

# Evaluation of preemptive interspace between the popliteal artery and the capsule of the posterior knee (IPACK) block for postoperative pain management in arthroscopic knee surgeries: a retrospective study

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## ABSTRACT

**Background:** Interspace between the popliteal artery and the capsule of the posterior knee (IPACK) block is block, which is done by infiltration of local anesthetic to block terminal branches of genicular nerves and popliteal plexus that innervate the posterior capsule of the knee joint. In this study, we retrospectively reviewed our patient's data to which IPACK block was applied for arthroscopic knee surgery. Our aim was to evaluate the effectiveness of IPACK block on postoperative analgesia, effects on additional analgesic consumption and patient satisfaction.

**Material and Method:** The data of 60 patients who underwent arthroscopic knee surgery under spinal anesthesia with or without applied preemptive IPACK block for postoperative analgesia were collected between October 2019 and December 2020. Group I consisted of 30 patients with preemptive IPACK block, while 30 patients without block were classified as the control group (Group II). Postoperative 0-1-2-6-12 and 24<sup>th</sup> hour VAS scores, additional analgesic needs, patient satisfaction scores, were compared in groups as primary outcome.

**Results:** As a result of the comparison between the groups, it was seen that there was a significant difference between the groups in favor of the IPACK Block group in terms of postoperative VAS scores after 1st hour, postoperative analgesic needs and patient satisfaction ( $p < 0.001$ ).

**Conclusion:** Preemptive IPACK block, performed in patients who will undergo arthroscopic knee surgery, reduces the patient's pain in the postoperative period, shortens the length of hospital stay, positively affects patient comfort and increases patient satisfaction considerably. We believe that IPACK block alone or in addition to other blocks or methods will be effective in preventing arthroscopic knee surgery pain and it will be useful to conduct new studies with more patients.

**Keywords:** Interspace between the popliteal artery and the capsule of the posterior knee (IPACK) block, arthroscopic knee surgery, preemptive, analgesia, peripheral block

## INTRODUCTION

Anesthesia applications offer different options to anesthetists. Different techniques can be applied depending on the general condition of the patient, the operation area and the way it is done, the possibilities at hand and the wishes of the patient. In recent years, attempts to reduce health expenditures have been tried.

The anesthesia method to be used in surgical procedures is aimed to be a method that will both accelerate the discharge of the patient and provide effective intraoperative and postoperative analgesia, increasing patient satisfaction (1,2).

Postoperative pain is an acute pain that begins with surgery and gradually decreases with healing of the tissue. Despite the advances in anesthesia and surgery postoperative pain remains a challenging. It is critical to relieve pain, especially to prevent the development of chronic pain, and also to protect patient's cognitive functions and improve the quality of life. Postoperative analgesia for knee surgeries can be achieved by oral and systemic analgesics, intra-articular drug infiltration and regional anesthesia techniques (3-5).

A new technique for posterior knee joint pain is a block of interspace between the popliteal artery and the capsule of the posterior knee (IPACK), which is done by infiltration of local anesthetic to block terminal branches of genicular nerves and popliteal plexus that innervate the posterior capsule of the knee joint. This technique involves very selective blocking of the terminal sensory branches of the posterior aspect of the knee without the involvement of the motor branches of the tibial and peroneal nerves, resulting in reduced pain with no effect on muscle strength (6,7).

In recent years, studies evaluating the effectiveness of the IPACK block have begun to appear in the literature. We applied this relatively new and easy-to-do technique to our patients who were undergoing arthroscopic knee surgery in our training hospital; to learn the technique and to assess the effectiveness on postoperative analgesia.

In this study, we retrospectively reviewed our patient's data to which IPACK block was applied for arthroscopic knee surgery. Our aim was to evaluate the effectiveness of IPACK block on postoperative analgesia, effects on additional analgesic consumption and patient satisfaction.

## MATERIAL AND METHOD

This retrospective study was conducted with the approval by the Non-Interventional Clinical Researches Ethics Committee of the Kırıkkale University (Date: 10/12/2020 Decision no: 2020.11.25). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki. The data of patients who underwent arthroscopic knee surgery under spinal anesthesia with or without applied preemptive IPACK block for postoperative analgesia were collected in our clinic between October 2019 and December 2020.

