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Original article

Pericapsular Nerve Group Block for Postoperative Analgesia in Patients Undergoing Total Hip Arthroplasty

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ABSTRACT

Background: Total hip arthroplasty (THA) is a common surgery that is associated with moderate to severe pain. Optimal pain relief is essential for functional recovery and outcome and reducing the immobility related complications after surgery. Our study aimed to achieve of better postoperative analgesia in patients undergoing total hip arthroplasty using ultrasound Pericapsular Nerve Group block, our primary outcome was Postoperative pain score while secondary outcome was First time to rescue analgesia, motor recovery of the hip joint and degree of patient satisfaction.

Methods: This study included 64 patients undergoing total hip arthroplasty at Zagazig University Hospitals. Patients divided into 2 equal groups: patients received standard general anesthesia, and patients received GA then receive an ultrasound guided PENG block following anesthesia induction and before initiation of surgery. Anesthesia was induced with fentanyl 1 mcg/kg, propofol (2-3 mg/kg) and rocuronium (0.7 mg/kg) for intubation, cuffed endotracheal tube (ETT) was inserted and mechanical ventilation was adjusted using tidal volume (6-8 ml/kg) after induction of anesthesia.

Results: Post-operative pain at rest and movement was statistically significant increase in NRS in control group compared to PENG group. The time of 1st rescue analgesia was significantly longer in PENG group than control group. There was statistically significant decrease in nalbuphine consumption in PENG group in comparison with control group. According to duration of motor block, there was not statistically significance difference between the two studied groups.

Conclusions: Ultrasound guided PENG block is an effective method for postoperative analgesia in patients undergoing total hip arthroplasty as it prolongs time to first rescue analgesia, decreases postoperative pain scores, without significant effect on motor power or the incidence of complications.

Keywords: Total Hip Arthroplasty; Postoperative Analgesia; Pericapsular Nerve Group Block

INTRODUCTION

The typical major surgical treatment referred to as total hip arthroplasty also helps patients' functional status and health-related quality of life **(1,2)**. Even so, there is a chance that the acute phase following surgery will result in excruciating pain, which will prolong hospital stays and postpone mobilization while raising the risk of thromboembolic events **(3)**.

Various regional anesthesia procedures have been employed to address postoperative pain, such as fascia iliac block, lumbar plexus block, parasacral block, femoral, obturator, and sciatic nerve block. But these methods could come with drawbacks including epidural hematoma, headache after

surgery, or prolonged motor block, which would postpone hospital discharge **(4,5)**.

In comparison with the infra-inguinal technique, the supra-inguinal fascia iliaca compartment block (FICB) offers better spread beneath the fascia iliaca while deposing local anaesthetic more cranially **(6)**. But obturator nerve block has not been clinically established, even with these favourable results. **(7)**. Additionally, there is a possibility that the supra-inguinal FICB might suffer quadriceps weakness, which might prevent early ambulation **(8)**.

The femoral, accessory, and obturator nerves innervate the anterior hip capsule. The inferomedial acetabulum and iliopubic eminence have been proposed as pertinent anatomical landmarks to block the articular branches from these three nerves, according to current anatomical investigations. Furthermore, it has been observed that the femoral nerve and the auxiliary obturator nerve play a larger role in the innervation of the anterior hip **(7)**.

An ultrasound-guided method known as the pericapsular nerve group (PENG) block is used to block the articular branches of the femoral, obturator, and auxiliary obturator nerves, which supply sensory innervation to the anterior hip capsule **(8)**. Covering the sensory neurons feeding the anterior hip without impairing quadriceps motor blockade a documented side effect of fascia iliaca and femoral blocks analgesia during elective hip surgery **(9)**.

Therefore, this study aimed to achieve of better postoperative analgesia in patients undergoing total hip arthroplasty using ultrasound Pericapsular Nerve Group block.

METHODS

This randomized clinical trial included 64 patients of both sexes admitted to Zagazig university hospital for total hip arthroplasty. They were classified into 2 groups:

- Control group (n=32) patients received standard general anesthesia.
- PENG group (n=32) patients received general anesthesia then receive an ultrasound guided PENG block following anesthesia induction and before initiation of surgery.

Sample Size:

Assuming the mean time to first walk was 22.2 ± 9.6 hour. Vs 32.4 ± 10.6 hour in intervention vs control group. At 80% power of test and 95% confidence level, the estimated sample was calculated by Open Epi info program to be 64 patients (32 subjects in each group) **(2)**.

