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Effect of pericapsular nerve group block on perioperative analgesia characteristics for hip fracture operations

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ABSTRACT

Aims: Pericapsular nerve group (PENG) block is a new regional analgesia technique that has recently been used for perioperative analgesia for hip fracture operations. This study, it was aimed to investigate the perioperative analgesia characteristics of PENG block in patients scheduled for hip fracture operation under spinal anesthesia.

Methods: The study was conducted as a prospective randomized controlled study between February 2021 and May 2021 after ethics committee approval. Patients with consent were included in the study. The patients were randomly divided into two groups (Group-I and Group-II). Patients in Group I underwent a PENG block with a 0.25% concentration of 20 cc bupivacaine in the preoperative waiting room 30 minutes before the operation. Afterward, spinal anesthesia was applied in the operating room. Only spinal anesthesia was applied to the patients in Group II. Preoperative visual analog scale (VAS) scores were recorded for both groups in the preoperative period. ECG, arterial blood pressure, pulse, and oxygen saturation measurements were performed in all patients preoperatively, intraoperatively, and postoperatively. Pulse, arterial blood pressure, oxygen saturation measurements, and VAS scores were recorded in the lateral decubitus position before and at the 5th minute after spinal anesthesia. In addition, the comfort of the anesthetist who will administer the spinal anesthesia during the application was questioned (0: poor, 1: moderate, 2: good, 3: very good). All patients 5 min after spinal anesthesia. It was kept in the lateral position throughout. In the postoperative period, VAS scores at 0th, 2nd, 8th, 16th, and 24th hours and the time of first analgesic administration were recorded. The total amount of paracetamol and tramadol consumed in the first 24 hours postoperatively were recorded.

Results: Patients; gender, age, body weight, height, BMI, and ASA values were statistically similar ($p > 0.05$). In comparisons between the groups; During position, postoperative 2nd, 8th, 16th, 24th hours, and their sum, VAS values were found to be statistically lower in Group-I ($p < 0.05$). While it was found that the first analgesic administration time was statistically longer in Group-I patients ($p<0.001$), the amounts of paracetamol and tramadol consumed in the first 24 hours were found to be statistically lower ($p<0.001$). In addition, the comfort of the anesthetist during spinal anesthesia was found to be better in Group-I (p:0.014).

Conclusion: PENG block can be used effectively as a part of perioperative multimodal analgesia in hip fracture surgery. PENG can reduce the pain levels of patients with hip fractures as well as reduce the need for additional analgesia. It also increases the comfort of the anesthetist who will administer regional anesthesia.

Keywords: Hip fracture, pericapsular nerve group, PENG block, position pain, spinal anesthesia

INTRODUCTION

Hip fractures are a common public health problem.[1] In the perioperative period, 75% of the patients suffer from moderate to severe pain associated with movement.[2] Pain causes endocrine and metabolic changes in the body. These physiological responses may contribute to chronic persistent pain after surgery in patients.[3] It can also cause pain, delirium, sleep disorders, and depression in patients.[4]

There is no standardized approach to hip fracture anesthesia because neither regional nor general anesthesia has been

shown to be superior in specific outcomes such as 30-day mortality, myocardial infarction, pneumonia, delirium, or renal failure.[5] The choice of anesthesia is therefore based on surgical concerns, including the expected operative time and complexity of the operation, as well as the patient's comorbidities and preferences. The patient should be aware of the risks and benefits of both general and neuraxial anesthesia, and a joint decision should be made on the most appropriate anesthesia technique.[6]

Positioning patients with hip fractures for regional anesthesia is very difficult due to pain. Opioids and nonsteroidal anti-inflammatory drugs are widely used for analgesia, but these drugs can cause serious side effects due to decreased hepatic and renal functions in the geriatric age group.[7] Regional anesthesia techniques (nerve blocks or field blocks) applied by experienced personnel provide perioperative analgesia, lead to a decrease in the amount of opioids administered to patients, and are recommended because they cause a decrease in opioid-related side effects such as nausea, vomiting, and respiratory depression.[8]

The anterior hip capsule is innervated by the obturator nerve, the accessory obturator nerve, and the femoral nerve. These three nerves should be targeted to provide analgesia for hip fractures. A recent anatomical study confirmed the innervation of the anterior hip capsule by these three main nerves.[9]

