Original Article

Comparison of the popliteal artery and the capsule of the posterior knee (IPACK) block and the genicular nerve block in primary total knee arthroplasty

A prospective randomized trial

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ABSTRACT

الأهداف: مقارنة فعالية الكتلة الجينية والفراغ بين الشريان المأبضي وكتلة المحفظة الخلفية (IPACK) في تقليل آلام ما بعد الجراحة، والحاجة إلى مسكنات الإنقاذ، والتأثيرات على نطاق الحركة (ROM) في المرضى الذين يعانون من TKA.

المنهجية: أجريت هذه الدراسة العشوائية المرتقبة خلال الفترة من فبراير ومايو 2023م. بناءً على طريقة الكتلة، أجرينا تقسيم 60 مشاركًا إلى 3 مجموعات متساوية. تضمنت هذه المجموعات مجموعة كتلة IPACK (العدد=20)، ومجموعة الكتلة الجينية (العدد=20)، ومجموعة التحكم (العدد=20). تم استخدام مؤشر التهاب المفاصل في جامعات أونتاريو الغربية وماكماستر (WOMAC)، ودرجة جمعية الركبة (KSS) ودرجة أكسفورد للركبة (OKS) للتقييم السريري في فترة ما بعد الجراحة.

النتائج: كانت درجات KSS وOKS من IPACK وGNB أقل بكثير من المجموعة الضابطة ($p<0.001$، $p<0.001$). كانت قيم التوقيت والانطلاق (TUG) لمجموعتي IPACK وGNB في الساعة 12 و24 أقل بكثير من مجموعة التحكم ($p<0.001$، $p<0.001$). كانت قيم إنقاذ الترامادول لمجموعة IPACK ومجموعات التحكم أعلى بكثير من مجموعة GNB القيمة الإحصائية($p=0.001$، $p=0.028$، على التوالي). كانت قيم ROM لمجموعتي IPACK وGNB أعلى بكثير من مجموعة التحكم ($p<0.001$، $p<0.001$).

الخلاصة: كان لكل من كتلتي GNB وIPACK تأثير إيجابي كبير على درجات الألم بعد العملية الجراحية خلال الـ 24 ساعة الأولى بعد تقويم مفاصل الركبة الكلي (TKA). بالمقارنة مع IPACK، كان لدى GNB استهلاك أقل للمواد الأفيونية في فترة ما بعد الجراحة المبكرة مع الترويج أيضًا لتعبئة أفضل.

Objectives: To compare the efficacy of genicular block and interspace between the popliteal artery and the posterior capsule (IPACK) block in the reduction of postoperative pain, the need for rescue analgesics, and the effects on a range of motion (ROM) in patients with TKA.

Methods: This prospective randomized controlled study was carried out between February and May 2023. Based on the block method, 60 participants were divided into three equal groups. These groups included the IPACK block group (n=20), the genicular block group (n=20), and control group (n=20). Western Ontario and McMaster Universities Arthritis Index (WOMAC), Knee Society score (KSS) and Oxford Knee score (OKS) were used for clinical evaluation in the postoperative period.

Results: The KSS and OKS scores of the IPACK and GNB were significantly lower than the control group ($p<0.001$, $p<0.001$). The timed up and go (TUG) values of the IPACK and GNB groups at 12th and 24th hour were significantly lower than the control group ($p<0.001$, $p<0.001$). The Tramadol rescue values of the IPACK block and control groups were significantly higher than the GNB group ($p=0.028$, $p=0.001$, respectively). The ROM values of the IPACK and GNB groups were significantly higher than the control group ($p<0.001$, $p<0.001$).

Conclusion: Both GNB and IPACK blocks had a significant positive impact on postoperative pain scores within the initial 24 hours following total knee arthroplasty (TKA). In comparison with IPACK, GNB had lower opioid consumption in the early postoperative period while also promoting better mobilization.

Keywords: IPACK, GNB, total knee arthroplasty, TUG, pain

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Total knee arthroplasty (TKA) is a prevalent and substantial orthopedic surgical procedure, often leading to considerable postoperative pain. Consequently, anesthesiologists and surgeons continuously seek strategies to address postoperative pain effectively. The utilization of multimodal analgesia and motor-sparing blocks have gained popularity due to their ability to mitigate the side effects associated with opioid usage, facilitate early ambulation, and improve performance.[1,2] As the number of TKA procedures increase and with the development of modern anesthesiology and pain management techniques, various approaches to pain management, hospital stay, and recovery are gaining popularity to improve patient and surgeon satisfaction and comfort. The ideal postoperative analgesia management strategy for TKA should provide adequate postoperative analgesia and maximally preserve the muscle strength of the extremity.