Inclusion criteria:

Patient with American Society of Anesthesiologists (ASA) I, II aged 21 to 60 years, of both sexes and BMI between 18.5 to 32 (kg/m²). Type of operation was an elective unilateral total hip arthroplasty under general anesthesia not exceeding two hours.

Exclusion criteria:

Patient with advanced cardiac, renal, hepatic disease. Contraindication of regional anesthesia (allergy, infection or coagulopathy). Patients with pre-existing neurologic or anatomic deficits in the lower extremities. Patients who have dementia or cognitive impairment with difficulties in pain evaluation. Patients with Chronic use of analgesia or drug dependence.

- **Anesthetic technique:**

Preoperative assessment was carried out through history taking, clinical examination and laboratory investigations (complete blood count, PT, PTT, INR, liver and kidney function tests). The study protocol and U.S guided PENG block procedure had been explained to all patients as well as numeric rating scale (NRS) score (0: no pain and 10: worst pain) **(10).**

All patients were kept fasting for about 6 -8 hours before operation. Venous access by introducing a 18-gauge (IV) cannula was secured in the contralateral side of surgery. Lactated ringer (8-10 ml / kg) was started to be infused for replacement of the overnight fasting **(11).**

On arrival at operation room, routine monitoring of heart rate by 5 leads ECG, noninvasive blood pressure (NIBP), pulse oximetry & capnography was done. Basal vital data heart rate (HR), mean arterial blood pressure (MAP), peripheral oxygen saturation (SpO2) & end tidal CO_2 were measured and recorded

- **Intraoperative management**

Fentanyl (1 mcg/kg), propofol (2–3 mg/kg) for induction, and rocuronium (0.5–0.9 mg/kg) for intubation were the standard forms of general anesthesia administered to all patients. A cuffed endotracheal tube (ETT) was placed, and mechanical ventilation was adjusted using tidal volume (6–8 ml/kg) and appreciated respiratory rate to achieve end tidal CO2 (EtCO2) between 30-35 mmhg. While the P group underwent conventional anesthesia before the block was carried out, the GA group only received general anesthesia.

The ultrasound machine (US GE model LOGIQ p7, "2.5 Mhz to 7.5 Mhz"), gauze, skin gel, plaster, 22-gauge spinal needle, 20 ml syringe, and bottle of

0.5% bupivacaine are among the equipment in the block.

The PENG block technique was used after the induction of anesthesia but before to the start of the surgical procedure. The ultrasound GE LOGIC P7, a curvilinear low-frequency ultrasound probe, was positioned across the line parallel to the inguinal ligament in the PENG group. After that, it turned 45 degrees to reveal the psoas tendon, the iliopubic eminence, and the anterior inferior iliac spine, a total volume of 20 mL of bupivacine 0.25% was injected.

Anesthesia maintenance during surgery in both group:

- Isoflurane 1-2% in O2 and rocuronium (0.1-0.2 mg/kg) maintenance dose, guided by nerve stimulator and Capnography. IV crystalloids will be administered based on patient weight (4 ml/kg for the first 10 kg of BW + 2 ml/kg for the second 10 kg of BW + 1 ml / kg for the remaining BW).
- After the procedure, isoflurane was stopped, and the patients were given neostigmine 0.05 mg/kg and atropine 0.02 mg/kg to reverse the effects. Following the extubation criteria, which included self-extubation attempts, full reversal of neuromuscular blockade with minimal coughing, and regular spontaneous respiration (regular spontaneous respiratory rate > 6 & < 30, spontaneous tidal volume > 5 mL/kg and SpO2 > 92% on room air), the patients were taken to the post-anesthesia care unit.
- Vital data (HR, MAP & SPO_2) were continuously monitored through operation and recorded after intubation, at surgical incision recorded every 15 minutes till end of surgery.
- If there was an increase in HR or MAP by 20% above the baseline for two consecutive readings, it was be considered as inadequate analgesia and it was managed by increasing the depth of anesthesia and IV fentanyl (0.5 µg/kg).
- Hypotension (MAP decreased > 20% of basal reading) was treated by IV fluids and/or ephedrine (5mg bolus). Bradycardia (HR decreased >20% of basal reading or HR ≤ 60/min) was corrected by confirmation of adequate oxygenation, atropine 1mg IV increments up to 3 mg and or ephedrine 5 mg IV increments when associated with hypotension.
- Total amount of fentanyl and maximum percentage of inhaled isoflurane intraoperatively used were calculated and recorded.

