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Postoperative Analgesic Effectiveness of Combined Ultrasound Guided Adductor Canal Block with ipack (Infiltration Between Popliteal Artery and Posterior Knee Capsule) and Adductor Canal Block Alone in Patients Undergoing Knee Arthroscopy: An Observational Study

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ABSTRACT

Background: Peripheral nerve blocks are ideally suited for lower extremity ambulatory surgery because of potential to block pain pathways at multiple levels. The objective of this observational studies was to assess the analgesic characteristics of USG guided combined ACB with IPACK block and ACB alone, in arthroscopic ACL reconstruction.

Methods: This prospective observational study was conducted over a period of twenty months on 61 patients (18-65 years, ASA grade I, II, III) undergoing knee arthroscopic ACL reconstruction under spinal block who were divided into two groups. Group 1 (n=32) received combined USG guided ACB with IPACK and Group 2 (n=29) received USG guided ACB alone. Both groups received 20 ml of 0.2% Ropivacaine. Postoperative pain was assessed by VAS score at 2, 4, 8, 12, 18 and 24 hours.

Results: VAS score were significantly lower in group 1 as compared to group 2 at 4, 8, 12 and 18 hours postoperatively. Mean duration of post-operative analgesia was significantly longer in group 1 than group 2 (16.5 ± 4.57 hours vs. 10.3 ± 2.01 hours). The difference between mean time to first rescue analgesia between the two groups was statistically significant (p-value of <0.001). Difference in analgesic consumption in 24 hours was statistically significant between two groups.

Conclusion: Combined USG guided adductor canal block with IPACK is superior to USG guided Adductor canal block alone with respect to postoperative pain scores, time to first rescue analgesia, total doses of rescue analgesia consumption and patient satisfaction. However, about complications and side effects both groups were equivalent as no complication/side effect was noted in any of the groups.

Key words: Pain, Nerve block, Arthroscopy, Adductor canal block, IPACK, Analgesia

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INTRODUCTION

Acute postoperative pain is a common problem encountered by all medical professionals as per evidence-based practice guidelines. Pain in the immediate postoperative period after knee ligament repairsmay hinder rehabilitative programmes and cause various pathophysiological consequences. Arthroscopic knee surgery is associated with variable amount of postoperative pain, which is caused by irritation of free nerve endings of synovial tissue, anterior fat pad, and joint capsule during surgical excision and resection [1]. Several analgesic strategies such as systemic medication (narcotics, non-steroidal anti-inflammatory drugs) [2], central or peripheral nerve blocks [3,4] and intra-articular drug administration such as ketorolac [5], α2-agonists [6], opioids [7,8], local anaesthetics [9,10] have been used to interrupt the pain pathway. However, none is free from limitations such as risk of several complications and requirement for special monitoring equipment's. Nonsteroidal anti-inflammatory drugs are used to treat pain and inflammation. NSAIDS may cause renal complications, gastrointestinal bleeding, and epidural hematoma, especially when combined with antithrombotic prophylaxis like LMWH [4]. Peripheral nerve blocks are ideally suited for lower extremity ambulatory surgery because of the peripheral location of the surgical site and the potential to block pain pathways at multiple levels. peripheral nerve blocks avoid hemodynamic instability and pulmonary complications, facilitate postoperative pain management and timely discharge [11]. Adductor canal Block attracted extensive attention due to its lower complication of reducing quadriceps strength and similar outcomes of opioid consumption, pain management, opioid adverse events, and ambulation ability when compared with FNB [12-14]

Though ACB provides analgesia to the peripatellar and intra-articular aspect of knee joint, it does not relieve posterior knee pain which is moderate to severe in intensity [15,16] The recent technique of USG guided local anaesthetic infiltration of the interspace between the popliteal artery and the capsule of posterior knee (IPACK) has shown promising results [17-19]. The technique involves a very selective block of the terminal sensory branches of the posterior aspect of the knee without the involvement of motor branches of the tibial nerves and peroneal nerves leading to reduced pain without motor weakness [20,21], hence, preserving the sensory motor function of leg and foot. This leads to earlier ambulation, rehabilitation, and recovery in various knee surgeries [19]. The objective of this observational study was to assess the analgesic characteristics of the USG guided combined ACB with IPACK block and ACB alone, measuring variables such as postoperative pain, rescue analgesic used, patient satisfaction in patients undergoing arthroscopic ACL reconstruction.