The preemptive analgesia block application procedure of our clinic is as follows: All patients are taken to the block room, routinely monitored before performing the blocks, nasal oxygen supply is provided, and sedated with 0.03-0.05 mg/kg IV midazolam. After the block is performed, the patients are taken to the operating room.

We perform IPACK block according to methods previously described in literature (8). After patient's knee flexed at supine position, ultrasound (USG) probe (Esaote MyLab 30, Geneva; Italy) is placed from the medial side; femur and popliteal artery are visualized. Then an 18 Gauge 50 mm needle (Pajung, Geisingen, Germany) is advanced in plane until it reaches the gap between popliteal artery and posterior knee joint capsule, where 3 mL isotonic saline is injected to ensure the correct placement; and then 20 mL of 0.5% bupivacaine (Buvasin 0.5%, Vem, İstanbul, Turkey) solution is injected into this space. The cephalic and caudal distribution of local anesthetic is observed by USG (Figure 1).

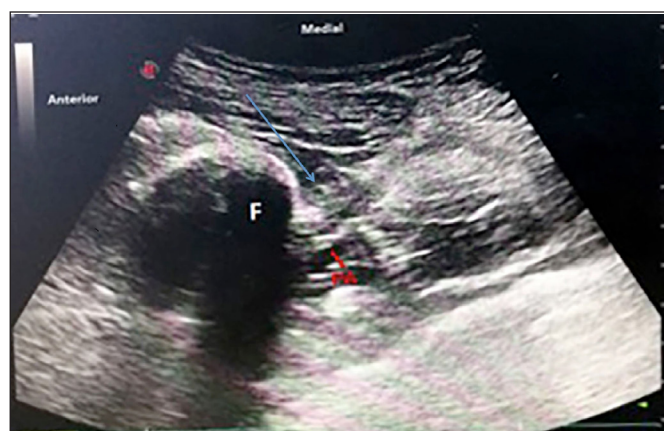


Figure 1. IPACK Block USG image (F: Femur, PA: Popliteal artery)

In accordance with the spinal anesthesia application procedure for arthroscopic knee surgery of our clinic, the procedure is performed in the operating room; with 2.5-3 mL of 0.5% hyperbaric bupivacaine (Buvasin 0.5% Spinal Heavy, Vem; İstanbul, Turkey) at the L3-L4 or alternatively L2-L3 interspaces. For postoperative pain, if there are no contraindications, patients receive tramadol 100 mg IV immediately before the end of surgery.

For our study, the files of patients who underwent arthroscopic knee surgery under spinal anesthesia between October 2019 and December 2020 were scanned first. Among these patients, it was determined that there were 30 patients who had preemptive IPACK block and had the necessary data for the study in their file and these patients were grouped as Group I (IPACK Block). Among scanned patients, those who had spinal anesthesia as mentioned above, but no block was made for preemptive analgesia; and whose files had complete data required for the study were identified. Thirty of them were randomly selected and grouped as Group II (Control).

Demographic data, ASA scores, postoperative 0-1-2-6-12 and 24<sup>th</sup> hour VAS scores, additional analgesic needs, patient satisfaction scores, presence of complications and adverse effects, and length of hospital stay were collected from the anesthesia and service follow-up forms of the

patients. While assessing patient satisfaction, we use a 5-point Likert scale (9), in which 5: Very satisfied 4: Satisfied 3: Not sure 2: Not satisfied 1: Not at all satisfied.

The data obtained in the study were evaluated using the IBM SPSS Statistics 16 (IBM SPSS, Turkey) (Statistical Package of Social Science) program. Assessment of whether the data are normally distributed was made using the Kolmogorov-Smirnov test. Continuous variables were analyzed using the Student's t Test. Categorical data were analyzed using Chi-square test and expected count analysis were interpreted using Fisher's exact test, Continuity Correction or Likelihood Ratio as appropriate. VAS values are given as median, and all other values are given as mean±standard deviation. P<0.05 was considered statistically significant in all results.

### RESULTS

Between October 2019 and December 2020, 60 patients scheduled in this study in which 30 patients received IPACK block+spinal anesthesia (Group I) and 30 patients received only spinal anesthesia alone (Group II) for arthroscopic knee surgery. The entire study group included 33 male and 27 female patients of which 16 males and 14 females were in IPACK block group (Group I) and 17 males and 13 males in control group (Group II). The overall demographic perioperative characteristics in both groups were similar (p>0.05) and given in **Table 1**.

