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Comparative study between Ropivacaine and bupivacaine in cocktail periarticular injection, in immediate post-operative analgesia and rehabilitation in patients undergoing total knee arthroplasty (TKA)

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Abstract

Background: Total knee arthroplasty (TKA) is associated with moderate to severe post-operative pain in approximately 20-30% of patients despite oral and parenteral analgesic use. A novel approach to pain management is to control local pain pathways and receptors within the knee. A safe and cost effective measure of achieving this is by local intra and periarticular injections of cocktail anesthesia.

Objective: To compare the efficacy of ropivacaine and bupivacaine in cocktail periarticular injection, in immediate post-operative analgesia and rehabilitation in patients undergoing total knee arthroplasty.

Materials and methods: A total of 46 patients undergoing total knee arthroplasty was divided into two groups. Group I received bupivacaine based cocktail regimen and group II received ropivacaine based cocktail regimen. In the post-operative period, both the groups were compared for pain relief and range of knee movements at 12 and 24 hours respectively.

Results: In group I, the mean VAS at 12 hours was 8.01 ± 0.38 and at 24 hours was 3.93 ± 1.95 while in group II, the mean VAS at 12 hours was 7.12 ± 0.47 and at 24 hours was 2.09 ± 0.06 . Paired 't' test show statistical significant difference in pain relief among both the groups ($p < 0.05$). Among our study population, the mean range of movements improved in group II with significant statistical difference of $p < 0.001$ $p = 0.03$.

Conclusion: In patients with TKA, Ropivacaine based cocktail regimen has better post-operative pain relief and earlier range of knee movements while comparing with bupivacaine based cocktail regimen.

Keywords: Bupivacaine, ropivacaine, total knee arthroplasty

Introduction

Total knee arthroplasty (TKA) is associated with moderate to severe post-operative pain in approximately 20-30% of patients despite oral and parenteral analgesic use [1]. Suitable pain control is vital to ensure patient satisfaction and reduce hospital stay, thereby improving functional outcome and reducing associated complications. Pain can be controlled in various ways, though each modality has its own pros and cons [2, 3]. With the advent of multimodal analgesic regimens in the form of cocktail, various studies have been performed to assess the innumerable advantages it has over epidural anaesthesia and nerve blocks, which are associated with undesirable adverse events like increased risk of thromboembolism, muscle weakness, hematoma formation and delayed mobilization [4].

A novel approach to pain management is to control local pain pathways and receptors within the knee. A safe and cost effective measure of achieving this is by local intra and periarticular injections of cocktail anaesthesia. Though no guidelines have been framed for the constituency of cocktail, various studies have explored different combinations to investigate its safety and efficacy. Pain, functional outcome and patient satisfaction rates are significantly better with periarticular injection of cocktail [5].

Cocktail works on the principle of using multiple agents that have effect at different sites of the pain pathway. It not only controls pain adequately but also lowers overall opioid consumption, reduces length of stay (LOS) in the hospital, improves function and reduces the side effects of analgesics [6, 7].

Hence the study was undertaken to compare the efficacy of ropivacaine and bupivacaine in cocktail periarticular injection, in immediate post-operative analgesia and rehabilitation in patients undergoing total knee arthroplasty.

Materials and Methods

With a level IV evidence, a prospective comparative study was conducted in patients undergoing elective Total knee arthroplasty in the department of Orthopaedics, Yenepoya Medical College from November 2019 to April 2020. A total of 46 patients undergoing total knee arthroplasty were given the respective cocktail protocol and the functional outcome scores were analysed.

All patients undergoing elective total knee arthroplasty consenting for the study were included in the study. Patients with active inflammatory or connective tissue diseases, hypersensitivity to NSAIDs or local anaesthetic agents, patients with major surgery on the knee on which TKA was performed and patients with post traumatic secondary arthritis knee were excluded from the study.

After approval from the ethical committee and obtaining informed & written consent from the study participants, the eligible patients were included in the study. Patients undergoing elective total knee arthroplasty were clinically examined and pre-operative oxford knee score was assessed. All the surgeries were performed by a single surgeon using a medial sub-vastus approach and the periarticular cocktail injection was given by the same surgeon. Local infiltration injection of a mixture cocktail (Total-64ml) comprising of 0.5% of Bupivacaine 20ml or 0.5% Ropivacaine 20ml, Tranexamic acid 20ml (2g/20ml), Butorphanol 1ml (1mg/1ml), Ketorolac 1 ml of 30mg/ml, Tramadol 2ml (100mg/2ml) and Inj Piperacillin and Tazobactam 20ml (4.5g/20ml) were given.