Many different nerve-block analgesic treatment methods have been reported in the literature for rapid functional recovery and effective postoperative analgesia after TKA.[3,4] However, debate still continues regarding the superiority of the techniques.

An innovative intervention has emerged in recent years in the form of a genicular nerve block (GNB) to relieve postoperative pain in both chronic knee pain and TKA.[5] Genicular nerve block targets the superior lateral, superior medial, and inferior medial genicular nerves to block pain transmission to the knee region.[6] The genicular nerves derive from the tibial, femoral, saphenous, obturator, common peroneal nerves, and provide innervation to the capsule of the knee.[7] It has a desirable motor protective effect for early postoperative ambulation, better physical therapy, and early discharge.[8] Conversely, the interspace between the popliteal artery and the posterior capsule (IPACK) represents an alternative approach to achieving analgesia in the posterior knee. This method employs ultrasound guidance to introduce local anesthetic between the posterior capsule and the popliteal artery of the knee. Notably, in this procedure, the primary trunks of the tibial and common peroneal nerves remain unaffected, while the terminal branches responsible for innervating the posterior capsule of the knee joint, including the genicular nerves and the popliteal plexus, are effectively blocked.[9]

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The objective of this investigation was to assess and contrast the effectiveness of GNB and IPACK block concerning the mitigation of postoperative pain, the requirement for supplementary pain relief, and their impact on the range of motion (ROM) in individuals who have undergone total TKA. We hypothesized that GNB and IPACK block might have better postoperative pain scores, ambulation, opioid-related side effect reduction, and patient comfort in patients undergoing TKA surgery compared to the control group.

Methods. This prospective randomized controlled investigation was conducted at Hitit University Erol Olçok Training and Research Hospital from February to May, 2023. The study received approval from the Hitit University Ethics Committee and was done in accordance with the Declaration of Helsinki (approval reference: 2023-05). All patients gave their written informed consent. The study involved individuals slated for their initial single-sided TKA procedure under spinal anesthesia.

Sixty participants were divided into 3 equal groups based on the block method. These groups included the IPACK block group (n=20), the genicular block group (n=20), and control group (n=20). Exclusion criteria included a history of previous knee surgery, contraindication to a nerve block, other connective tissue diseases affecting the knee, allergy to local anesthesia, sciatic pain, hepatic and renal insufficiency, body mass index (BMI) higher than 40 kg/m^2, use of anticoagulant drugs, age <18 years or >80 years, inability to comprehend or cooperate to perform this study and refusal of spinal anesthesia or regional block (**Figure 1**).

The study included 3 cohorts, each consisting of 20 randomly allocated patients. The randomization process involved using sealed opaque envelopes and a computer-generateåd algorithm. Group I received a GNB, Group II underwent an IPACK block, and Group III served as the control group with no regional block performed. All nerve block procedures were performed by the same senior anesthesiologist before anesthesia. Demographic data, BMI and ASA scores were evaluated preoperatively. Functional performance indicators were investigated and recorded. Timed Up and Go (TUG) test was used to evaluate ambulation at 12 and 24 hours postoperatively. To conduct the TUG test, the patient is required to rise from the chair, walk a distance of 3 meters, then return to the chair and resume a seated position. The duration of this activity is quantified in seconds.

Range of motion was evaluated one day preoperatively and 12 and 24 hours postoperatively