The application of regional anesthesia techniques such as femoral nerve block, fascia iliaca block, psoas compartment block, or lateral femoral cutaneous nerve block, which are applied with ultrasound and/or nerve stimulator, which is an effective perioperative analgesia method in pain control in patients with hip fractures and reduces opioid consumption, is becoming increasingly common. In addition, new peripheral nerve block methods are being investigated in this field. Pericapsular nerve group (PENG) block, defined in 2018, is a new regional anesthesia technique first developed for postoperative analgesia in total hip arthroplasties (THA) where the motor functions of the quadriceps muscle are preserved.[10] It is thought that it provides comprehensive analgesia by administering a local anesthetic to the myofascial area between the psoas muscle and the superior pubic ramus.[11]

The hypothesis in this study is that PENG block application in patients scheduled for hip fracture operation under spinal anesthesia may reduce the VAS scores of the patients as well as reduce the need for additional postoperative analgesia. VAS scores were determined as the primary outcome at the time of spinal anesthesia application and during the postoperative 24-hour period. First analgesia need, total analgesic consumption, and anesthetist comfort during spinal anesthesia were determined as secondary outcomes.

METHODS

This study was conducted as a prospective, randomized controlled study after the approval of the Ankara Bilkent City Hospital Clinical Researches Ethics Committee (Date: 24.02.2021 and Decision No: E2-21-200). After the patients were informed about the study and their consent was obtained, they were included in the study. Patients over the age of 50, with ASA I-III, who will be operated on due to hip fracture in the Department of Anesthesiology and Reanimation of the Ankara Bilkent City Hospital between February 2021 and May 2021 were included in the study. ASA IV and above, coagulopathy and using anticoagulant drugs, accompanying severe cardiac, respiratory, hepatic, and renal disease, known diabetic neuropathy, motor or sensory deficit after a previous cerebrovascular accident, known neuropsychiatric disorder, local anesthetic allergy, patients with infection or wound scar at the application site, were excluded from the study.

The patients were randomly divided into two groups using the closed envelope method (Group-I and Group-II). Visual analogue scale (VAS) was recorded for both groups in the preoperative period before the applications (0:No pain, 10: Unbearable pain). ECG, arterial blood pressure, pulse, and oxygen saturation measurements were routinely performed in all patients during the preoperative, intraoperative, and postoperative periods.

Patients in Group-I underwent PENG block with 20 ml, 50 mg of 0.25% bupivacaine using linear probe (HFL 38x/13-6 MHz Transducer) USG (Sonosite S-Nerve; SonoSite Inc, Bothell, WA, USA) in the preoperative waiting room 30 minutes before the operation. In the PENG block, the USG probe was placed parallel to the imaginary line passing between the anterior inferior iliac spine and iliopubic eminence. The iliopubic eminence, iliopsoas muscle and tendon, femoral artery, and pectineus muscle were visualized. A peripheral block needle (22G 80 mm iğne, Pajunk, GmbH, Medizintechnologie, Karl-Hall-Strasse 1, 78187 Geisingen / Germany) was advanced between the psoas tendon and the iliopubic ramus with the in-plane technique. 20 ml of 0.25% bupivacaine was injected after negative aspiration showed that there was no hemorrhagic injury (Figure 1).

