value indicates no statistically significant difference in the mean ages of participants between Group A and Group B (Fig. 1).

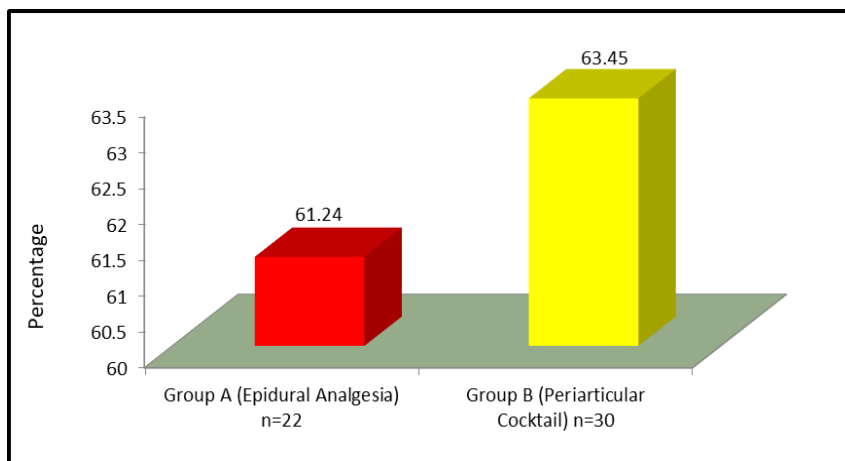


Fig. 1: Age Distribution

Fig. 2 provides the number of cases for both male and female participants in each group. In Group A, there were 14(63.6%) male participants and 8(36.4%) female participants. In Group B, there were 24(80.0%) male participants and 6(20%) female participants. The chi-

square value was calculated to be 1.72, and the associated p-value was 0.188, greater than the conventional significance level of 0.05, reinforcing this finding.

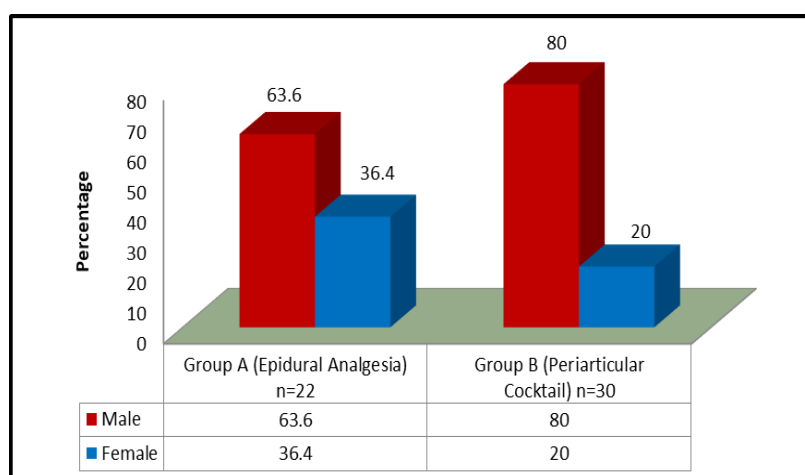


Fig. 2: Sex Distribution

Fig. 3 data highlights the evolution of pain levels for pain management methods and indicates significant differences in pain levels at some time points. For instance, at 2 hours, 6 hours and 48 hours post-surgery, Group B (Periarticular Cocktail) reported significantly lower pain levels than Group A (Epidural Analgesia), as evidenced by the low p-values (0.002 and 0.04,

respectively). These findings suggest that the periarticular cocktail may offer more effective pain relief during the early postoperative period. However, at 12 hours and 24 hours post-surgery, statistically significant differences were not observed in pain levels between the two groups, as indicated by the higher p-values (0.51 & 0.09, respectively).

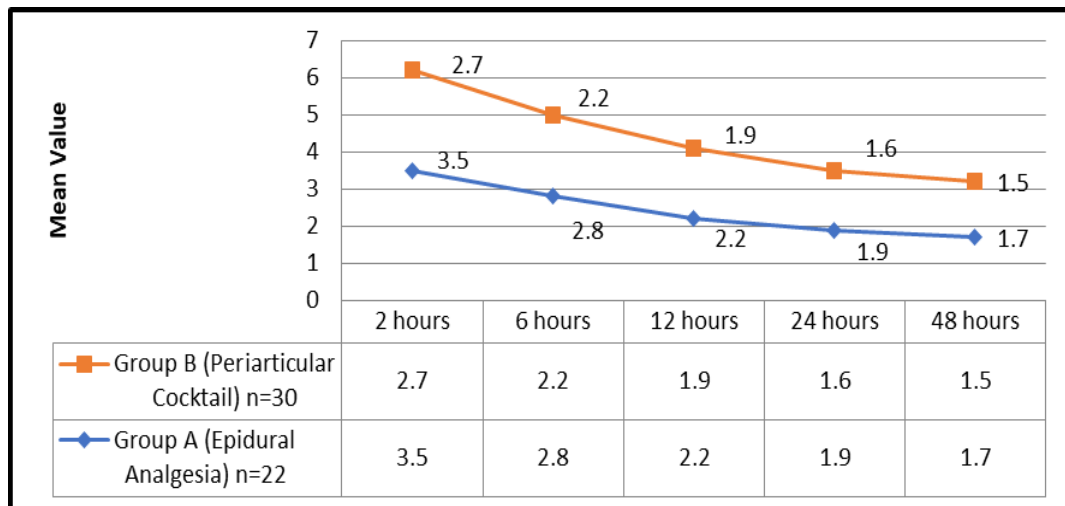


Fig. 3: Pain Levels (VAS) in Group A (Epidural Analgesia) & Group B (Periarticular Cocktail)

Fig. 4 compares two groups, Group A and Group B, based on knee flexion achieved after 24 and 48 hours. In Group A, which received Epidural Analgesia, had an average knee flexion of 36.5 ± 5.2 degrees. In contrast, Group B, treated with a Periarticular Cocktail, achieved an average knee flexion of 30.8 ± 4.7 degrees. The difference

between the groups was statistically significant ($p=0.01$). At the 48-hours Group A exhibited an average knee flexion of 52.3 degrees (± 6.1 degrees), while Group B had a mean knee flexion of 43.2 degrees (± 5.3 degrees). Again, the difference between the two groups was statistically significant ($p=0.002$).

