Research Article

INTERNATIONAL RESEARCH JOURNAL OF PHARMACY

www.irjponline.com

ISSN 2230-8407 [LINKING]

ANALGESIC EFFECTIVENESS OF GENICULAR NERVE BLOCK AND ADDUCTOR CANAL BLOCK IN TREATING POSTOPERATIVE PAIN IN LIGAMENT REPAIR

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How to cite: Singh V, Rupani KT. Analgesic effectiveness of genicular nerve block and adductor canal block in treating postoperative pain in ligament repair. International Research Journal of Pharmacy. 2017; 8:3:68-72.

Doi: 10.7897/2230-8407.080339

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ABSTRACT

Background: GNB, also known as genicular nerve block, is beneficial for individuals' early ambulation and quicker discharge since it spares their motor skills and inhibits the articular branches only. However, there is a lack of data in the literature to compare adductor canal block with GNB.

Aim: The purpose of this study was to evaluate the analgesic effectiveness of genicular nerve block and adductor canal block (ACB) in treating postoperative pain in patients having arthroscopic knee ligament restoration. For postoperative rescue analgesia, morphine was administered intravenously as part of Patient-Controlled Analgesia (PCA).

Methods: 76 adult patients having anterior cruciate ligament repair (ACLR) were evaluated for this research. Two groups of 38 participants each were created from these subjects. Group I received GNB treatment, which consisted of 2 mg of dexamethasone and 3 ml of 0.25% bupivacaine, whereas Group II received 6 mg of dexamethasone and 20 ml of 0.25% bupivacaine. Number-rating-score (NRS) pain ratings during a 24-hour period were the primary outcome evaluated, whereas the duration of analgesia and the amount of morphine used during that time were the secondary outcomes. For the purpose of formulating outcomes, the collected data underwent statistical analysis.

Results: The results of the study showed that the NRS ratings of the two study groups were comparable at rest and following a 24-hour period of physical activity (p=0.427 and 0.103, respectively). The mean time to rescue analgesia was also comparable between the two groups (p=0.803). There was no statistically significant difference in the mean 24-hour morphine intake between the two research groups (p=1.000).

Conclusion: The current study comes to the conclusion that in patients having arthroscopic anterior cruciate ligament repair, ultrasound-guided genicular nerve block had analgesic effectiveness comparable to ultrasound-guided adductor canal block.

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

INTRODUCTION

Effective postoperative analgesia can aid with arthroscopic ACLR (anterior cruciate ligament replacement), an ambulatory operation that can save healthcare system costs while also improving patient satisfaction and achieving early mobility. Peripheral nerve blocks, opioid analgesics, and NSAIDs are among the multimodal anesthetic techniques that are advised.[1]

In ACLR procedures, adductor canal block (ACB), femoral nerve block, and local instillation are often employed regional methods. For the treatment of persistent knee pain, radiofrequency ablation and US (ultrasound) guided genicular nerve block have been proven effective. As the primary articular nerves that innervate the knee joints, GNs (genicular nerves) are made

up of the recurrent peroneal genicular nerve, inferior lateral nerve, inferior medial nerve, superior medial nerve, superior lateral nerve, and superior lateral nerve.[2]

Because a genicular nerve block preferentially blocks the articular branches and is motor-sparing, it can be highly beneficial for the subjects' rapid and early postoperative release after ACLR as well as for their early ambulation.[3]

Numerous studies have evaluated the analgesic effectiveness of adductor canal block in patients undergoing ACLR, according to the literature currently in publication. Data from the literature currently in publication, however, is limited when it comes to evaluating the analgesic effectiveness of genicular nerve block in patients undergoing ACLR. Four Therefore, the goal of the current study was to compare the postoperative pain levels of two groups using a 24-hour numerical rating scale (NRS). The study also examined the 24-hour postoperative morphine intake and the duration of analgesia in two blocks.

MATERIALS AND METHODS

The goal of the current clinical assessment research was to compare the postoperative pain levels of two groups using a 24-hour numerical rating scale (NRS). The length of analgesia in two blocks and the amount of morphine used 24 hours after surgery were also compared in the research. The research participants were from the Institute's Department of Orthopedic Surgery. Prior to their involvement in the study, all individuals gave their written and verbal informed consent. Both sexes and participants between the ages of 18 and 60 who were receiving elective ACLR under spinal anesthesia and had ASA (American Society of Anesthesiologists) physical status I or II were evaluated for the research. Participants with pre-existing neurological impairments, a history of drug allergies to study medications, renal, respiratory, hepatic, or cardiac failure, inability to do a nerve block, coagulopathies, anticoagulant use, and local infection at the site of needle insertion.

