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**ORIGINAL RESEARCH**

# Comparative Assessment Of Analgesic Efficacy Of Adductor Canal Block To Genicular Nerve Block For Managing Postoperative Pain In Subjects Undergoing Arthroscopic Knee Ligament Reconstruction

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**Abstract**

**Background:** GNB or genicular nerve block is advantageous for faster discharge and early ambulation of the subjects as it motor-sparing and selectively blocks the articular branches. However, existing literature data is scarce for comparison of GNB and adductor canal block.

**Aim:** The present study aimed to compare the analgesic efficacy of adductor canal block (ACB) to genicular nerve block for managing postoperative pain in subjects undergoing arthroscopic knee ligament reconstructionIntravenous Patient-Controlled Analgesia (PCA) with morphine was used for postoperative rescue analgesia.

**Methods:** The study assessed 76 adult subjects undergoing anterior cruciate ligament reconstruction (ACLR). These subjects were divided into 2 groups of 38 subjects each, where Group I subjects were managed with GNB using 2mg dexamethasone with 3 ml of 0.25% bupivacaine, and Group II subjects were given 6mg dexamethasone with 20 ml of 0.25% bupivacaine. The primary outcome assessed was NRS (numerical rating score) pain scores over 24 hours, and the secondary outcomes assessed were 24 hours of morphine consumption and analgesia duration. The data gathered were analyzed statistically for results formulation.

**Results:** The study results showed that NRS scores at rest and physical activity after 24 hours were comparable in the two study groups, with p=0.427 and 0.103, respectively. Mean time to rescue analgesia was also comparable in the two groups, with p=0.803. Mean 24-hour morphine consumption showed no statistical difference in the two study groups, with p=1.000.

**Conclusions:** The present study concludes that ultrasound-guided genicular nerve block has analgesic efficacy similar to ultrasound-guided adductor canal block in subjects undergoing arthroscopic anterior cruciate ligament repair.

**Keywords:** analgesic efficacy, anterior cruciate ligament, adductor canal block, genicular canal block, knee ligament reconstruction.

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## Introduction

Arthroscopic ACLR (anterior cruciate ligament reconstruction) is an ambulatory procedure where effective postoperative analgesia can help in enhanced satisfaction and in attaining early mobilization along with improved patient satisfaction, in addition to decreased cost of the healthcare system. The recommended guidelines suggest the use of multimodal anesthesia including peripheral nerve blocks, opioid analgesics, and NSAIDs (non-steroidal anti-inflammatory drugs) use.[1]

Common regional techniques used in ACLR surgeries include local instillation, adductor canal block (ACB), and femoral nerve block. Radiofrequency ablation and US (ultrasound) guided GNB (genicular nerve block) have also been used with success for the management of chronic knee pain. GNs (genicular nerves) are the main articular nerves that innervate the knee joints and are comprised of recurrent peroneal genicular nerve, IM (inferior medial) nerve, inferior lateral nerve, SM (superior medial) nerve, and SL (superior lateral) nerves.[2]

A genicular nerve block can be very helpful in the faster and earlier discharge of the subjects postoperatively following ACLR and for early ambulation of the subjects as a genicular nerve block selectively blocks the articular branches and is also motor-sparing.[3]

Existing literature data has substantial studies that assessed the analgesic efficacy of adductor canal block in subjects undergoing. ACLR. However, existing literature data is scarce for the assessment of the analgesic efficacy of genicular nerve block in subjects undergoing ACLR.[4] Hence, the present study aimed to comparatively assess the postoperative pain scores in two groups with NRS (numerical rating scale) over 24 hours. The study also compared the analgesia duration in two blocks and postoperative morphine consumption over 24 hours.

## Materials and methods

The present clinical assessment study aimed to comparatively assess the postoperative pain scores in two groups with NRS (numerical rating scale) over 24 hours. The study also compared the analgesia duration in two blocks and postoperative morphine consumption over 24 hours. The study was done atDepartment of Anesthesiology, Shri Shankaracharya Institute of MedicalSciences, Bhilai, Durg, Chhattisgarhafter the clearance was given by the concerned Institutional Ethical committee. The study subjects were from the Department of Orthopedic Surgery of the Institute. Verbal and written informed consent were taken from all the subjects before study participation.