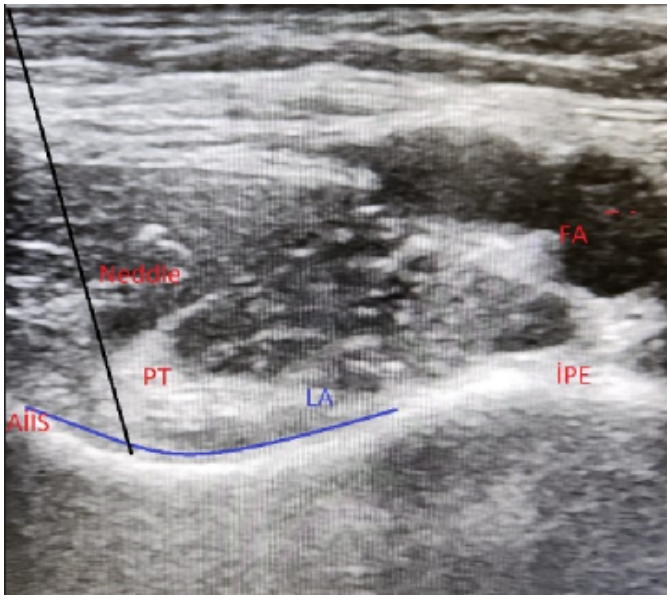

Figure 1. Sonographic view of PENG block. (FA: Femoral artery, PT: Psoas tendon, IPE: Ileopubic eminence, AIIS: Anterior inferior iliac spine, LA: Local anesthetic)

Sensory block time after the block was recorded every 5 minutes for 30 minutes. While evaluating sensory block, pinprick sensory examination was used (sensation: 0,

hypoesthesia:1, no sensation:2). Patients with hypoesthesia were considered suitable for positioning.

Intravenous fentanyl 1 mcg/kg was administered to the patients in Group II, 1 minute before positioning for spinal anesthesia.

All patients were placed in the lateral decubitus position with the fractured side down. Meanwhile, arterial blood pressure, pulse, oxygen saturation values, and VAS scores were recorded. 1 mcg/kg of intravenous fentanyl was administered to patients with a VAS score higher than 4 during the position. Heavy bupivacaine 10 mg at 0.5% concentration was administered to the patients through the L4-L5 or L3-L4 spinal space. All patients were kept in the side position for 5 minutes after spinal anesthesia. Arterial blood pressure, pulse, oxygen saturation measurements, and VAS scores at the 5th minute after spinal anesthesia were recorded. The patients were then placed in the supine position. In addition, the comfort of the anesthetist who will administer the spinal anesthesia during the application was questioned. (0: bad, 1: fair, 2: good, 3: very good).

The patients' age, gender, height, weight, body mass index, ASA score, comorbidities, type of fracture, type of operation (endoprosthesis, proximal femoral nail, etc.), and duration of operation were recorded.

In the postoperative period, VAS scores at 0th, 2nd, 8th, 16th, and 24th hours and the time of first analgesic administration were recorded. Paracetamol was given to patients with a VAS score above 4 in the postoperative period. A minimum of 6 hours waited between two paracetamol doses. During the follow-up of the patients, tramadol was given to patients with a pain score above 4 despite paracetamol. The total amount of paracetamol and tramadol consumed in the first 24 hours postoperatively were recorded.

Statistical Analysis

Data analysis was performed using the IBM SPSS 25.0 (Armonk, NY: IBM Corp.) statistical package program. While evaluating the study data, chi-square[2] test was used to compare qualitative data as well as descriptive statistical methods (frequency, percentage, mean, standard deviation, median, min-max). The suitability of the data to the normal distribution was evaluated using the kolmogorov-smirnow test, skewness-kurtosis, and graphical methods (histogram, Q-Q Plot, stem and leaf, boxplot). In the study, in the comparison of normally distributed quantitative data between groups; the Independent samples t-test (t-test in independent groups) and repeated measures anova (repeated measure analysis of variance) were used for within-group comparison. The statistical significance level was accepted as <0.05. Power analysis was made with G*Power 3.1.9.4 statistical package program; n1=34, n2=34, α=0.05, Effect Size (d) = 0.80; power = 90% was found.

RESULTS

The data of 68 patients who were operated on under spinal anesthesia for hip fractures between February 2021 and May 2021 were analyzed (Figure 2).

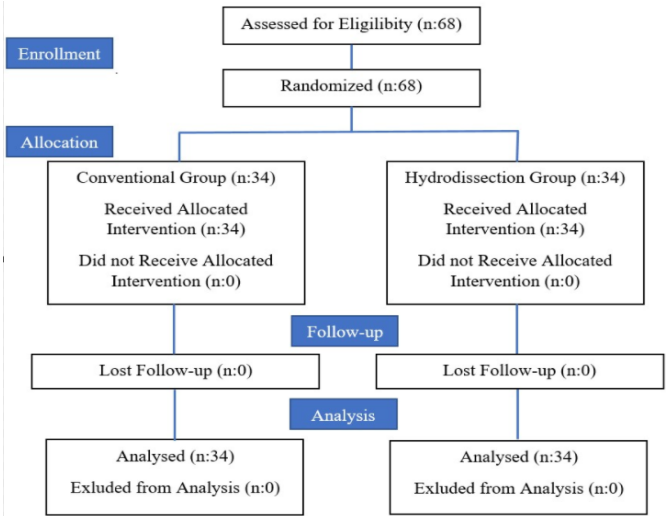

Figure 2. Flow chart.