The patients were divided into two groups (with n=23 in each group) based on the cocktail combination used. Patients in Group I received the cocktail combination consisting of Bupivacaine (Bupivacaine + Tranexamic acid + Butorphanol + Ketorolac + Tramadol + Antibiotic). Similarly, Group II patients received the cocktail injection containing of Ropivacaine (Ropivacaine + Tranexamic acid + Butorphanol

+ Ketorolac + Tramadol + Antibiotic). The cocktail injection was formulated by the orthopaedic surgeon and the anaesthetist based on their clinical experience and past clinical studies. Special care was taken to avoid infiltration of the common peroneal nerve and popliteal fossa to avoid injury to vessels and nerves. The cocktail was injected at the following 7 anatomical zones according to Galindo *et al.*, namely.

Zone 1: Medial retinaculum

Zone 2: Medial collateral ligament and medial meniscus capsular attachment

Zone 3: Posterior capsule

Zone 4: Lateral collateral ligament and lateral meniscus capsular attachment

Zone 5: Lateral retinaculum

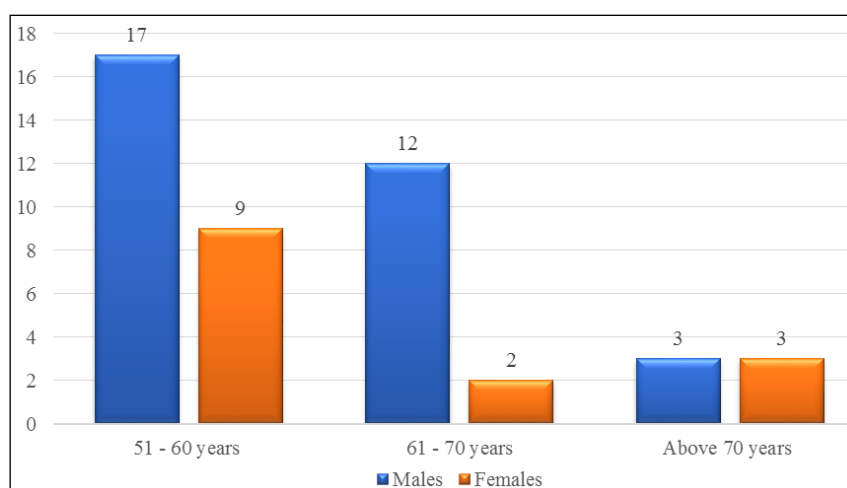
Zone 6: Patellar tendon and fat pad

Zone 7: Quadriceps muscle and tendon

Measurement of outcome: Postoperative pain over the operated knee was assessed, using Visual analogue scale (VAS) at 12 hours and 24 hours following the surgery. Postoperatively knee active range of movements and time taken to perform active straight leg raise were also noted at 12 hours and 24 hours following the surgery. Patient satisfaction rate was assessed using a 4 point Likert scale with response categories comprising of very satisfied, somewhat satisfied, somewhat dissatisfied and very dissatisfied, post operatively.

Results

A total of 46 cases entered our study and were treated & followed up as per our protocol. The statistical analysis with paired 't' test and P value were derived from IBM SSPS statistics for Windows, Version 24.0, IBM Corp, Chicago, IL. The mean (\pm SD) age of the patients in the study was 64.97 ± 3.19 years with 32 males (69.55%) and 14 females (30.43%). The majority of the patients belong to 51-60 years (n=26, 56.52%) followed by 61-70 years (n=14, 30.43%) and remaining patients belong to above 70 years (n=6, 13.04%) (as shown in graph 1). A total of 35 patients (76.08%) belong to grade 3 osteoarthritis knee and 11 patients (23.91%) belong to grade 4 osteoarthritis knee.