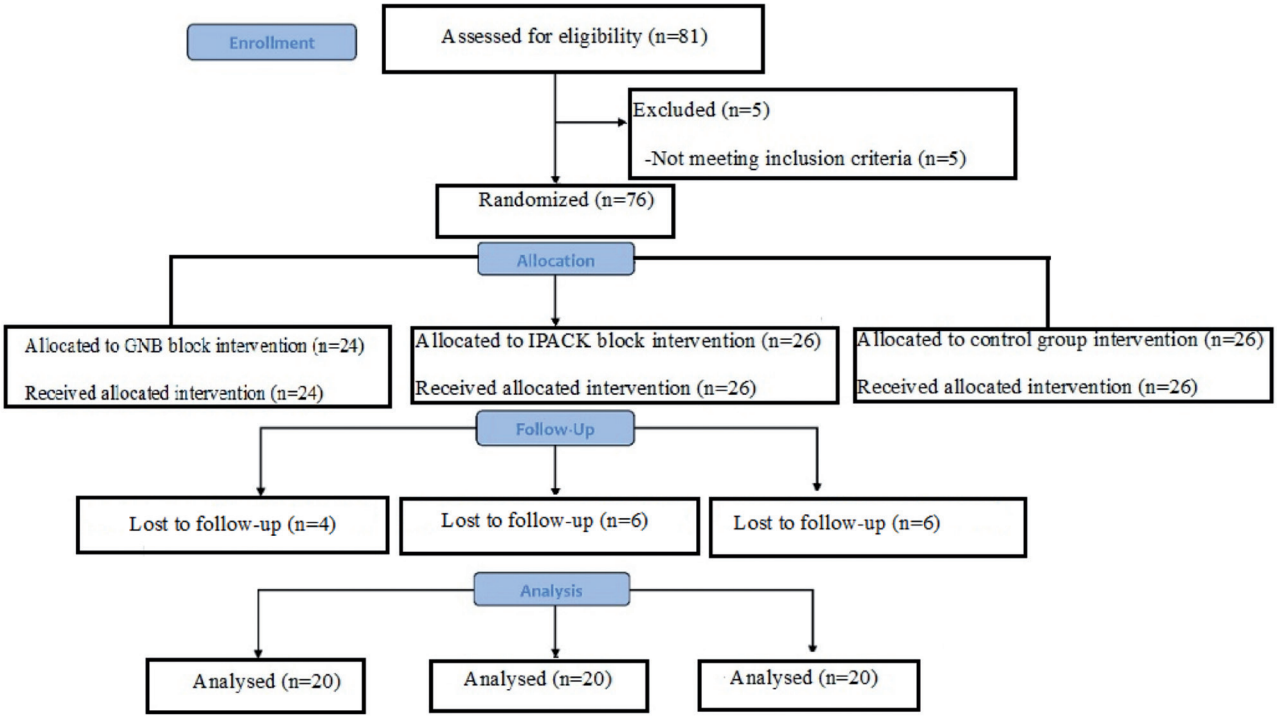

Figure 1 - The study flow diagram highlighting the process of study.

at rest and in motion. A straight leg raising test was conducted with the patients in the supine position, and quadriceps muscle strength was evaluated. Quadriceps muscle strength was assessed at 12 and 24 hours postoperatively using the Medical Research Council (MRC) scale. Western Ontario and McMaster Universities Arthritis Index (WOMAC), Oxford Knee Score (OKS) and Knee Society Score (KSS) were used for clinical evaluation in the postoperative period.

Before the surgical procedure, all patients received instruction on how to evaluate their postoperative discomfort using a visual analog scale (VAS), which ranges from 0 (representing the absence of pain) to 10 (indicating the most severe pain). Visual analog scale scores were assessed preoperatively and postoperatively at 12 and 24 hours at rest and on movement. All regional blocks were performed preoperatively under ultrasound guidance using Marcain solution (bupivacaine hydrochloride 5%), and then patients were moved to the operating room, where they underwent spinal anesthesia administered with Marcain while seated. This was carried out in the L3-4 or L4-5 intervertebral space.

During the postoperative period, all patients received a standardized analgesic regimen. Acetaminophen was administered every 6 hours at a dose of 15 mg/kg, and tramadol was administered as a rescue analgesic at a dose of 100 mg IV. The primary assessment was the VAS score measured at rest and on movement at 12 and 24 hours postoperatively. The secondary assessment was total tramadol requirement, ROM, and clinical outcomes.

Statistical analysis. Statistical analysis of the data was carried out using the Statistical Package for the Social Sciences software, version 22, (IBMCorp, Armonk, NY, USA). Descriptive statistics for categorical variables were presented in terms of percentage (%) and frequency (n). To evaluate the proportions among categorical variables, we employed either Athe Chi-square analysis or Fisher's exact probability test, based on sample sizes in crosstab cells. The normality assumption of numerical data was assessed using the Shapiro-Wilk test and various graphical tools like histograms, box plots, and Q-Q plots. We reported descriptive statistics for numerical data in terms of either the mean ± standard deviation (SD) or the median (min-max), taking into account the assumption of normality. To evaluate variance homogeneity, Levene's test was employed. One-way analysis of variance (ANOVA) was used in the comparison of more than 2 related numerical data, since parametric test assumptions were provided. To compare numerical data across multiple independent