MATERIAL AND METHODS

The study was conducted in the Bone and Joint Hospital which is one of the associated hospitals of Government Medical College, Srinagar. After obtaining approval from the Institutional Ethical Committee and informed consent of the patients for participation in the study, patients scheduled to undergo knee arthroscopic surgery were enrolled in this prospective observational study from November 2018-June 2020. Inclusion criteria included patients in the age group of 18-65 years, American Society of Anaesthesiologists (ASA) grade I, II, III undergoing knee arthroscopic ACL (anterior cruciate ligament) repair surgery. Exclusion criteria included Allergy to local anaesthetics, Patient refusal, Inflammation or infection over the injection site, Pre-existing peripheral neuropathy, Gangrene of the lower limb, Patients with serum creatinine above 1.5.

Before surgery, the participants were educated about the visual analogue score and the details of the block procedure. After an 8 hour fast, the patients were taken in the operation theatre. On arrival in the Operation Theatre, all patients were kept in supine position, multichannel monitor connected and preoperative vitals (Heart rate, non-invasive blood pressure, SpO2, ECG) recorded. An 18 G i.v. cannula was placed in the arm in all patients. Standard intravenous premedication Inj. Pantoprazole 40 mg was administered to all the patients. Supplemental oxygen at 4L/minute was given to all the patients. The patients were given intrathecal block using Injection Bupivacaine 0.5% (Heavy). After the block was confirmed, patients were given 1 milligram of Midazolam intravenously. After giving intrathecal block, patients were given either Adductor canal block alone or combined adductor Canal block with IPACK. The blocks for postoperative pain were performed with 20 mL of 0.2%ropivacaine for adductor canal block and 20mL of 0.2% ropivacaine for IPACK in the operation theatre by an experienced Anaesthesiologist preoperatively and the surgery was commenced. All the blocks were performed using portable ultrasound machine. After completion of surgery, patients were shifted to the recovery ward and observed. The duration of the sensory block was defined as the time interval between the administration of peripheral nerve block to the requirement of first postoperative (rescue) analgesia. The patients were observed at an interval of 2, 4, 8, 12, 18 and 24 hours. Postoperative pain was assessed by VAS score and a score of 4 or more than 4 when recorded was taken as end point for the duration of block and the patient was given rescue analgesics. First level of rescue analgesia was 1 gram of intravenous Paracetamol, second level of analgesia was 50 milligrams of intravenous Tramadol, and third level of analgesia was 75 milligrams of Diclofenac intravenously. The patients were observed for 24 hours. Any side effects/complications were also noted. The above data was then subjected to statistical analysis according to the appropriate statistical tests.

Primary outcome measures

Pain relief [Time Frame: first 24 hours] Time to first rescue analgesia is noted.

Secondary outcome measures

Total rescue analgesic consumption [24hours postoperatively].

Other outcome measures: Patient satisfaction [Time frame: 24 hours postoperatively].

The patient's satisfaction with the block was assessed postoperatively using a 2- point scale (0=unsatisfied; 1=satisfied). The patients were asked to mark it as satisfactory only if they would be happy to accept the same block in future.

Statistical methods

The recorded data was compiled and entered in a spreadsheet t (Microsoft Excel) and then exported to data editor of SPSS Version 20.0(SPSS Inc., Chicago, Illinois, USA). Statistical software SPSS (version20.0) and Microsoft Excel were used to carry out the statistical analysis of data. Continuous variables were expressed as Mean ± SD and categorical variables were summarized as percentages. Student's independent t-test was employed for comparing continuous variables. Chi-square test or Fisher's exact test, whichever appropriate, was used for comparison of categorical variables. Graphically the data was presented by bar and line diagrams. A P-value of less than 0.05 was considered statistically significant. All P-values were two tailed.

RESULTS

In our study 32 patients belonged to group 1 and 29 patients belonged to group 2. The difference of age, gender, weight, ASA status, duration of surgery in patients of two groups was statistically insignificant ($p>0.05$) (Table 1). Preoperative vitals, intraoperative vitals, and postoperative vitals at different time intervals

in patients of two groups was statistically insignificant (p>0.05) (Table 2). Postoperative VAS score in two groups at 2, 4, 8, 12, 18 hrs showed statistically Significant Difference (p<0.05) (Table 3). The mean duration of analgesia in patients of group 1 ranged from 12 to 24 hours with a mean of 16.5 ± 4.57 hours. However, the duration of analgesia in patients of group 2 ranged from 8 to 12 hours with a mean duration of 10.3 ± 2.01 hours. The difference in duration of analgesia in both the groups was statistically significant (p<0.05) about rescue analgesia, PCM requirement ingroup 1 was 81.3% and in group 2 was 100% which was statistically significant with a p-value of 0.014. Tramadol requirement in group 1 was 21.9%and in group 2 was 75.9% which was statistically significant (p-value <0.05). Diclofenac requirement in both the groups was 0%(Figure 1). The difference in patient satisfaction between two groups was statistically significant (p-value 0.001).