Graph 1: Demographic details of study population

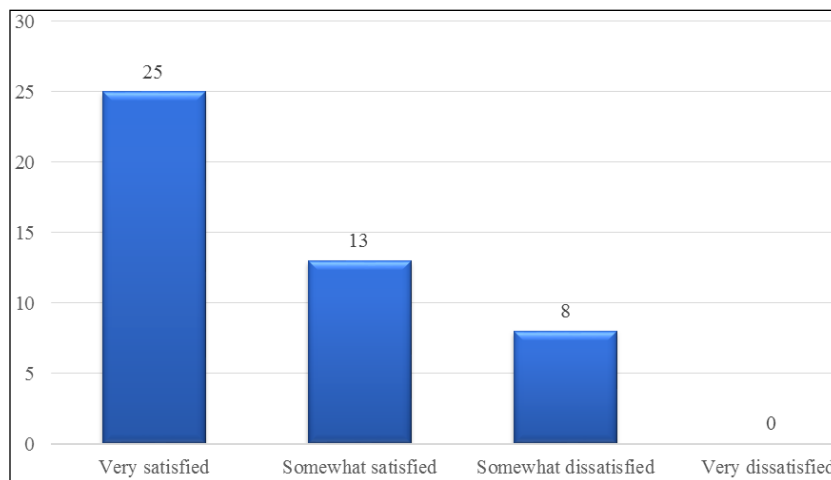
In group I, the mean VAS at 12 hours was 8.01 ± 0.38 and at 24 hours was 3.93 ± 1.95 while in group II, the mean VAS at 12 hours was 7.12 ± 0.47 and at 24 hours was 2.09 ± 0.06 . Paired 't' test show statistical significant difference in pain relief among both the groups ($p < 0.05$). Among our study

population, the mean range of movements improved in group II with significant statistical difference of $p < 0.001$ $p = 0.03$. Patients of both the groups were able to perform active straight leg raise at 12 hours.

Table 1: Post-operative assessment

Post-operative parameters	Group I (n=23)		Group II (n=23)		P value
	12 hours	24 hours	12 hours	24 hours	
Mean VAS	8.01±0.38	3.93±1.95	7.12±0.47	2.09±0.06	<0.05
Mean flexion of knee	32 °	79°	39°	93°	<0.001

Patient satisfaction rate was assessed using a 4 point Likert scale where 25 patients were very satisfied, 13 patients somewhat satisfied and 8 showed somewhat dissatisfied response. Overall study population showed no very dissatisfied response.

**Graph 2:** Patient satisfaction rate according to Likert's scale

Discussion

Given recent focus for maximizing postoperative pain relief following knee arthroplasty, as well as efforts to reduce cost of care in total joint replacement, this study sought to compare two popular periarticular injection protocols in TKA patients [8]. The cocktail analgesia have been previously shown to be successful in controlling pain after knee arthroplasty, but controversy exists over whether one injection type is more effective than the other [9]. The ability to assess the functional outcome scores and knee range of movements strengthens this study's ability to detect differences in outcomes between knees.

Vikram I Shah *et al.*, showed that intraoperative multimodal cocktail injection safely provides excellent postoperative pain control and functional recovery by comparing intraoperative multimodal analgesia (treatment/cocktail group) with control group in patients undergoing TKA. Subjects were divided into 3 groups.

- Group 1:** Served as control and were not given any injection.
- Group 2:** Received cocktail injection comprising of Cefuroxime, Normal saline (NS) and Bupivacaine hydrochloride.
- Group 3:** Received cocktail injection containing Cefuroxime, NS, Bupivacaine hydrochloride and Methylprednisolone (40 mg/mL).

They found that patients in the cocktail groups had significantly lower VAS score than the control group during early postoperative days. They also had reduced hospital stay and early rehabilitation [10].

Kelly *et al.*, compared the clinical efficacy of periarticular injections comprising of Ropivacaine and epinephrine with and without combinations of Clonidine and/or Ketorolac. They concluded that the multimodal pain control protocol involving an intraoperative periarticular injection containing ropivacaine, epinephrine, clonidine and ketorolac showed better early postoperative pain control than control group (ropivacaine and epinephrine) [11].

A study by Lee YS *et al.*, studied different protocols of periarticular injections and assessed their therapeutic efficacy.

They studied a randomised controlled trial by Kim *et al.*, which found that among 6 tested protocols, a combination of ropivacaine, morphine, and ketorolac in a PAI showed significantly stronger and sufficiently synergistic analgesic effect without adding methylprednisolone in TKA [12].

V Sreedharan Nair *et al.*, found in their study that post-operative pain was significantly lesser in cocktail injected knee (normal saline, Bupivacaine, Ketorolac and Adrenaline) when compared to the control group i.e., who received the same amount of normal saline. They also revealed that range of motion was significantly better in the cocktail group than control group [13].

Bupivacaine is a well-established long-acting regional anaesthetic and has been associated with cardiotoxicity when used in high concentration or when accidentally administered intravascularly when used as local anaesthetic [14].