groups, we applied ANOVA when the parametric test assumptions were satisfied, and the Kruskal-Wallis test when they were not. Following the ANOVA test, post-hoc assessments using Tukey and Games-Howell tests were performed to identify specific groups with significant differences, depending on the assumption of variance homogeneity. Following the Kruskal-Wallis test, the Dunn-Bonferroni post-hoc test was utilized to identify groups that displayed significant differences. The paired t-test was employed when the conditions for a parametric test were satisfied, while the Wilcoxon signed-rank test was chosen when these conditions were not fulfilled in the comparison of two related (pre-operative and post-operative change) numerical data. Repeated Measures ANOVA was used in the comparison of more than two related numerical data, since parametric test assumptions were provided. Bonferroni post-hoc tests were used to determine at which time points the difference occurred after the Repeated Measures ANOVA. In all statistical tests performed, a significance threshold of $p<0.05$ was utilized.

Results. In our study, data of 60 patients, 20 (33.3%) in IPACK, 20 (33.3%) GNB, and 20 (33.3%) Control, were statistically analyzed. Of the patient population, 45% (n=27) were male, while the remaining 55% (n=33) were female. The mean age of the patients was 66.12±6.54 (min-max: 55–78) and the mean BMI was 31.3±2.49 (26–36). The mean operation time for all patients was 60.48±4.01 (53-67) minutes. **Table 1** displays the statistical results concerning the comparison of demographic and clinical characteristics among the study groups. Notably, there were no significant differences observed in the distribution of gender, ASA rates, mean age, BMI, and mean operation time across the groups ($p=0.817$, $p=0.857$, $p= 0.182$, $p=0.176$, $p=0.450$).

In comparison to the control group, both the IPACK and GNB groups exhibited notably lower scores for KSS, OKS, and WOMAC (all $p<0.001$).

The KSS scores in the IPACK group were significantly inferior in comparison to the GNB group ($p=0.004$). Nevertheless, there were no significant distinctions observed between the IPACK and GNB groups with regards to OKS scores ($p=0.127$), and similarly, no statistically significant variance was noted between these 2 groups in terms of WOMAC scores ($p=0.279$).

Statistical findings for the comparison of TUG, MRC, tramadol rescue, and ROM parameters within and between groups are presented in **Table 2**. The TUG values of the IPACK and GNB groups at 12th and 24th hours were significantly lower compared to the control group ($p<0.001$, $p< 0.001$); no significant difference was determined between the IPACK and GNB groups at the 12th and 24th hours ($p=0.277$, $p=0.555$). The TUG values at 24 hours were significantly lower compared to the TUG values at 12 hours in all groups ($p<0.001$ for all comparisons).

MRC values at the 12th hour showed significant variations between the groups ($p=0.001$). The MRC values for both the IPACK and GNB groups displayed a significant increase in comparison to the control group ($p=0.002$, $p=0.002$, respectively). The values of MRC at 24 hours did not exhibit significant differences among the groups ($p=0.131$). The MRC values observed within the control group at the 24th hour was significantly higher compared to the MRC values at the 12th hour ($p=0.001$).

The tramadol rescue values within the groups displayed notable differences from 0 to 12 hours ($p=0.001$), and the tramadol rescue values of the IPACK block and control groups were significantly higher than the GNB group ($p=0.028$, $p=0.001$). The tramadol rescue values at 12th and 24th hours showed significant variation between the groups ($p<0.001$). The tramadol rescue values of the IPACK and GNB groups were significantly lower compared to the control group ($p=0.028$, $p<0.001$). No significant difference was determined between tramadol rescue values of the IPACK and GNB groups ($p=0.427$). The mean and 95% confidence interval plots showing the time-dependent variation of TUG, MRC, and tramadol rescue repeated measures are shown in **Figure 2.**

There were no significant differences observed in the pre-op ROM values for subsequent knee surgeries across the groups ($p=0.862$). The postoperative 12-hour ROM values were significantly higher in both the IPACK and GNB groups when compared to the control group ($p<0.001$, $p<0.001$). No significant difference was determined between the ROM values of the IPACK and GNB groups ($p=0.882$). ROM values at 24 hours were not significantly different between the groups ($p=0.541$). The mean and 95% confidence interval plots showing the time-dependent variation of ROM repeated measures are shown in **Figure 2D.**

The preoperative VAS scores, both at rest and during mobility, showed no significant differences across the groups ($p=0.190$, $p=0.741$) (**Table 3**). The postoperative 12-hour VAS scores were significantly reduced in both the IPACK and GNB groups in comparison to the control group ($p<0.001$, $p<0.001$, respectively). No significant difference was determined between VAS scores of IPACK and GNB groups ($p=0.986$). The

Table 1 - Statistical results for comparison of demographic and clinical characteristics of patients among research groups.