The demographic and operational characteristics of the patients were statistically similar. The comfort scale of the anesthetist during spinal anesthesia was found to be better in Group I (Table 1).

Table 1. Comparison of patient characteristics between groups

		Group I (n=34)	Group II (n=34)	p
Gender	Male	14 (41.2 %)	8 (23.5 %)	0.195 [a]
	Female	20 (58.8 %)	26 (76.5 %)	
Age (Year)		78.7 ± 9.0	81.6 ± 6.7	0.147 [b]
Body weight (kg)		73.9 ± 12.5	74.8 ± 10.2	0.751 [b]
Height (cm)		163.4 ± 10.3	161.1 ± 9.2	0.324 [b]
Body mass index (kg/m²)		27.7 ± 4.2	28.7 ± 3.8	0.291 [a]
ASA	I	1 (2.9 %)	0 (0.0 %)	0.956 [a]
	II	14 (41.2 %)	11 (32.4 %)	
	III	19 (55.9 %)	23 (67.6 %)	
Fracture type	Intertrochanteric femur fracture	19 (55.9 %)	21 (61.8 %)	0.741 [a]
	Subtrochanteric femur fracture	5 (14.7 %)	3 (8.8 %)	
	Femur neck fracture	10 (29.4 %)	10 (29.4 %)	
Fracture side	Right	18 (52.9 %)	17 (50.0 %)	1.000 [a]
	Left	16 47.1 %)	17 (50.0 %)	
Type of surgery	Endoprosthesis	15 (44.1 %)	21 (61.8 %)	0.224 [a]
	PFN	18 (52.9 %)	13 (38.2 %)	
Anesthetist's comfort scale during spinal anesthesia	Bad	2 (5.9 %)	3 (8.8 %)	0.014 [a]
	Middle	8 (23.5 %)	19 (55.9 %)	
	Good	14 (41.2 %)	10 (29.4 %)	
	Very good	10 (29.4 %)	2 (5.9 %)	
Operation time (min)		119.5 ± 28.4	107.7 ± 29.3	0.097 [b]

ASA: American Society Of Anesthesiologists, ARIF: Arthroscopic reduction and internal fixation, PFN: Proximal femoral nail, a: Chi-square test (n / %), b: Independent samples T test (Mean ± SD), Min:Minumum

While SAB was found to be lower in Group-I at the preoperative time (p:0.007), there was no significant difference between the groups during the position and at the 5th minute after spinal anesthesia (p >0.05). The groups were similar in terms of DAB and heart rate (p >0.05). When the groups were compared in terms of SpO_2, they were found to be similar at the time of preoperative (p >0.05), while the SpO_2 values of the patients in Group-I were found to be higher during the position (p:0.002) and at the 5th minute after spinal anesthesia (p <0.001) (Table 2).

In comparisons between groups in terms of VAS scores; there was no statistically significant difference between the groups in terms of preoperative, 5th minute after spinal anesthesia, and postoperative 0th-hour VAS values (p >0.05). There was a statistically significant difference between the groups in terms

of VAS values during position (p:0.009), at postoperative 2nd, 8th, 16th, 24th hour, and their sum (p <0.001). The values in group II were higher in all cases where there was a difference (Figure 3). In group comparisons; It was found that there was a statistically significant difference between the VAS values at the preoperative, during the position, and 5th minute after spinal anesthesia in both groups (p < 0.05), and the values at the three measurement times in both groups were different from each other.