Table 1: Patient demographic characteristics.

Parameters	Group 1	Group B	P value
Age (years)	40.9 ± 11.53	39.4 ± 11.52	0.631
Weight (kg)	66.4+6.71	67.9+5.28	0.343
Height(cm)	160.3 ± 6.49	169.2 ± 6.07	0.596
Sex M/F	20/12	20/9	0.596
ASA status I/II	26/6	25/4	0.735
Duration of surgery	42.12 ± 13.70	46.13 ± 14.45	0.456

Values in the table are mean ± SD or absolute numbers (percentage). SD = Standard deviation, ASA = American Society of Anesthesiologists.

Table 2: Comparison based on preoperative vitals in two groups.

Preoperative vitals	Group 1	Group B	P value
HR (beats/min)	86.09 ± 9.14	89.52 ± 8.10	0.129
SBP (mmHg)	123.69+8.54	123.83+10.57	0.955
DBP (mmHg)	79.44 ± 6.37	77.93 ± 6.63	0.334
MAP (mmHg)	94.19 ± 6.47	93.23 ± 6.63	0.57
Oxygen Saturation (%)	97.75 ± 1.19	97.87 ± 1.21	0.491

Abbreviations: HR: Heart rate, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, MAP: Mean arterial pressure.

Table 3: Postoperative VAS score in two groups at various intervals of time.

Time interval	Group 1	Group B	P value
1 Hour	0.13+0.34	0.21+0.41	0.397
4 Hour	0.19 ± 0.4	1.31 ± 1.14	<0.001*
8 Hour	0.31 ± 0.59	2.69 ± 1.56	<0.001*
12 Hour	2.63 ± 1.34	3.45 ± 1.52	<0.001*
18 Hour	2.25 ± 1.45	3.07 ± 1.31	<0.001*
24 Hour	1.41 ± 1.70	1.79 ± 1.82	0.394

*Statistically Significant Difference (P-value<0.05); P-value by Student's independent t-test

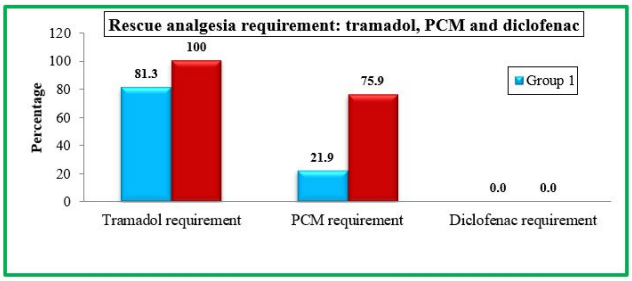

Figure 1: Rescue analgesia requirement: tramadol, paracetamol and diclofenac.

DISCUSSION

Knee injuries and arthroscopy assisted ligament repairs are getting more common now days. Pain in the immediate postoperative period after knee ligament repairs may hinder rehabilitative programmes and also cause various pathophysiological consequences.

Systemic opioids are the mainstay of postoperative analgesia but with side effects. Complete de afforestation's also not possible with drugs.