The study assessed subjects from both genders and in the age range of 18-60 years, in ASA (American Society of Anesthesiologists) physical status I/II and undergoing elective ACLR under spinal anesthesia. The exclusion criteria for the study were subjects with renal, respiratory, hepatic, or cardiac insufficiency, pre-existing neurological deficits, history of drug allergy for study drugs, contraindication to a nerve block, local infection at the needle insertion site, taking anticoagulants, and coagulopathies.

The included 76 subjects were randomly divided into two groups. This was followed by the administration of ultrasound-guided ACB or ultrasound-guided GNB blocks based on the group. In all the subjects, the comprehensive pre-anesthetic assessment was done and subjects were guided about the block technique and pain grading with NRS from 0 to 10 where 0 showed no pain and 10 depicted unbearable pain. Subjects were also guided concerning the PCA pump and were asked to press the PCA button in conditions with NRS ≥4 postoperatively. Routine ASA monitoring with non-invasive blood pressure, pulse oximeter, and electrocardiogram recordings assessment at baseline. 5ml/kg/h Ringer lactate was given intravenously. In both groups, spinal anesthesia was given. Following strict aseptic and sterile protocol, subjects were placed in the sitting position. After infiltrating skin with 1% lidocaine as 1-2ml, subarachnoid block was given in L3-L4 intervertebral space using a 25-gauge spinal needle with 10–15 mg (2.0–3.0 ml) of hyperbaric bupivacaine (0.5%) and 10 µg fentanyl, injected intrathecally at a rate of 0.2 ml/s after confirming clear and free flow of cerebrospinal fluid. Subjects were then placed in the supine position and a venturi mask was used for oxygen administration at 4l/min. Following spinal block, nerve blocks were given based on the group.

In the GNB group (Group I), ultrasound-guided GNB was given at sites of IM, SM, and SL genicular nerve. Color Doppler was performed for the identification of genicular arteries which worked as a landmark for corresponding nerve.A 21G and 5cm insulated block needle was aligned and inserted in the ultrasound scanning place. After attaining a satisfactory needle position, 3 ml of 0.25% bupivacaine added with 2mg dexamethasone were injected slowly in the proximity of all three genicular nerves. The local anesthesia spread adjacent to the target nerves was observed.

In Group ACB, after identification of the adductor canal, the probe was placed at mid-thigh at half the distance between the patella and inguinal canal. The superficial femoral artery was identified as dorsal to the boat-shaped sartorius muscle.At this level, the hyperechoic view of the saphenous nerve was seen anterior and lateral to the artery in the sub-sartorial region. 6mg dexamethasone with 20 ml of 0.25% bupivacaine was injected utilizing the in-plane technique.

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Intraoperative, SpO2, mean arterial pressure, DBP, SBP, and HR were assessed every 5 minutes throughout the procedure. 15 mg/kg IV paracetamol was given. After the end of the surgery, subjects were shifted to PACU (Post Anesthesia Care Unit) and were monitored. When any subject complained of postoperative pain with NRS ≥7, subjects were administered general anesthesia. The subjects were given care following standard protocol and were excluded from the study.

Postoperatively, an IV PCA pump was used for analgesia. The pump settings were made at 1mg/ml morphine, bolus dose of 1ml, lockout interval of 10 minutes, and maximum dose of 5mg/hour. The pain was assessed using NRS ranging from 0 to 10 where 0 depicted pain-free and 10 showed the worst imaginable pain during rest and physical activity as deep breathing and cough at 2, 4, 8, 12, and 24 hours after administering the block. A total number of morphine taken were recorded at various time intervals at 2, 4, 8, 12, and 24 hours.

Block administration time to the patient's first pressing of the PCA button was recorded at the time of rescue analgesia. Any side effects including vomiting and nausea were recorded. All subjects were given IV 1-gram paracetamol 8 hourly for the first day followed by 650mg paracetamol tablet orally for the next two days.

The data gathered were statistically analyzed using SPSS (Statistical Package for the Social Sciences) software version 24.0 (IBM Corp., Armonk. NY, USA) for assessment of descriptive measures, one-way ANOVA (analysis of variance), Pearson correlation, and chi-square test. The results were expressed as mean and standard deviation and frequency and percentages. The p-value of <0.05 was considered statistically significant.