Table 2. Comparison of SAP, DAP, Pulse, and SpO_2

	Group I (n=34)	Group II (n=34)	p*
SAP (mmHg)			
Preoperative[1]	143.9±21.2	157.9±20.2	0.007
During position[2]	147.2±20.9	157.1±22.4	0.065
5 min after spinal anesthesia[3]	119.3±18.7	117.4±22.6	0.714
DAP (mmHg)			
Preoperative[1]	78.1±11.2	77.9±10.4	0.956
During position[2]	71.2±14.0	75.6±13.4	0.190
5 min After spinal anesthesia[3]	63.6±13.2	58.4±12.6	0.107
Pulse (min)			
Preoperative[1]	91.2±17.4	87.3±15.7	0.326
During position[2]	90.8±16.3	87.0±13.8	0.301
5 min after spinal anesthesia[3]	89.9±18.5	84.6±18.0	0.238
SpO_2 (%)			
Preoperative[1]	93.5±3.2	92.9±3.9	0.541
During position[2]	92.7±3.4	89.6±4.4	0.002
5 min after spinal anesthesia[3]	92.8±3.1	89.4±4.2	<0.001

Group I: PENG, Group II: Kontrol, *: Independent samples t Test (Mean ± SD), SAP: Systolic arterial pressure, DAP: Diastolic arterial pressure, SpO2: Peripheral oxygen saturation

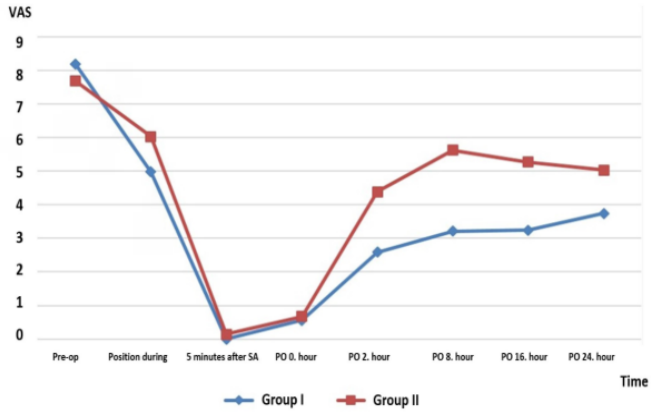

Figure 3. Comparison of VAS between groups. VAS: Visual analog scale, Pre-op: Preoperative, PO: Postoperative.

In intra-group comparisons of the postoperative period; It was found that there was a statistically significant difference (p < 0.05) in terms of VAS values between the measurement times in both groups. Post-hoc tests were applied to find out which time(s) the difference was. In both groups, postoperative 0th-hour values were found to be lower than the values at other times. In addition, it was found that there was a difference between the postoperative 2nd and 24th-hour VAS values in Group I, and between the postoperative 2nd and 8th-hour VAS values in Group II (Table 3).

In comparisons between groups; It was found that there was a statistically significant difference between the groups in terms of the first analgesic administration time in the postoperative period, and the amounts of paracetamol and tramadol consumed in the first 24 hours postoperatively (p <0.001). It was found that the first analgesic administration time was longer and the amounts of paracetamol and tramadol consumed in the first 24 hours were lower in patients in Group I (Table 4).

Table 3. Comparison of VAS between and within groups

VAS	Group I (n=34)	Group II (n=34)	p*
Preoperative	8.2±1.1	7.7±1.4	0.109
During position	5.0±1.6	6.0±1.6	0.009
5 min After spinal anesthesia	0.0±0.0	0.1±0.9	0.325
p**	<0.001	<0.001	
Difference	All	All	
Postoperative 0th hour [1]	0.6±1.0	0.7±1.0	0.634
Postoperative 2nd hour [2]	2.6±1.7	4.4±2.0	<0.001
Postoperative 8th hour [3]	3.2±1.3	5.6±1.6	<0.001
Postoperative 16th hour [4]	3.2±1.6	5.3±1.3	<0.001
Postoperative 24th hour [5]	3.7±1.2	5.0±1.1	<0.001
p**	<0.001	<0.001	
Difference	1 with others 2 with 5	1 with others 2 with 3	
Sum of VAS scores at five separate times	13.4±4.6	21.1 ± 3.9	<0.001

Group I: Peng, Group II: Kontrol, VAS: Visual analog scale, *: Independent Samples T test (Mean ± SD), **: Repeated measures anova (Mean ± SD)