Factors	Groups			*P*-values	Post-hoc *P*-values
	IPACK (n=20)	Genicular (n=20)	Control (n=20)		
Gender					
Male	8 (40%)	9 (45%)	10 (50%)	0.817[a]	-
Female	12 (60%)	11 (55%)	10 (50%)		
ASA					
1	2 (10%)	2 (10%)	3 (15%)		
2	5 (25%)	8 (40%)	6 (30%)	0.857[b]	-
3	13 (65%)	10 (50%)	11 (55%)		
Age	65.85±6.87	68.15±6.96	64.35±5.43	0.182[c]	-
Body mass index	30.5±2.03	31.95±2.48	31.45±2.8	0.176[c]	-
Surgical time (minutes)	60.9±4.34	59.55±4.14	61±3.53	0.450[c]	-
KSS score	44±3.98	48.9±5	69.45±10.33	<0.001[d]	1-2: 0.004 1-3: <0.001 2-3: <0.001
OKS score	23.05±3.8	26.35±5.66	49.15±6.06	<0.001[c]	1-2: 0.127 1-3: <0.001 2-3: <0.001
WOMAC score	38.4±5.92	41.4±4.74	69.95±7.48	<0.001[c]	1-2: 0.279 1-3: <0.001 2-3: <0.001

[a]Chi square test with n (%). [b]Fisher exact test with n (%). [c]One way ANOVA followed by Tukey post-hoc test with mean±standard deviation (SD). [d]One way ANOVA followed by Games-Howel post-hoc test with mean±SD. BMI: body mass index, KSS: Knee Society Clinical Rating System, OKS: Oxford Knee Score, WOMAC: Western Ontario, McMaster Universities osteoarthritis index, IPACK: interspace between the popliteal artery and the posterior

postoperative 24-hour VAS scores were significantly elevated in both the IPACK and control groups when compared to the GNB group (p<0.001, p<0.001). No significant difference was determined between VAS scores of IPACK and control groups (p=0.882). The mean and 95% confidence interval plots showing the time-dependent variation of repeated measurements of VAS scores at rest and movement are shown in **Figure 3**.

Discussion. This study aimed to compare IPACK and GNB nerve blocks in terms of postoperative pain control, ambulation, and physical activity scores and to evaluate their efficacy. In this study, the GNB block was better than IPACK and the control group in regards to the TUG test, VAS scores, and opioid consumption at 12 and 24 hours postoperatively. Nevertheless, it is important to note that the MRC test demonstrated a marked improvement in the IPACK and GNB groups in comparison to the control group after 12 hours; patients in all groups could mobilize at 12 hours and thus could be evaluated in terms of motor functionality. Although the time to first mobilization did not differ between groups, the genicular block presented better analgesia at 12 and 24 hours postoperatively when patients were ambulating, supporting our hypothesis.

A successful regional technique for postoperative TKA management involves both accelerating early functional recovery and providing effective analgesia at the same time with minimal muscle weakness. Traditionally, postoperative pain management after TKA is accomplished with a combination of various regional nerve blocks, periarticular infiltration, and epidural analgesia.[10] The ideal regional analgesic method for TKA patients is still evolving and remains a research topic, as the method used must provide adequate analgesia to allow early mobilization.[11] These treatment modalities have been gaining popularity in the last few years because motor protective nerve blocks performed before TKA facilitate early ambulation and discharge. In the literature, there are limited studies comparing IPACK and genicular block.

In our study, a significant improvement in postoperative WOMAC and CSR scores in all 3 groups was observed. In comparison to the control group, IPACK and GNB groups were better while there was no significant difference in OKS and WOMAC. We found a significant reduction in OKS and WOMAC scores with IPACK and GNB application in managing knee pain after TKA.

Systemic toxicity, vasovagal recurrences, and peripheral nerve damage due to direct traumatic impact of the needle or hematoma compression have been well documented as complications of regional nerve blocks.[12] Our study did not observe any of the

Table 2 - Statistical results for the comparison of TUG, MRC, ROM, and Tramadol rescue values among research groups between groups and within groups at different time points.

