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Comparison of analgesic efficacy between continuous adductor canal nerve block catheter with and without posterior capsular infiltration in patients undergoing unilateral robotic total knee replacement: A retrospective study

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Abstract
Total knee arthroplasty is a major surgical procedure that can result in significant pain during recovery. Adequate analgesia is, therefore, the cornerstone in enabling good functional outcomes for the patient. Our study assessed retrospectively, the post-operative pain scores with continuous proximal adductor canal nerve block catheter with and without posterior capsular infiltration.
Materials and Methods: All patients undergoing unilateral robotic total knee arthroplasty were randomized into two groups. One group received only a continuous adductor canal nerve block catheter. The other group was provided with a continuous adductor canal nerve block catheter with posterior capsular infiltration. The post-operative VAS (Visual Analogue Scale) score and the time of the first rescue analgesic were noted.
Results: The group which received continuous adductor canal nerve block catheter with posterior capsular infiltration had better post-operative analgesia with delayed time of first rescue analgesia. Hence local anaesthetic infiltration in the posterior capsule provided superior recovery rates in terms of pain management.
Conclusion: Our study concluded that patients receiving continuous adductor canal catheters and posterior capsular infiltration had better post-operative analgesia than those receiving only continuous adductor canal catheters. This aided in faster recovery and mobilization in robotic knee arthroplasty, contributing to fast-tracking.

Keywords: Robotic total knee arthroplasty, adductor canal nerve block catheter, posterior capsular infiltration, VAS score, rescue analgesia

Introduction

Robotic Total Knee Arthroplasty creates a virtual, patient-specific 3D reconstruction of the knee joint using anatomical data in computerized software [1]. Nerve block catheters have greatly impacted post-operative analgesia, enabling faster mobilization and reduced hospital stay. Previous studies have proved that adductor canal nerve block ensures good pain relief and early mobilization in the recovery phase [2]. The addition of a posterior capsular infiltration and its impact on pain scores in robotic total knee arthroplasty marks the highlight of this study. Local infiltration in the posterior capsule provides accelerated rehabilitation [3]. Use of lignocaine and ketamine for capsular infiltration caused a significant reduction in opioid consumption post-procedure [4].

Aims and Objectives

Our study aimed to bring to practice the effective mode of analgesia for robotic total knee arthroplasty. Our primary objective was to compare two groups, Group 1 and Group 2, for post-operative pain scores in robotic total knee arthroplasty. Group 1 comprised of patients receiving only continuous adductor canal nerve block catheter. Group 2 consisted of an additional posterior capsular infiltration along with the nerve block catheter. The secondary objective was to document and compare the time of first rescue analgesic administered between the two groups.

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Materials and Methods

All patients who underwent unilateral robotic total knee arthroplasty from Jan 2023 to March 2023 were followed retrospectively at Apollo Hospitals, Chennai. A sample size of 50 patients (n=50) underwent the above-mentioned surgery and were randomized into two groups. One group received only a continuous adductor canal nerve block catheter. The other group was provided with a continuous adductor canal nerve block catheter with local anaesthetic infiltration in the posterior capsule. Posterior capsular infiltration was given with a 50ml solution containing 15ml of 0.5% bupivacaine, 5ml of 2% lignocaine with adrenaline (1:200000), and 2ml of 1:10 dilution of ketamine. This was infiltrated by the operating surgeon. The post-operative pain scores were documented with the VAS score, and the time of the first rescue analgesic given was noted. This was done periodically at 6, 12, and 18hrs postoperatively. In this way, the two groups were compared for analgesic efficacy.

Statistical analysis

Descriptive statistics were presented with Mean ± SD and frequency (percentage) for the continuous and categorical factors. Median Inter Quartile Range (IQR) was presented while the data followed non-normal distribution. The normality of the data was checked by using the Shapiro-Wilk test. Student's t-test/Mann Whitney U test was used to determine the significant difference between parameters and group. Chi-square/Fisher's exact test determined the association between ASA and the group. The Friedman test was used to determine the significant changes over the time period. Wilcoxon Sign rank test was performed as a post-hoc analysis and compared the VAS score pairwise. A P-value < 0.05 is considered statistical significance. All analysis was done by using the statistical software SPSS (IBM, 28.0)

Results

Table 1: Comparison of demographic profile, asa (American society of anaesthesiology) physical status classification and rescue analgesia between the two groups

Parameters	Group, n (%)		Overall, (n=50)	P-value
	Adductor Canal	Adductor Canal & Post capsular infiltration		
Age (In years)				
Mean ± SD	64.2±1.0	64.8±0.9	64.5±1.0	0.035*
Range	62-66	63-66	62-66	
Gender				
Male	13 (52.0)	11 (44.0)	24 (48.0)	0.778#
Female	12 (48.0)	14 (56.0)	26 (52.0)	
BMI				
Mean ± SD	23.5±1.2	23.6±1.2	23.6±1.2	0.807*
Range	21.2 – 25.6	21 – 25.3	21 – 25.6	
ASA Grade				
1	8 (32.0)	7 (28.0)	15 (30.0)	>0.99#
2	17 (68.0)	18 (72.0)	35 (70.0)	
TORA				
Mean ± SD	435.4±27.2	634.2±70.9	518.6±110.9	<0.001*
Range	402 – 489	434 – 689	21 – 25.6	

*- Student's t-test/Mann Whitney U test; #- Chi-square/Fisher's exact test; Boldface indicates statistical significance; BMI- Body Mass Index; TORA- Time of First Rescue Analgesic

Group 1 had a mean age of 64.2±1.0 years, while Group 2 had a mean age of 64.8±0. 9 years. Group 1 comprised 13 males and 12 females, while Group 2 comprised 11 males and 14 females. The mean BMI of Group 1 was 23.5±1.2 kg/m², with Group 2 showing a mean BMI of 23.6±1.2 kg/m². Both groups were comparable in terms of ASA classification of patients, with most of them belonging to ASA grade 1 or 2. The time of the first rescue analgesic was 435.4±27.2 minutes in group 1 and 634.2±70.9 minutes in group 2. This clearly proved that the time of rescue analgesia was delayed in patients belonging to Group 2, who received both adductor canal nerve block catheter catheter and posterior capsular infiltration.