Tablo 4. Comparison of the first analgesic administration time in the first 24 hours postoperatively, the average amounts of paracetamol-tramadol consumed, and the doses of paracetamol-tramadol administered between the groups

Postoperative First 24 Hours		Group I (n=34)	Group II (n=34)	p
Time to first analgesic		9.0 ± 6.7	3.7 ± 2.1	<0.001 a
Paracetamol amount	1 gr	12 (%35.3)	0 (%0.0)	<0.001 b
	2 gr	22 (%64.7)	28 (%82.4)	
	3 gr	0 (%0.0)	6 (%17.6)	
Total paracetamol amount (gr)		1,6 ± 0.5	2.2 ± 0.4	<0.001 a
Tramadol amount	0 gr	21 (%61.8)	3 (%8.8)	<0.001 b
	100 mg	9 (%26.5)	7 (%20.6)	
	200 mg	4 (%11.8)	24 (%70.6)	
Total tramadol amount (mg)		50 ± 70.7	161.8 ± 65.2	<0.001 a

Grup I: PENG, Grup II: Kontrol, A: Independent samples t test (Mean ± SD), b: Chi-square test (n / %)

DISCUSSION

In this study performed on patients who will be operated under spinal anesthesia due to hip fracture, it has been observed that PENG block reduces the pain that may occur due to the fracture during the position and in the postoperative period. In addition, it has been observed that patients need less additional analgesia in the postoperative period with this application. In addition, thanks to the PENG block, the comfort of the anesthetist who applies the spinal anesthesia increases due to giving the patients a more comfortable position.

Hip fracture is a traumatic condition that is usually treated with neuraxial anesthesia techniques and is mostly seen in elderly patients. It causes severe pain both in the lateral position of the patients during neuraxial anesthesia and in the postoperative period. Pain control may affect the success of the neuraxial anesthesia method in the lateral position. In addition, successful pain management in the postoperative period shortens the discharge time and contributes positively to postoperative patient outcomes.[12] Regional techniques are generally preferred for pain management in hip fractures, as the patient population is at risk for the adverse effects of opioids and nonsteroidal anti-inflammatory drugs (NSAIDs), including cognitive impairment, respiratory depression, gastrointestinal complications, and renal dysfunction.[8,13,14] One of the main goals of anesthesia in hip fracture surgery is to limit the use of opioid-based drugs in perioperative pain management while providing position-dependent and postoperative pain control during spinal anesthesia application.[15]

Regional analgesia techniques are widely used because they limit the use of opioids in perioperative hip fracture

analgesia and provide relatively effective, effective, and safe analgesia. Perioperative regional analgesia methods have been recommended in perioperative pain management since the 1990s, and fascia iliaca block, femoral nerve block, and 3-in-1 femoral nerve block are used for this purpose. A recent Cochrane study of nerve blocks for hip fractures, which included fascia iliaca block, femoral nerve block, and 3-in-1 femoral nerve block, showed high-quality evidence supporting a reduction in dynamic pain within 30 minutes post-block. However, no analgesic superiority of any of these techniques over the other has been demonstrated.[16]

Although each of these blocks alone provides a certain level of perioperative analgesia for hip fractures and positively affects patient outcomes, it has been discussed in the literature that these blocks do not cover all the nerves associated with hip fracture and cause varying degrees of quadriceps weakness due to the involvement of the femoral nerve. To summarize these discussions; Although femoral nerve block has been shown to provide effective postoperative analgesia, it has also been associated with postoperative quadriceps muscle weakness. This may cause a delay in mobilization and recovery times.[17–19] The fascia iliaca block has been defined as a suitable alternative with less apparent quadriceps weakness due to injection at a point farther from the femoral nerve.[20] However, it has been reported in the literature that it causes moderate quadriceps weakness and does not provide effective analgesia after hip arthroscopy.[21] 3-in-1 femoral block, which was not as effective as the fascia iliaca block before the use of USG, has been shown to be as effective as the fascia iliaca block with the initiation of the use of USG.[22,23]