Factors	Groups			*P*-values (between)	Post-hoc *P*-values
	IPACK (n=20)	Genicular (n=20)	Control (n=20)		
TUG					
12 hours	81.10±2.86	82.95±4.46	98.70±5.89	<0.001[d]	1-2: 0.277 1-3: <0.001 2-3: <0.001
24 hours	45.8±4.22	44.4±5.11	53.65±3.21	<0.001[c]	1-2: 0.555 1-3: <0.001 2-3: <0.001
P-values (within)	<0.001[f]	<0.001[f]	<0.001[f]		
MRC					
12 hours	4.85±0.36 5 (4-5)	4.85±0.36 5 (4-5)	4.35±0.48 4 (4-5)	0.001[e]	1-2: 1.000 1-3: 0.002 2-3: 0.002
24 hours	5±0 5 (5-5)	5±0 5 (5-5)	4.9±0.31 5 (4-5)	0.131[e]	-
P-values (within)	0.083[g]	0.083[g]	0.001[g]		
Tramadol rescue (mg)					
0-12 hours	230±65.69 200 (100-400)	175±55.01 200 (100-300)	245±51.04 200 (200-300)	0.001[e]	1-2: 0.028 1-3: 1.000 2-3: 0.001
12-24 hours	165±48.93 200 (100-200)	140±50.26 100 (100-200)	215±48.93 200 (100-300)	<0.001[e]	1-2: 0.427 1-3: 0.028 2-3: <0.001
P-values (within)	0.004[g]	0.052[g]	0.034[g]		
ROM					
Pre-op	111.1±5.99	110.2±5.45	111.2±6.63	0.862[c]	-
12 hours	33.9±3.81	34.45±3.87	23.65±3.18	<0.001[c]	1-2: 0.882 1-3: <0.001 2-3: <0.001
24 hours	91.45±4.05	90.35±3.42	90.20±4.09	0.541[c]	-
P-values (within)	<0.001[h]	<0.001[h]	<0.001[h]		
Post-hoc *P*-values	1-2: <0.001 1-3: <0.001 2-3: <0.001	1-2: <0.001 1-3: <0.001 2-3: <0.001	1-2: <0.001 1-3: <0.001 2-3: <0.001		

[c]One way ANOVA followed by Tukey post-hoc test with mean±standard deviation (SD). [d]One way ANOVA followed by Games-Howel post-hoc test with mean±SD. [e]Kruskal Wallis test followed by Dunn-Bonferroni post-hoc test with median (min-max) and mean±SD. [f]Paired t-test with mean±SD. [g]Wilcoxon signed rank test with median (min-max) and mean±SD. [h]Repeated measures ANOVA followed by Bonferroni post-hoc test with mean±SD. TUG: time up go test, MRC: Medical Research Council Scale for Muscle Strength, ROM: range of motion, IPACK: IPACK: interspace between the popliteal artery and the posterior