**Results**

The present clinical assessment study aimed to comparatively assess the postoperative pain scores in two groups with NRS (numerical rating scale) over 24 hours. The study also compared the analgesia duration in two blocks and postoperative morphine consumption over 24 hours. The study assessed 76 adult subjects undergoing anterior cruciate ligament reconstruction (ACLR). These subjects were divided into 2 groups of 38 subjects each where Group I subjects managed with GNB using 2mg dexamethasone with 3ml of 0.25% bupivacaine and Group II subjects were given 6mg dexamethasone with 20ml of 0.25% bupivacaine. The mean age of the study subjects in the ACB and GNB group was 26.30±6.37 and 26.45±7.57 respectively. There were 32 males and 6 females in the ACB group and 30 males and 8 females in the GNB group. The mean height of study subjects was 167.93±9.60 and 166.03±6.33cm in ACB and GNB groups respectively. The mean weight was 67.03±8.92 and 62.82±6.85 kg in the ACB and GNB groups respectively. Mean BMI was 23.75±2.64 and 22.74±1.74 kg/m2 in the ACB and GNB groups respectively. All these baseline parameters were statistically comparable in two groups with p>0.05 (Table 1).

It was seen that for comparison of NRS scores in study subjects at rest and during physical activity, at rest NRS was 0, 0, 0, and 0 at 0, 2, 4, and 6 hours in both ACB and GNB groups with p=1.000 for all. At 8 hours, NRS was 2 in both groups, at 12 hours, it was 1 in both groups, and at 24 hours, it was 2 and 1 respectively in ACB and GNB with p=0.671, 0.804, 0.962, and 0.427. At activity, NRS was 0, 0, 0, and 0 at 0, 2, 4, and 6 hours in both ACB and GNB groups with p=1.000. At6, 8, 12, and 24 hours, NRS was 0, 2, 2, and 1 respectively in both the groups with p=0.635, 0.904, 0.974, and 0.103 (Table 2).

The mean time for rescue analgesia was also comparable in the two study groups. In the ACB group, the mean time to first rescue analgesia was 858.93±460.04 minutes, whereas, it was 820.77±483.63 minutes in the genicular nerve block which was statistically non-significant with p=0.803.

The study results showed that for intergroup comparison of morphine consumption in study subjects, morphine consumption was statistically non-significant at 0, 2, 4, 6, 8, 12, and 24 hours with p=1.000, 1.000. 1.000, 0.778, 0.548, 0.838, and 1.000. It was 0 at 0, 2, and 4 hours in both the study groups. It was 0.14±0.67 and 0.09±0.44mg respectively at 6 hours with p=0.778. At 24 hours, it was 2.45±1.91 and 2.45±2.10 mg (Table 3).

| S. No | Characteristics | Group ACB (n=38) | Group GNB (n=38) |
|---|---|---|---|
| **1.** | **Mean age (years)** | 26.30±6.37 | 26.45±7.57 |
| **2.** | **Gender** | | |
| **a)** | Males | 32 | 30 |
| **b)** | Females | 6 | 8 |
| **3.** | **Height (cm)** | 167.93±9.60 | 166.03±6.33 |
| **4.** | **Weight (kg)** | 67.03±8.92 | 62.82±6.85 |
| **5.** | **BMI (kg/m2)** | 23.75±2.64 | 22.74±1.74 |

**Table 1: Demographic characteristics of the studysubjects**

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| S. No | Characteristics | Group ACB (n=38) | Group GNB (n=38) | p-value |
|---|---|---|---|---|
| **1.** | **NRS (at rest) hours** | | | |
| **a)** | 0 | 0 | 0 | 1.000 |
| **b)** | 2 | 0 | 0 | 1.000 |
| **c)** | 4 | 0 | 0 | 1.000 |
| **d)** | 6 | 0 | 0 | 0.671 |
| **e)** | 8 | 2 | 2 | 0.804 |
| **f)** | 12 | 1 | 1 | 0.962 |
| **g)** | 24 | 2 | 1 | 0.427 |
| **2.** | **NRS (at activity) hours** | | | |
| **a)** | 0 | 0 | 0 | 1.000 |
| **b)** | 2 | 0 | 0 | 1.000 |
| **c)** | 4 | 0 | 0 | 1.000 |
| **d)** | 6 | 0 | 0 | 0.635 |
| **e)** | 8 | 2 | 2 | 0.904 |
| **f)** | 12 | 2 | 2 | 0.974 |
| **g)** | 24 | 1 | 1 | 0.103 |