	Group I (IPACK Block) n=30	Group II (Control) n=30
Age (years)	47.8±16.5	42.5±17.4
Sex (M/F)	16 / 14	17 / 13
Weight (kg)	79.1±13.5	78.9±13.2
Height (m)	1.68±0.1	1.69±0.1
Duration of surgery (min)	87.7±22.7	100.7±27.7
ASA (I/II/III)	6 / 20 / 4	4 / 20 / 6

The values are mean±SD, number as appropriate.

As a result of the comparison between the groups, it was seen that there was a significant difference between the groups in favor of the IPACK Block group in terms of postoperative VAS scores after 1st hour, postoperative analgesic needs and patient satisfaction. It was determined that the VAS scores at the time of the patient's removal from the surgery (VAS 0) did not differ significantly between the groups; while the VAS scores were lower in the IPACK Block in all other time periods, which were also statistically significant (**Table 2**).

Patient satisfaction scores in the postoperative period were higher in IPACK Block group and this difference was statistically significant. All of the patients in the

Control group needed additional analgesics, while none of the patients in IPACK Block group needed additional analgesics (p<0.001). In addition, when the discharge times between the groups were compared, it was seen that patients in IPACK Block were discharged earlier, which was also statistically significant (**Table 3**).

	Group I (IPACK Block) n=30	Group II (Control) n=30	P
VAS 0.hr	0 (0-2)	0 (0-9)	0.550
VAS 1.hr	2 (0-5)	6 (1-9)	<0.001*
VAS 2.hr	2 (0-4)	6 (2-9)	<0.001*
VAS 6.hr	2 (0-3)	5 (2-10)	<0.001*
VAS 12.hr	1 (0-3)	4 (1-8)	<0.001*
VAS 24.hr	0 (0-1)	2 (0-5)	<0.001*

The values are median (range), \*: statistically significant

	Group I (IPACK Block) n=30	Group II (Control) n=30	p
Patient satisfaction	1	0	0
	2	0	3
	3	0	18
	4	8	9
	5	22	0
Additional analgesic need (n of patient)	0	15	<0.001*
Discharge time (days)	2.5±0.9	3.1±1.2	0.013*

The values are mean±SD, number as appropriate. \*: Statistically significant

No reported complications and adverse effects were detected in either group.

### DISCUSSION

In this retrospective study, we aimed to evaluate the effect of IPACK block applied for preemptive analgesia on postoperative pain and patient comfort in patients undergoing arthroscopic knee surgery. At the end of our study, we determined that preemptive IPACK block applied to arthroscopic knee surgery patients operated under spinal anesthesia resulted in a significant decrease in postoperative VAS scores, increased patient satisfaction and shortened the discharge times.

Preemptive analgesia is defined as alleviating the severity of pain and reducing the pain-induced stress response by using an analgesic medication or performing a nerve block before a painful stimulus, as well as reducing the need for postoperative analgesics (10). IPACK block, which is a relatively new block, is a block that we apply as a preemptive analgesia method for patients who will undergo arthroscopic knee surgery. In this study, we wanted to evaluate the effectiveness of this block for this purpose.

The increase in the number of knee surgeries performed worldwide increases the importance of postoperative pain control. This has led to the emergence of various postoperative pain management strategies, where peripheral nerve blocks have gained popularity (11). If the literature is reviewed, it is seen that various drugs and methods like systemic analgesic administration, neuraxial blocks, peripheral nerve blocks, local anesthetic infiltration and intra-articular injections are applied for knee surgery to reduce postoperative pain and increase patient satisfaction (12).