Regional anaesthesia with nerve blocks has become a mainstay in postoperative analgesia. In this prospective observational study 61 patients undergoing arthroscopic ACL repair were enrolled, and the patients who received either combined ultrasound guided Adductor Canal Block with IPACK (Infiltration between popliteal artery and posterior knee capsule) or ultrasound guided Adductor Canal Block alone, were observed over a period of 20 months. In this study, the mean values of visual analogue scale (VAS) score were significantly lower in patients who received combined adductor canal block with IPACK as compared to the patients who received adductor canal block alone at 4, 8, 12 and 18 hours postoperatively. However, the VAS at 2 and 24 hours was found to be comparable. Our results were in agreement with results that were observed by Sankineani et al [22] in their study in which they noted that visual analogue scale (VAS) score after 8 hours postoperatively on day 1 and day 2 showed significantly (p-value <0.005) better values in Adductor canal block combined with IPACK group compared to the Adductor canal block group. Similar results were found by El-Sayed M et al [23] who conducted a study titled "Ultrasound-Guided Adductor Canal Block versus Combined Adductor Canal and Infiltration between the Popliteal Artery and the Posterior Capsule of the Knee Block for Osteoarthritis Knee Pain". They concluded that the postoperative VAS scores were significantly lower in USG guided ACB with IPACK as compared to ACB alone. Amer [24] conducted a study titled "Combined adductor canal and i-PAK blocks is better than combined adductor canal and periarticular injection blocks for painless ACL reconstruction surgery". In their study they concluded that postoperative VAS scores at rest and on walking were reduced after use of combined adductor canal block and IPACK as compared to combined adductor canal and periarticular injection blocks. The results of their study were also in accordance to our study.

In our study, the mean duration of post-operative analgesia was16.5 ± 4.57 hours (with range from 12 to 24 hours) in group 1 and10.3 ± 2.01 hours (with range from 8 to 12 hours) in group 2. Duration of analgesia was significantly longer in group 1 than group 2. The difference between mean time to first rescue analgesia between the two groups was statistically significant (p-value of <0.001). Our results are comparable to study done by Jayaraman et al [15]in which they evaluated the efficacy of combined ultrasound assisted adductor canal and IPACK block for postoperative analgesia in patients undergoing knee surgeries. The time to first analgesic request was around 14 to 15 hours in all the cases. In a study conducted by Goyal et al [26] on Adductor canal block for post-operative analgesia after simultaneous bilateral total knee replacement: A randomised controlled trial to study the effect of addition of dexmedetomidine to ropivacaine, it was seen that the mean time to first rescue analgesia in the group receiving ACB with plain ropivacaine was 10.8 ± 7 hours which is in accordance with our study where the meantime for rescue analgesia in the ACB group was 10.3 ± 2.01 hours. Giving the IPACK block in addition to ACB greatly increases the time of analgesia and delays the time of request of first rescue analgesia. AMER et al [24] undertook the study, "Combined adductor canal and i-PAKblocks is better than combined adductor canal and periarticular injection blocks for painless ACL reconstruction surgery", in which he found that combined adductor canal and i-PAK block is better than combined adductor canal and periarticular injection blocks for ACL reconstruction surgery concerning postoperative pain. This is in line with our study observations where we concluded that combined ACB and IPACK block increases the analgesic time and delays the time to first rescue analgesics compared to ACB alone. In our study Difference in analgesic consumption in24 hours was statistically significant between two groups. Our results agreed with study done by Amer N et al [24] who concluded that opioid consumption was different in both groups. Highly statistically significant difference was observed between the two groups concerning the total pethidine consumption–pethidine consumption being significantly lower in patients who received combined adductor canal block with i-PAK. Thobhani S et al [27] conducted a study named Novel Regional Techniques for Total Knee Arthroplasty Promote Reduced Hospital Length of Stay: An Analysis of 106 Patients in which they compared 3 regional techniques (femoral nerve catheter [FNC] block alone, FNC block with IPACK, and ACB with IPACK). In their study, they concluded that opioid consumption was significantly reduced in the FNC with IPACK group compared to the other groups and that there is significant opioid sparing with the IPACK block. Kim DH et al [28] conducted a study on Addition of Infiltration between the Popliteal Artery and the Capsule of the Posterior Knee and Adductor Canal Block to Periarticular Injection Enhances Postoperative Pain Control in Total Knee Arthroplasty: A Randomized Controlled Trial. They concluded that patients in IPACK with an ACB group had lesser rescue analgesia consumption as compared to the control group. Their results were in accordance with our study.

CONCLUSION

In our study, we concluded that Adductor canal block provides localised analgesia to the anterior and medial aspects of the knee joint, but it does not provide analgesia to the posterior knee capsule. On the other hand, Adductor canal block plus IPACK is a better mode for control of postoperative pain in arthroscopic ACL repair. The addition of IPACK to Adductor canal block leads to the prolongation of analgesia and significant reduction of rescue analgesia consumption. Moreover, the patient satisfaction was better in IPACK plus Adductor canal block as compared to Adductor canal block alone. However, no complication and side effects were observed in any patients in either of the groups.

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Nil.

CONFLICTS OF INTEREST

Nil.

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