Table 2: Comparison of vas score between group 1 and group 2

VAS Score	Group, Median (IQR)		Overall, (n=50)	P-value*
	Group 1 Adductor Canal	Group 2 Adductor Canal & Post capsular infiltration		
At 6 hours	2 (2-2)	1 (1-1)	1 (1-2)	<0.001
At 8 hours	3 (3-3)	1 (1-1)	2 (1-3)	<0.001
At 12 hours	4 (3-4)	2 (2-2)	3 (2-4)	<0.001
p-value^F	<0.001	<0.001	<0.001	
p-value^{W1}	<0.001	0.157	<0.001	
p-value^{W2}	<0.001	<0.001	<0.001	
p-value^{W3}	<0.001	<0.001	<0.001	

*- Student's t-test/Mann Whitney U test; ^{F}- Friedman test; ^{W1}- Wilcoxon Sign rank test to compare 6 hrs. vs. 8 hrs.; ^{W2}- Wilcoxon Sign rank test to compare 6 hrs. vs. 12 hrs.; ^{W3}- Wilcoxon Sign rank test to compare 8 hrs. vs. 12 hrs.; Boldface indicates statistical significance

The above analysis showed that the VAS scores between Group 1 and Group 2 showed a statistically significant difference with a p-value of 0.001. The group which received both adductor canal catheter and posterior capsular infiltration had better analgesia with lesser pain scores. At 6 hours post-operatively, Group 1 had a median VAS score of 2, and Group 2 had a score of 1. At 8 hours post operatively, Group 1 and Group 2 had VAS scores of 3 and 1, respectively. At 12 hours post-operatively, Group 1 had a score of 4, and Group 2 had a score of 2. There was a significant difference in the VAS scores between the different time intervals. There was not much difference in analgesia between 6 and 8 hours post-operatively in Group 2.

Discussion

According to Ardon *et al*., a continuous adductor canal nerve block catheter appears to offer sufficient analgesia when compared to continuous femoral blockade [5]. In a study by Zuo *et al*., patients receiving adductor canal with posterior capsular infiltration had lesser pain scores with reduced post-operative morphine consumption [6]. Rajkumar *et al*., in their study, proved that a combination of adductor canal block with posterior capsular local infiltration results in improved pain management, good range of motion, faster recovery, and less narcotic use [7]. Anderson *et al*. proved that high-volume infiltration analgesia may be preferred

over other analgesic approaches in knee arthroplasty. Our study concluded similar results proving that an adductor canal catheter with posterior capsular infiltration provided excellent post-operative analgesia.

Limitations
The patients were followed up on the day of surgery only. Hence pain scores after physiotherapy were not compared between the two groups.

Conclusion
Our study concludes that patients receiving both continuous adductor canal catheter and posterior capsular infiltration had better post-operative analgesia than those receiving only continuous adductor canal catheter. Moreover, the time of the first rescue analgesia requirement was delayed in the group receiving posterior capsular infiltration, clearly proving to be superior in terms of analgesic profile. Hence the outcome of robotic surgery can be enhanced in terms of shortened hospital stay and early recovery.

Conflict of Interest
Not available

Financial Support
Not available

References
1. Kayani B, Haddad FS. Robotic total knee arthroplasty: clinical outcomes and directions for future research. Bone Jt Res. 2019;8(10):438-42.
2. Li D, Tan Z, Kang P, Shen B, Pei F. Effects of multi-site infiltration analgesia on pain management and early rehabilitation compared with femoral nerve or adductor canal block for patients undergoing total knee arthroplasty: a prospective randomized controlled trial. Int Orthop. 2017;41:75-83.
3. Gibbs D, Green T, Esler C. The local infiltration of analgesia following total knee replacement: a review of current literature. J Bone Joint Surg Br. 2012;94(9):1154-9.
4. Soffin EM, Wu CL. Regional and multimodal analgesia to reduce opioid use after total joint arthroplasty: a narrative review. HSS Journal®. 2019;15(1):57-65.
5. Ardon AE, Clendenen SR, Porter SB, Robards CB, Greengrass RA. Opioid consumption in total knee arthroplasty patients: a retrospective comparison of adductor canal and femoral nerve continuous infusions in the presence of a sciatic nerve catheter. J Clin Anesth. 2016;31:19-26.
6. Zuo W, Guo W, Ma J, Cui W. Dose adductor canal block combined with local infiltration analgesia has a synergistic effect than adductor canal block alone in total knee arthroplasty: a meta-analysis and systematic review. J Orthop Surg. 2019;14(1):1-8.
7. Rajkumar N, Karthikeyan M, Soundarrajan D, Dhanasekararaja P, Rajasekaran S. Comparison of efficacy of adductor canal block, local infiltration analgesia and both combined in postoperative pain management after total knee arthroplasty: a randomized controlled trial. Indian J Orthop. 2021;55:1111-7.