**Table 2: Comparison of NRS scores in study subjects at rest and during physical activity**

| S. No | Time (hours) | Morphine consumption (mg) | | p-value |
|---|---|---|---|---|
| | | Group ACB (n=38) | Group GNB (n=38) | |
| **1.** | **0** | 0.00±0.00 | 0.00±0.00 | 1.000 |
| **2.** | **2** | 0.00±0.00 | 0.00±0.00 | 1.000 |
| **3.** | **4** | 0.00±0.00 | 0.00±0.00 | 1.000 |
| **4.** | **6** | 0.14±0.67 | 0.09±0.44 | 0.778 |
| **5.** | **8** | 0.66±1.36 | 0.93±1.29 | 0.548 |
| **6.** | **12** | 1.35±1.69 | 1.24±1.46 | 0.838 |
| **7.** | **24** | 2.45±1.91 | 2.45±2.10 | 1.000 |

**Table 3: Intergroup comparison of morphine consumption in study subjects**

## Discussion

The study assessed 76 adult subjects undergoing anterior cruciate ligament reconstruction (ACLR). These subjects were divided into 2 groups of 38 subjects each where Group I subjects managed with GNB using 2mg dexamethasone with 3ml of 0.25% bupivacaine and Group II subjects were given 6mg dexamethasone with 20ml of 0.25% bupivacaine. The mean age of the study subjects in the ACB and GNB group was 26.30±6.37 and 26.45±7.57 respectively. There were 32 males and 6 females in the ACB group and 30 males and 8 females in the GNB group. The mean height of study subjects was 167.93±9.60 and 166.03±6.33cm in ACB and GNB groups respectively. The mean weight was 67.03±8.92 and 62.82±6.85 kg in the ACB and GNB groups respectively. Mean BMI was 23.75±2.64 and 22.74±1.74 kg/m2 in the ACB and GNB groups respectively. All these baseline parameters were statistically comparable in the two groups with p>0.05. These data were comparable to the previous studies of Everhart JS et al[5] in 2020 and Fonkoué L et al[6] in 2019 where authors assessed subjects with demographic data comparable to the present study.

The study results showed that for comparison of NRS scores in study subjects at rest and during physical activity, at rest NRS was 0, 0, 0, and 0 at 0, 2, 4, and 6 hours in both ACB and GNB groups with p=1.000 for all. At 8 hours, NRS was 2 in both groups, at 12 hours, it was 1 in both groups, and at 24 hours, it was 2 and 1 respectively in ACB and GNB with p=0.671, 0.804, 0.962, and 0.427. At activity, NRS was 0, 0, 0, and 0 at 0, 2, 4, and 6 hours in both ACB and GNB groups with p=1.000. At 6, 8, 12, and 24 hours, NRS was 0, 2, 2, and 1 respectively in both the groups with p=0.635, 0.904, 0.974, and 0.103. These results were consistent with the findings ofCaldwell GL Jr et al[7] in 2019 and González Sotelo V et al[8] in 2017 where comparison of NRS scores in study subjects at rest and during physical activity comparable to the present study were reported by the authors in their respective studies.

It was seen that the mean time for rescue analgesia was also comparable in the two study groups. In the ACB group, the mean time to first rescue analgesia was 858.93±460.04 minutes, whereas, it was 820.77±483.63 minutes in the genicular nerve block which was statistically non-significant with p=0.803.These findings were in agreement with the results of Kim DH et al[9] in 2019 and Cuñat T et al[10] in 2023 where meantime for rescue analgesia results reported by the authors were similar to the present study.

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It was also seen that for intergroup comparison of morphine consumption in study subjects, morphine consumption was statistically non-significant at 0, 2, 4, 6, 8, 12, and 24 hours with p=1.000, 1.000. 1.000, 0.778, 0.548, 0.838, and 1.000. It was 0 at 0, 2, and 4 hours in both the study groups. It was 0.14±0.67 and 0.09±0.44mg respectively at 6 hours with p=0.778. At 24 hours, it was 2.45±1.91 and 2.45±2.10 mg. These results correlated with the previous studies of Sahoo RK et al[11] in 2020 and Lynch JR et al[12] in 2019 where intergroup comparison of morphine consumption in study subjects similar to the present study was reported by the authors in their respective studies.

## Conclusions

The present study, within its limitations, concludes that ultrasound-guided genicular nerve block has analgesic efficacy similar to ultrasound-guided adductor canal block in subjects undergoing arthroscopic anterior cruciate ligament repair. Future studies with larger sample sizes and multi-institutional studies are needed to reach a confirmed conclusion.

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