Two groups of 76 participants were randomly selected. After that, depending on the group, either ultrasound-guided GNB or ultrasound-guided ACB blocks were administered. Every subject underwent a thorough pre-anesthetic evaluation, and they were instructed on the block method and how to grade their pain using an NRS. A score of 0 indicated no discomfort, while a score of 10 indicated excruciating agony. Also, subjects were instructed on the PCA pump and instructed to push the PCA button in postoperative settings where their NRS was ≥4. routine ASA monitoring at baseline, including non-invasive ECG, blood pressure, and pulse oximeter readings.

5 ml/kg/h Intravenous ringer lactate was administered. Spinal anesthesia was administered to both groups. The individuals were put in a sitting position while adhering to a rigorous aseptic and sterile protocol. A subarachnoid block was administered in the 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. This was done after infiltrating the skin with 1% lidocaine in the amount of 1-2 ml. After that, the subjects were put in the supine posture, and 4 liters of oxygen per minute were administered via a venturi mask. Depending on the group, nerve blocks were administered after spinal blocks. Ultrasound-guided GNB was administered to the IM, SM, and SL genicular nerve locations in the GNB group (Group I).

Genicular arteries served as a marker for the corresponding nerve, therefore they were identified using color Doppler imaging. A 5cm insulated block needle with a 21G tip was positioned and placed in the ultrasonic scanning area. Once the needle was in a good position, 3 milliliters of 0.25% bupivacaine mixed with 2 milligrams of dexamethasone were gradually administered close to each of the three genicular nerves. There was evidence of the local anesthetic spreading close to the target nerves.

Following the identification of the adductor canal, the probe was positioned in Group ACB at the mid-thigh, half the distance between the inguinal canal and patella. Dorsal to the boat-shaped sartorius muscle was found to be the superficial femoral artery. The saphenous nerve's hyperechoic image was visible at this level in the sub-sartorial area, both anterior and lateral to the artery. In-plane injection of 20 ml of 0.25% bupivacaine and 6 mg dexamethasone was performed.

Throughout the surgery, intraoperative oxygen saturation, mean arterial pressure, DBP, SBP, and heart rate were measured every five minutes. They administered 15 mg/kg of IV paracetamol. The patients were sent to the PACU (Post Anesthesia Care Unit) and kept under observation following the procedure. Whenever a participant reported experiencing pain following surgery with an NRS of ≥7, general anesthesia was given. Following conventional practice, the participants received treatment and were not included in the research. An intravenous PCA pump was utilized for analgesia after surgery.

Pump parameters were set at a maximum dose of 5 mg/hour, a lockout interval of 10 minutes, a bolus dose of 1 ml, and a morphine dosage of 1 mg/ml. At 2, 4, 8, 12, and 24 hours after applying the block, pain was measured using an NRS scale of 0 to 10, where 0 represented pain-free and 10 represented the greatest agony possible during rest and physical activity, such

as coughing and deep breathing. The total amount of morphine consumed was noted at several points in time—2, 4, 8, 12, and 24 hours.

Before the patient hit the PCA button for the first time, the block administration time was recorded during the rescue analgesia. We recorded any negative symptoms, such nausea and vomiting. Each participant had an intravenous dosage of 1 gram of paracetamol every 8 hours for the first day, and then 650 mg.

SPSS software version 24.0 (IBM Corp., Armonk, NY, USA) was used to statistically analyze the collected data. This included chi-square testing, Pearson correlation, one-way ANOVA (analysis of variance), and descriptive measure evaluation. In addition to frequency and percentages, the findings were presented as mean and standard deviation. A p-value of less than 0.05 was deemed statistically significant.

RESULTS

Using a numerical rating scale (NRS), the current clinical assessment research sought to compare the postoperative pain levels of two groups during a 24-hour period. The length of analgesia in two blocks and the amount of morphine used 24 hours after surgery were also compared in the research. 76 adult patients having anterior cruciate ligament repair (ACLR) were evaluated for the research. These participants were split up into two groups of 38. Group I received GNB in the form of 2 mg dexamethasone and 3 ml of 0.25% bupivacaine, whereas Group II received 6 mg dexamethasone and 20 ml of 0.25% bupivacaine. The research participants in the GNB group were 26.45±7.57 years old, whereas those in the ACB group were 26.30±6.37 years old. The GNB group consisted of 30 males and 8 females, whereas the ACB group included 32 males and 6 females.

The research participants' mean heights in the ACB and GNB groups were 167.93±9.60 and 166.03±6.33 cm, respectively. GNB and ACB groups had mean weights of 62.82±6.85 and 67.03±8.92 kg, respectively. In the GNB group, the mean BMI was 22.74±1.74 kg/m2, while in the ACB group, it was 23.75±2.64. Table 1 shows that all of these baseline characteristics were statistically comparable between the two groups with $p>0.05$.