Femoral nerve block and fascia iliaca block have shown good results for post-surgical analgesia. However, the obturator nerve and accessory obturator nerve should also be targeted to achieve more effective perioperative pain control.[24,25] The anterior hip capsule is innervated by the obturator nerve, the accessory obturator nerve, and the femoral nerve. These three nerves should be targeted to provide analgesia in hip fractures.[11] Short et al.[26] confirmed the innervation of the anterior hip by these three nerves in a recent anatomical study. It also found that the accessory obturator nerve and the femoral nerve play a larger role in anterior hip innervation than previously reported.[9]

The branches from the femoral nerve and accessory obturator nerve are located between the anterior inferior iliac spine (AIIS) and the iliopubic eminence (IPE), while the obturator nerve is located close to the inferomedial acetabulum. Using this information, Girón et al.[11] described a new regional anesthetic technique, which they named pericapsular nerve group (PENG) block, for pain control on hip fractures. In this study conducted on five patients, a significant decrease in pain scores was found in patients without quadriceps muscle weakness. Orozco et al.[15] demonstrated successful perioperative pain control using the PENG block technique in five patients who underwent hip arthroscopic surgery.

Although peripheral nerve blocks are widely used for perioperative analgesia for hip fracture surgery, the effectiveness of each is a matter of debate, so new blocks continue to be investigated. PENG block is a block that has just started to be applied and is becoming more common in clinical use. Although PENG block has been shown to be effective in postoperative analgesia for hip fracture surgery, we did not find any randomized controlled studies investigating the perioperative pain characteristics, including the postoperative period, as well as the preoperative application of the PENG block for neuroaxial anesthesia and positioning during spinal anesthesia. We found only studies in which case series were collected on this subject.[11,27] This study, it was aimed to investigate the effectiveness of PENG block in pain management starting from positioning for spinal anesthesia and up to the first 24 hours postoperatively for hip fracture surgery under unilateral spinal anesthesia.

The results of our study showed that PENG block provides more effective analgesia than the sedoanalgesia method applied with fentanyl at doses specified in the literature during spinal anesthesia positioning.[28] In accordance with the literature, it was determined that it is necessary to provide analgesia during the position while applying spinal anesthesia, PENG block application provides analgesia, albeit partial, and this application is more effective than the frequently used fentanyl analgesia. Acharya et al.,[27] in their study on 10 patients, found the average pain score of 7.5 before the block to 1.2 when the spinal anesthesia position was given. In our study, we found that the mean pain score, which was 8.2 before the PENG block, decreased to 5 during the pre-spinal anesthesia position. As shown in the literature, we preferred unilateral spinal anesthesia to traditional spinal anesthesia because it has fewer hemodynamic side effects.[29] In our study, we found that the VAS score decreased significantly during position with the effect of the PENG block. Unlike the literature, the pain scores we detected were higher. The reason for this difference may be that, unlike Acharya et al.,[27] we placed the lateral position (for unilateral spinal anesthesia using low dose local anesthetic to provide hemodynamic stability) with the fractured side down instead of the traditional spinal anesthesia position in our study. In this regard, new studies are needed to evaluate the analgesic efficacy of PENG block in different spinal anesthesia positions.

In our study, we observed that the need for total sedoanalgesia before spinal anesthesia was less in the PENG block group, and we found that early peripheral oxygen saturations during spinal anesthesia were significantly higher in this group compared to the control group. In addition, we found that the comfort level reported by the anesthetists during spinal anesthesia was more positive in the PENG group. Anesthetists in the PENG block group reported that they performed a more comfortable spinal anesthesia application. The reason for this difference may be that the patients in the control group could not be effectively positioned due to sedation and impaired cooperation due to higher position-related pain levels. The reason for the decrease in saturation values, albeit minimally, in the control group may be opioid-related respiratory depression, which is also mentioned in the literature in the elderly patient group.[13,14]

Hwang et al.[31] show that approximately 36% of hip fractures do not receive any analgesia, and opioids are used in 57%.30 Foss et al. showed that regional analgesia techniques were

more effective in reducing dynamic pain compared to systemic opioids and that similar results were obtained with regional analgesia techniques and opioids in pain at rest.