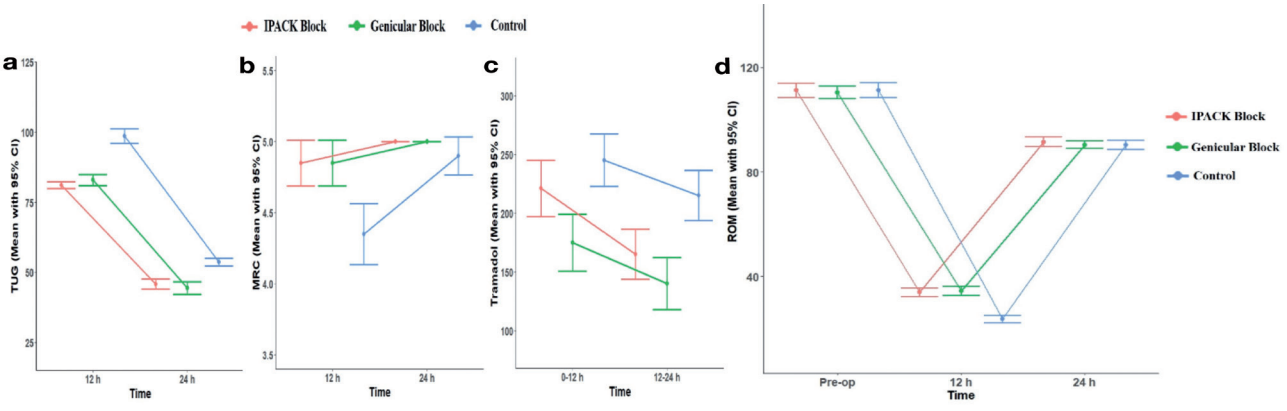

Figure 2 - Mean and 95% confidence interval plots showing the time-dependent variation of **a**) TUG, **b**) MRC, and **c**) Tramadol, **d**), repeated measures, Mean and 95% confidence interval plots showing the time-dependent variation of ROM repeated measures. IPACK: interspace between the popliteal artery and the posterior, TUG: time up go test, MRC: Medical Research Council Scale for Muscle Strength, ROM: range of motion

Table 3 - Statistical results for the comparison of VAS scores at rest and movement between research groups between groups and within groups at different time points.

Factors	Groups			*P*-values (between)	Post-hoc *P*-values
	IPACK (n=20)	Genicular (n=20)	Control (n=20)		
VAS at rest					
Pre-op	4.8±1.05	5.4±1.14	4.95±0.99	0.190[c]	-
12 hours	5±1.07	4.95±0.99	7.1±0.91	<0.001[c]	1-2: 0.986 1-3: <0.001 2-3: <0.001
24 hours	5.75±0.63	4.15±0.58	5.85±0.74	<0.001[c]	1-2: <0.001 1-3: 0.882 2-3: <0.001
P-values (within)	0.013[h]	0.001[h]	<0.001[h]		
Post-hoc*P*-values	1-2: 1.000 1-3: 0.032 2-3: 0.073	1-2: 0.675 1-3: 0.002 2-3: 0.017	1-2: <0.001 1-3: 0.011 2-3: 0.004		
VAS at movement					
Pre-op	7.05±0.88	6.9±1.07	6.8±1.1	0.741[c]	-
12 hours	7.3±1.03	6.55±0.94	8.2±1.05	<0.001[c]	1-2: 0.058 1-3: 0.018 2-3: <0.001
24 hours	7±0.79	5.15±0.67	7.60±0.68	<0.001[c]	1-2: <0.001 1-3: 0.028 2-3: <0.001
P-values (within)	0.536[h]	<0.001[h]	<0.001[h]		
Post-hoc *P*-values	-	1-2: 0.892 1-3: <0.001 2-3: <0.001	1-2: 0.002 1-3: 0.058 2-3: 0.146		

[c]One way ANOVA followed by Tukey post-hoc test with mean±standard deviation (SD). [h]Repeated measures ANOVA followed by Bonferroni post-hoc test with mean±SD, VAS: visual analog scale