NRS scores were compared between study participants at rest and during physical activity. At rest, both ACB and GNB groups' NRS scores were 0, 0, 0, and 0 at 0, 2, 4, and 6 hours, with p=1.000 for each. At 8 hours, both groups' NRS values were 2, and at 12 hours, they were both 1, 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. Both the ACB and GNB groups had NRS values of 0, 0, 0, and 0 at 0, 2, 4, and 6 hours of activity (p=1.000). With p=0.635, 0.904, 0.974, and 0.103 at 6, 8, 12, and 24 hours, the NRS was 0, 2, 2, and 1 in both groups, respectively (Table 2).

Additionally, the mean time for rescue analgesia was similar across the two research groups. As compared to the genicular nerve block, which was statistically non-significant with p=0.803, the mean time to first rescue analgesia in the ACB group was 858.93±460.04 minutes, whereas in the genicular nerve block.

According to the study's findings, morphine intake was statistically non-significant at 0, 2, 4, 6, 8, 12, and 24 hours with p=1.000, 1.000 for subject intergroup comparison. The values are 1.000, 0.778, 0.548, 0.838, and more. In both research groups, it was 0 at 0, 2, and 4 hours. The values at 6 hours were 0.14±0.67 mg and 0.09±0.44 mg, respectively, with p=0.778. According to Table 3, it was 2.45±1.91 and 2.45±2.10 mg at 24 hours.

The 76 adult participants in the discussion study were having anterior cruciate ligament repair (ACLR). Two groups of 38 participants each were created from these subjects. Group I received GNB in the form of 2 mg dexamethasone and 3 ml of 0.25% bupivacaine, whereas Group II received 6 mg dexamethasone and 20 ml of 0.25% bupivacaine. Study participants in the ACB and GNB groups had respective mean ages of 26.30±6.37 and 26.45±7.57. Thirty men and eight females made up the GNB group, whereas thirty males and six females made up the ACB group.

The average height of the research participants in the ACB and GNB groups was 167.93±9.60 and 166.03±6.33 cm, respectively. The average weight for the ACB and GNB groups was 67.03±8.92 and 62.82±6.85 kg, respectively. The ACB and GNB groups had mean BMIs of 23.75±2.64 and 22.74±1.74 kg/m2, respectively. In two groups, all of these baseline measures were statistically equivalent ($p>0.05$). These findings were similar to those of Everhart JS et al.'s 2020 research and Fonkoué L et al.'s 2019 study, in which the authors evaluated participants using demographic information similar to that of the current study.

In order to compare the NRS scores of the study participants during physical activity and at rest, the ACB and GNB groups had NRS 0, 0, 0, and 0 at 0, 2, 4, and 6 hours, with p=1.000 for each.

With p=0.671, 0.804, 0.962, and 0.427, the NRS was 2 in both groups at 8 hours, 1 in both groups at 12 hours, and 2 and 1 in ACB and GNB as well at 24 hours. Both the ACB and GNB groups had NRS values of 0, 0, 0, and 0 at 0, 2, 4, and 6 hours of activity [p=1.000]. NRS was 0, 2, 2, and 1 in both groups at 6, 8, 12, and 24 hours, with p=0.635, 0.904, 0.974, and 0.103 respectively. The findings of Caldwell GL Jr et al7 and González Sotelo V et al8 (2017), who compared the NRS scores of study participants at rest and during physical activity, were in line with these findings were reported by the authors in their respective studies.

The mean time for rescue analgesia was found to be similar across the two trial groups. The genicular nerve block, which was statistically non-significant with p=0.803, took 820.77±483.63 minutes, whereas the ACB group took 858.93±460.04 minutes on average to achieve initial rescue analgesia. These results were consistent with the findings of Kim DH et al. (2019) and Cuñat T et al. (2023), whose results for rescue analgesia were comparable to the current investigation. Additionally, with p=1.000, 1.000, 0.778, 0.548, 0.838, and 1.000, it was observed that the study subjects' morphine intake was statistically non-significant at 0, 2, 4, 6, 8, 12, and 24 hours when compared between groups.

In both research groups, it was 0 at 0, 2, and 4 hours. The values at 6 hours were 0.14±0.67 mg and 0.09±0.44 mg, respectively, with p=0.778. The values were 2.45±1.91 and 2.45±2.10 mg at 24 hours. These findings were consistent with earlier research by Sahoo RK et al. (2020) and Lynch JR et al. (2019), in which the authors in their separate studies reported an intergroup comparison of morphine intake in study subjects comparable to the current study.

CONCLUSION,

Within the constraints of this investigation, the results indicate that in patients having arthroscopic anterior cruciate ligament repair, ultrasound-guided genicular nerve block had analgesic effectiveness comparable to ultrasound-guided adductor canal block. A verified finding requires multi-institutional investigations and further research with bigger sample numbers.

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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 study subjects

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