Ropivacaine is a long-acting regional anaesthetic that is structurally related to Bupivacaine. It is a pure S(-) enantiomer, unlike Bupivacaine, which is a racemate, developed for the purpose of reducing potential toxicity and improving relative sensory and motor block profiles in patients undergoing surgeries to provide post-operative analgesia [15]. In our study, we compared two cocktails in two group of patients undergoing total knee arthroplasty for postoperative analgesia. Group I received Bupivacaine + Tranexamic acid + Butorphanol + Ketorolac + Tramadol + Antibiotic and group II received Ropivacaine + Tranexamic acid + Butorphanol + Ketorolac + Tramadol + Antibiotic. Both the groups were followed up for post-operative pain relief with VAS score and range of knee movements. Group II showed statistical significant difference in terms of pain relief and range of knee movements while comparing with group I.

Conclusion

The satisfaction rate of patients undergoing total knee arthroplasty relies on post-operative pain relief and earlier range of knee movements. The cocktail analgesia paved a big boon to have a better satisfaction rate among patients undergoing TKA. In patients with TKA, Ropivacaine based cocktail regimen has better post-operative pain relief and

earlier range of knee movements while comparing with bupivacaine based cocktail regimen.

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References

- Gurava Reddy AV, Thayi C, Natarajan N, Sankineani SR, Daultani D, Khanna V *et al.* Validating the role of steroid in analgesic cocktail preparation for local infiltration in total knee arthroplasty: A comparative study. *Anesth Essays Res.* 2018; 12:903-6.
- Park KK, Shin KS, Chang CB, Kim SJ, Kim TK. Functional disabilities and issues of concern in female Asian patients before TKA. *Clin. Orthop. Relat. Res.* 2007; 461:143-152.
- Capdevila X, Barthelet Y, Biboulet P, Ryckwaert Y, Rubenovitch J, d'Athis F. Effects of perioperative analgesic technique on the surgical outcome and duration of rehabilitation after major knee surgery. *Anesthesiology.* 1999; 91(1):8-15.
- Chelly JE, Ben-David B, Williams BA, Kentor ML. Anesthesia and postoperative analgesia: outcomes following orthopedic surgery. *Orthopaedics.* 2003; 26(8):s865-71.
- Dalury DF, Lieberman JR, MacDonald SJ. Current and innovative pain management techniques in total knee arthroplasty. *J Bone Joint Surg Am.* 2011; 93(20):1938-1943.
- Bagsby DT, Ireland PH, Meneghini RM. Liposomal bupivacaine versus traditional periarticular injection for pain control after total knee arthroplasty. *J Arthroplasty.* 2014; 29(8):1687-1690.
- Surdam JW, Licini DJ, Baynes NT, Arce BR. The use of exparel (liposomal bupivacaine) to manage postoperative pain in unilateral total knee arthroplasty patients. *J Arthroplasty.* 2015; 30(2):325-329.
- Busch CA, Shore BJ, Bhandari R *et al.* Efficacy of periarticular multimodal drug injection in total knee arthroplasty. A randomized trial. *J Bone Joint Surg Am.* 2006; 88:959.
- Bramlett K, Onel E, Viscusi ER *et al.* A randomized, double-blind, dose-ranging study comparing wound infiltration of Depo Foam bupivacaine, an extended release liposomal bupivacaine, to bupivacaine HCl for postsurgical analgesia in total knee arthroplasty. *Knee.* 2012; 19(5):530-6.
- Shah VI, Upadhyay S, Shah K, Sheth AN, Kshatriya A, Saini D. Multimodal Cocktail Injection relieves Postoperative Pain and improves Early Rehabilitation following Total Knee Replacement: A Prospective, Blinded and Randomized Study. *J Recent Adv. Pain* 2017; 3(1):14-24.
- Kelley TC, Adams MJ, Mulliken BD, Dalury DF. Efficacy of multimodal perioperative analgesia protocol with periarticular medication injection in total knee arthroplasty: a randomized, double-blinded study. *J Arthroplasty.* 2013; 28(8):1274-7.
- Lee YS. Comprehensive Analysis of Pain Management after Total Knee Arthroplasty. *Knee Surg. Relat. Res.* 2017; 29(2):80-86.
- Sreedharan Nair V, Ganeshan Radhamony N, Rajendra R, Mishra R. Effectiveness of intraoperative periarticular cocktail injection for pain control and knee motion recovery after total knee replacement. *Arthroplasty Today.* 2019; 5(3):320-324.
- Graf BM, Abraham I, Eberbach N, Kunst G, Stowe DF, Martin E. Differences in cardiotoxicity of bupivacaine and ropivacaine are the result of physicochemical and stereoselective properties. *Anesthesiology.* 2002; 96:1427-34.
- Dony P, Dewinde V, Vanderick B, Cuignet O, Gautier P, Legrand E *et al.* The comparative toxicity of ropivacaine and bupivacaine at equipotent doses in rats. *Anesth Analg.* 2000; 91:1489-92.