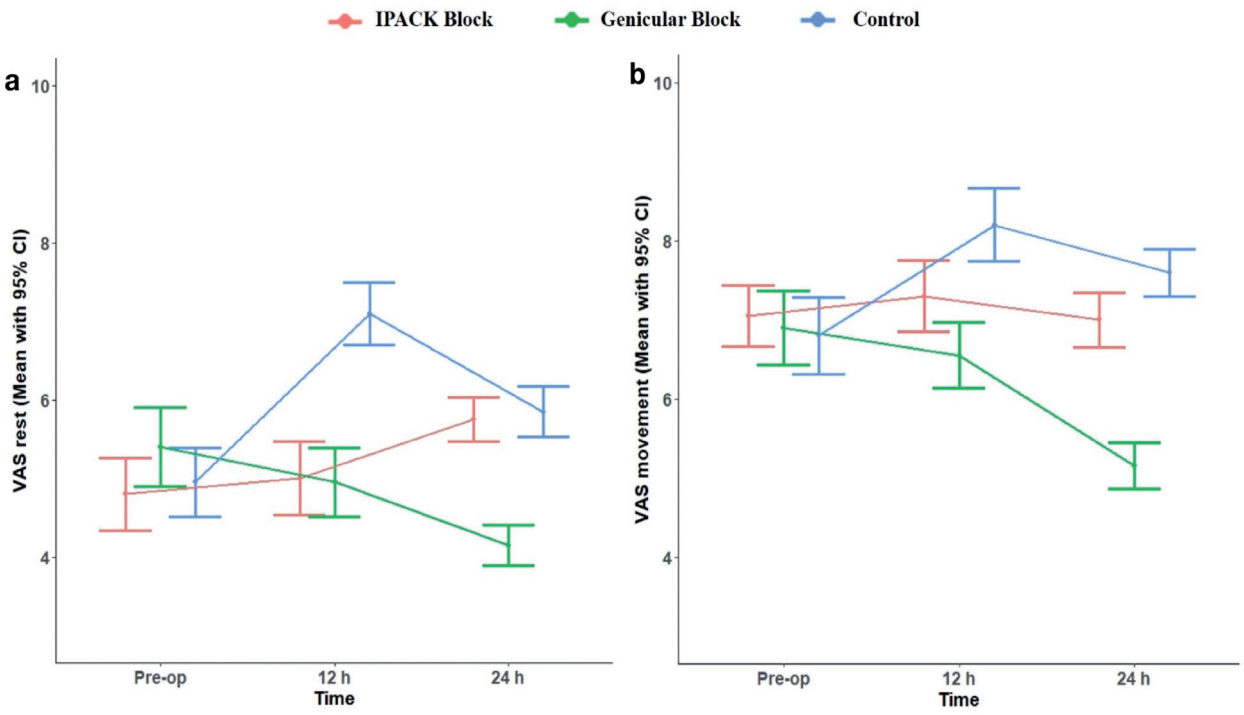

Figure 3 - Mean and 95% confidence interval graphs showing the time-dependent variation of repeated measures of **a**) VAS scores at rest and **b**) movement.

above-mentioned side effects during or after applying either block method. GNB is reported to be superior to adductor block and sciatic nerve block in terms of the size of the analgesia area and motor nerve involvement.

Furthermore, studies have reported that both sciatic nerve blocks and the adductor canal block (ACB) might influence the motor components of the peroneal and tibial nerves, potentially prolonging the ambulation recovery period and leading to postoperative neurological issues.[12] Previous studies have used ACB and sciatic nerve block for postoperative analgesia after TKA. It has been reported that ACB provides analgesia only within the knee joint's anterior and medial regions, and no analgesic effect was obtained in the posterior part of the knee.[13] Different studies have also reported that ACB protects quadriceps muscle strength and provides early mobilization.[14,15] However, this technique does not act on the deep genicular nerves and only provides an analgesic effect on the anteromedial aspects of the knee. The IPACK procedure involves the application of effective analgesia in the posterior knee joint by targeting the region between the popliteal artery and the posterior capsule, all without inducing motor deficits.[16] The IPACK block delivers pain relief without causing a reduction in muscle strength by precisely blocking the sensory endings in the posterior part of the knee while leaving the motor components of the tibial and peroneal nerves unaffected.[17,18]

In this study, although IPACK block significantly reduced pain levels in patients compared to the control group, the GNB group showed better pain control in the early postoperative period compared to orher both groups. Ambulation levels were better in the early and late postoperative period, and this result is supported by the fact that ROM measurements at 12 hours were better in the GNB group compared to the other two groups. Compared to IPACK and control groups, the genicular block group had significantly greater degree of flexion 12 and 24 hours after surgery. These data suggest that genicular block provides better pain control efficacy, a better physical activity profile, and early ambulation in the postoperative period. Similarly, successful results have been reported with GNB for postoperative analgesia and mobilization in patients undergoing TKA.[19,5]

An additional significant finding in our study was the notable decrease in opioid consumption observed in the genicular block group at 12 and 24 hours after the surgery. This reduction suggests more effective pain management during the initial postoperative period compared to the other groups, which is supported by the range of motion (ROM) scores and visual analog scale (VAS) at 12 and 24 hours postoperatively, both during rest and while in motion.

Study limitations. Firstly, the sample size employed in the study is relatively small. Secondly, the follow-up period for patients was limited to 24 hours postoperatively, and any complications related to the GNB and IPACK procedures beyond this time frame were not recorded. Thirdly, the study did not differentiate between varus and valgus knees, thus making it difficult to assess the postoperative clinical efficacy in each knee type specifically. However, it is worth noting that no significant difference was determined in preoperative ROM levels between the groups, and patients were standardized in this aspect.

In conclusion, study findings reveal that both GNB and IPACK blocks had significant positive impacts on postoperative pain scores within the initial 24 hours following total knee arthroplasty (TKA). Furthermore, these blocks facilitated quadriceps muscle function, enabling early mobilization and discharge of patients. In comparison with IPACK, GNB had lower opioid consumption in the early postoperative period while also promoting better mobilization. However, further studies with larger patient populations are crucial to gain a more comprehensive understanding of this matter.

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