Peripheral nerve blocks like femoral nerve block (FNB), adductor canal block (ACB) and sciatic nerve block (SNB) have been used to control pain after knee surgeries (13-15). One of the peripheral nerve blocks, ACB is a nerve block that has been reported to provide significant pain relief and earlier mobilization in patients as it preserves quadriceps muscle strength (16). However, this technique provides pain relief only in anterior and medial areas since it has no effect on deep genicular nerves and is not effective in posterior knee pain. Therefore, full knee extension and early ambulation are prevented, resulting in a delay in rehabilitation (14,17-18). FNB may provide effective pain control, but it may also cause weakness in the quadriceps muscle after surgery (13). Neither of these blocks is effective in relieving posterior knee pain (19-21). To alleviate posterior knee pain, periarticular multimodal drug injection (PMDI), sciatic nerve block (SNB) and IPACK can be applied (8). PMDI can be performed easily and quickly without risk of injury to nerves and blood vessels. However, direct injection into the knee joint has a potential risk of infection (22). Also, PMDI can only be performed during surgery and additional injections are not possible. SNB can also reduce posterior knee pain but foot drop in 65-68% of cases reported in literature (19,23).

IPACK is the administration of a local anesthetic agent into the space between the popliteal artery and the posterior capsule to block the deep genic nerves supplying the posterior aspect of the knee joint. The technique involves very selective blocking of the terminal sensory branches of the posterior aspect of the knee without involvement of the motor branches of the tibial and peroneal nerves, resulting in reduced pain with no effect on muscle strength (21).

When the literature on the use of IPACK block after knee surgeries for postoperative analgesia is reviewed, it is seen that studies are mostly performed in addition to ACB. In the study of Zhen et al. (15) postoperative 72-hour VAS scores were evaluated after ACB and FNB were applied to patients who had undergone total knee arthroplasty operations. While the VAS scores measured in the first 24 hours were found to be significantly lower in the FNB

group, they found that the VAS scores at the 48<sup>th</sup> and 72<sup>nd</sup> hours were similar.

Elliot et al. (22) in their study on knee surgeries showed that IPACK block applied together with ACB shortened the hospital stay and improved the response to physical therapy. They found that it had positive effects on pain scores, opioid consumption, physical therapy performance and discharge times.

Sahaneani et al. (23) reported significantly increased range of motion and walking distance as well as reduced visual analog scale scores after total knee arthroplasty in the ACB and IPACK block combined group compared to a group receiving ACB alone. Grevstad et al. reported that the femoral nerve catheter can provide significant postoperative analgesia, but on the other hand, it causes significant weakness in the quadriceps, which prevents early physical activity (13).

Amer et al. (24), in their study investigating the efficacy of peripheral nerve blocks in meniscal surgeries, documented that ACB and IPACK blocks are more effective than combined ACB and intra-articular infiltration for postoperative pain following surgery. They showed that their patients' VAS values were low in ACP and IPACK blocks.

Our study has some limitations. It is a retrospective study & the sample size is not large. We frequently apply spinal anesthesia as neuraxial block and ACB as peripheral block in our patients who have approved for arthroscopic knee surgery in our clinic. IPACK block is a relatively new block and we wanted to evaluate the effectiveness of this block, which we applied alone and in a limited number of patients for preemptive analgesia in our education clinic; and also compare it with the control group.

As a result of this evaluation, we found that the VAS scores of the patients, who had IPACK block, were lower from the 1<sup>st</sup> postoperative hour to the 24<sup>th</sup> hour. Although IPACK block is effective on the pain of the posterior side of the knee, we have also seen that this decrease in VAS scores increases the satisfaction of the patients and reduces the use of additional analgesics. The absence of any complications and the shortening of the discharge times were also considered as positive effects.

In conclusion; in this study, we observed that preemptive IPACK block, performed with ultrasonography in patients who will undergo arthroscopic knee surgery, reduces the patient's pain in the postoperative period, shortens the length of hospital stay, positively affects patient comfort and increases patient satisfaction considerably. We believe that IPACK block alone or in addition to other blocks or methods will be effective in preventing arthroscopic knee surgery pain and it will be useful to conduct new studies with more patients.

## ETHICAL DECLARATIONS

**Ethics Committee Approval:** The study was carried out with the permission of Kırıkkale University Hospital, Non-invasive Clinical Researches Ethics Committee (Date: 10/12/2020, Decision No: 2020.11.25).

**Informed Consent:** Because the study was designed retrospectively, no written informed consent form was obtained from patients.

**Referee Evaluation Process:** Externally peer-reviewed.

**Conflict of Interest Statement:** The authors have no conflicts of interest to declare.

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**Author Contributions:** All of the authors declare that they have all participated in the design, execution, and analysis of the paper and that they have approved the final version

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