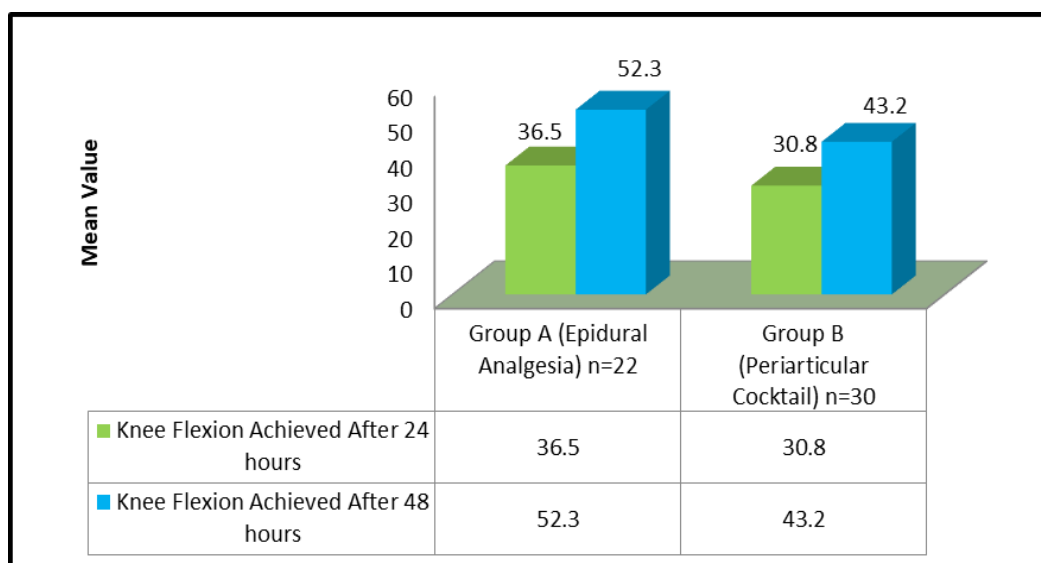


Fig. 4: Time to Achieve Knee Flexion in Group A (Epidural Analgesia) & Group B (Periarticular Cocktail)

DISCUSSION

The most popular treatment for end-stage knee osteoarthritis (OA) is thought to be total knee arthroplasty (TKA). In addition, TKA is an excellent treatment for malignancy, dysplasia, inflammatory arthritis, fracture (post-traumatic OA and/or deformity), and dysplasia^[18,19]. From its inception at the Hospital for Special Surgery in the early 1970s, the current TKA has changed over the last fifty years^[20]. These days, there is a dramatic rise in the necessity for TKA worldwide due to the increased incidence of knee arthritis. It is anticipated that 1.26 million main TKA procedures will have been carried out by 2030, an 85% increase^[21].

In our study, patients in Group B (Periarticular Cocktail) reported significantly lower pain levels at 2 hours and 48 hours post-surgery than those in Group A (Epidural Analgesia). This finding aligns with the results of Fu *et al.*^[22], where a periarticular cocktail also demonstrated superior early postoperative pain control in TKR patients (Parvataneni *et al.*)^[23].

The efficacy of periarticular cocktails in reducing postoperative pain has been recognized in the literature. Previous research by Vaishya *et al.* demonstrated similar benefits in orthopedic surgeries, supporting the consistent advantage of periarticular cocktails in pain management^[24].

Our study found that Group B patients achieved knee flexion degrees significantly faster than Group A at 24 hours and 48 hours post-surgery. This outcome is consistent with the Study, where a periarticular cocktail facilitated quicker postoperative knee mobility (Fu *et al.*)^[22]. Similar to other studies, the investigation by Dalury *et al.*^[25] and the study conducted by Nakai *et al.*^[26] have also reported reduced time to achieve target knee flexion with periarticular cocktails in orthopedic procedures, further supporting the advantage of this approach.

Clinical Implications- The cumulative evidence from our study and existing literature underscores the clinical significance of the Periarticular Cocktail in TKR. This approach may lead to improved patient comfort, enhanced early knee function, and potentially shorter hospital stays, benefiting both patients and healthcare systems.

CONCLUSIONS

The findings from this study suggest that the Periarticular Cocktail is associated with superior pain control during the early postoperative period following Total Knee Replacement (TKR) surgery. Additionally, patients receiving the Periarticular Cocktail achieved 90 degrees of knee flexion more rapidly than those receiving Epidural Analgesia, indicating better early knee mobility. These results support the notion that the Periarticular Cocktail may be an effective and advantageous option for pain management in TKR patients, as it reduces postoperative pain and facilitates quicker postoperative knee mobility. However, it is essential to consider the clinical implications and potential benefits in the context of individual patient needs and preferences.

Further research and clinical evaluation may be necessary to confirm these findings and assess long-term outcomes.

CONTRIBUTION OF AUTHORS

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