The prevalence of delirium after hip fracture surgery was found to be 40% with the effect of opioid narcotics.[32] Lee et al.[33] found that the 1-year mortality rate was almost 2 times higher in patients with dementia or delirium after hip fracture. Despite the known adverse effects of opioid analgesia in the vulnerable elderly population, schepis and McCabe published findings from the National survey on Drug Use and Health that showed a sustained increase in opioid use in the older adult population.[34]

The morbidity and mortality associated with delirium are being struggled with. Alternatives to opioids are being explored, including various nerve blocks and systemic treatments such as methylprednisolone, to control pain in elderly hip fracture patients.[35,36]

A Cochrane study concluded that the use of peripheral nerve blocks made no difference in pain relief, length of hospital stay, or patient satisfaction compared to a neuraxial block.[37]

In Freeman and Clarke's extensive literature review, it was emphasized that analgesia in the elderly population should be focused on minimizing risk factors for delirium, including pain and constipation side effects. They found that fascia iliaca block is safe and easy to apply in the elderly population, reduces the need for opioids, and is effective in reducing pain and preventing delirium.[38] Bang et al.[39] conducted a prospective, randomized study in postoperative hemiarthroplasty patients who received patient-controlled analgesia versus fascia iliaca block and found that VAS scores were similar in both groups, but opioid use was significantly lower in the block group.

There is limited literature comparing PENG block with other regional anesthesia techniques for postoperative analgesia of hip fractures. Lin et al.[40] compared PENG and femoral block for postoperative analgesia in hip fractures. In this single-center randomized controlled double-blind study, it was found that patients who underwent PENG block had lower pain scores than patients who underwent femoral block.

Bhattacarya et al.[41] compared the onset of analgesia and total analgesia time of PENG block and fascia iliaca block in their study on 50 patients with femoral neck fractures. They found that PENG block had a faster onset of pain control compared to fascia iliaca block in patients with femoral neck fractures, however, it was almost equally effective (mean 10 hours) in terms of block duration in both groups. In our study, we found that VAS scores at the 2nd, 8th, 16th, and 24th hours in the postoperative period were significantly lower in patients who underwent PENG block compared to the control group and that the total amount of paracetamol and tramadol consumed in the postoperative period was significantly lower. We found that the PENG block group was significantly later than the control group at the time of first dose analgesic administration in the postoperative period. This result shows us that PENG block provides effective analgesia in the postoperative period in hip fractures and can be used to reduce opioid consumption. More randomized controlled trials are needed on the efficacy of PENG block. We think that the PENG block is an easily applicable field block because spina iliaca anterior superior, iliopubic eminence and psoas tendon are easily identifiable sonographic points. In our study, no serious adverse events such as permanent nerve damage, major vascular damage, or local anesthetic systemic toxicity were observed after PENG block, which is quite satisfactory.

PENG block may have potential advantages over traditional regional analgesia techniques such as femoral nerve or fascia iliaca blocks for hip fracture operations. One of these potential advantages may be more extensive blocking of the sensory nerves that innervate the hip. Due to this feature, it can provide more effective analgesia in perioperative analgesia. This situation increases patient satisfaction and postoperative i.v. may lead to decreased consumption of analgesics and/or opioids. It can be used as part of perioperative multimodal analgesia, which ultimately results in effective but less adverse events. In addition, if studies with large patient numbers confirm the absence of quadriceps weakness after PENG block, this may contribute to early postoperative recovery by enabling early mobilization of patients.

This study has some limitations. First of all, our study is single-centered. Therefore, we cannot generalize to the whole population. Therefore, multicenter studies may give better results in this regard. Second, pain monitoring was limited to 24 hours. Prospective randomized studies at 48 and 72 hours postoperatively may be appropriate to evaluate the longer-term analgesic efficacy.

CONCLUSION

In this study, we found that patients who underwent PENG block had reduced pain during spinal anesthesia positioning and lower VAS scores while providing less opioid consumption in the postoperative period. This study shows that PENG block is promising as a viable and perioperative analgesia technique. In the light of all this information, randomized controlled studies are needed to compare PENG block with blocks such as femoral nerve block and fascia iliaca block. We believe that this study will lead to the proliferation of studies using PENG blocks and contribute to its use in clinical practice.

ETHICAL DECLARATIONS

Ethical approval

The study was carried out with the permission of Ethics Committe of the Ankara Bilkent City Hospital (Date: 24.02.2021, Decision No: E2-21-200).

Informed Consent

All patients signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

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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