- **Postoperative management**

1. Patients were deemed eligible for discharge to the surgical word if they scored ≥ 9 on the modified Aldrete grading scale.
2. All patients in both groups received postoperative analgesia (acetaminophen 1 gm IV/8 h), and nalbuphine 0.25 mg/kg i.v. was administered as a rescue analgesic if the numerical rating scale (NRS) was 3.
3. Using a 0–10 NRS (0 no pain, 10 worst imaginable agony), patients were asked to report their perceived pain at rest and during 45° passive flexion of the hip at all postoperative time periods (0, 2, 4, 6, 8, 12, 18, & 24 hours postoperative).
4. The time of first rescue analgesia was recorded and the total nalbuphine consumption in first 24 hour was calculated.

RESULTS

There was no statistically significant difference ($p < 0.05$) between the two studied groups of included patients. The baseline characters of included patients were illustrated in **Table (1)**. From the start of the surgical incision until 75 minutes afterward, BP was higher in control groups than in PENG group. Moreover, BP was higher in control groups than in PENG group 95 minutes after the surgical incision. There was no statistically significant difference between both groups in Post-operative Hospital stay. Control group showed a significant increase in total amount of post-operative nalbuphine in the 1st 24h (27.66±7.62 mg) compared with PENG group (14±4.71mg). Repeated measurement of heart rate during THA showed a significant increase in control group compared with PENG groups from the start of the surgical incision until 115 minutes afterward **(Table 1)**.

Total amount of fentanyl (mic) used intraoperative, and percentage of inhaled isoflurane were higher in control group than in PENG group. Comparing both group post-operative measurement of blood pressure was lower in PENG group compared with control group. Comparing both group post-operative measurement of heart rate was lower in PENG group compared with Control group **(Table 2)**.

Assessment of post-operative pain using NRS after THA showed a significant increase in control group compared with PENG groups at all measuring periods **(Table 3)**. Post-operative NRS measurement in both groups at movement indicate a statistically significant difference between both groups **(Table 4)**.

Kaplan meier analysis revealed that, control group showed a significant decrease in first time to request

analgesia (2.86±0.28 hour) compared with PENG group (28.2±0.7 hour). Control group showed a significant increase in time for ability to walk (19.18±0.56 hr) compared with PENG group (13.5±.424 hr) **(Table 5)**.

Assessment of motor recovery of the hip joint showed a significant increase in PENG group compared with control groups 12 hours and 24 hours after THA **(Table 6)**.

There was significant decrease of incidence of postoperative nausea and vomiting in PENG group compared to control group. But there were insignificant differences between the two groups as regards bradycardia, hypotension and Respiratory depression in Post-operative Complications (p>0.05) **(Table 7)**.

Table (1): Demographic and Intraoperative data among the studied groups

	Control group (n=32)	**PENG group (n=32)**	MD	P value
Age(years)	48.5±7.36	48.03±6.69	0.469	0.79
BMI(kg/m^2)	27.08±1.70	27.5±1.80	-0.425	0.33
Sex				
male	15 (46.9%)	16(50.0%)	0.063	0.802
female	17(53.1%)	16(50.0%)		
ASA			.251	.616
I	14(43.8%)	16(50.0%)		
II	18(56.3%)	16(50.0%)		
Duration of surgery	110.8±7.20	109.69±8.3	-0.406	0.083
MAP	89±6.76	87.78±5.98	1.125	0.565
Baseline	86.81±7.18	83.44±6.74	3.38	0.054
After Intubation	89.72±7.17	79.97±7.02	9.750*	0.000
At Surgical Incision	86.22±9.25	81.78±6.32	4.437*	0.011
After 15 Min	86.56±9.29	82.59±5.16	3.969*	0.024
After 30 Min	86.25±9.73	81.31±5.16	4.938*	0.005
After 45 Min	87.19±8.03	82.28±5.33	4.906*	0.005
After 60 Min	86.91±7.95	83.06±4.78	3.844*	0.028
After 75 Min	87±6.54	83.13±6.03	3.871*	0.028
After 90 Min	86.58±6.97	84±5.42	2.58	0.189
After 105 Min	81.75±5.56	85.40±3.65	-3.65	0.437
After 120 Min	81.75±5.56	85.40±3.65	-3.65	0.437
After 120 Min				
HR	91.03±10.33	91.06±9.96	1.218	0.448
Baseline	89.16±10.69	89.41±7.15	-0.250	0.909
After Intubation	95.06±10.10	85.22±7.57	9.844*	**0.000**
At Surgical Incision	95±9.43	81.63±7.59	13.375	**0.000**
After 15 Min	88.72±11.24	82.66±5.96	6.063*	**0.005**
After 30 Min	89.31±11.68	81.94±6.98	7.375*	**0.001**
After 45 Min	88.34±12.33	82.34±6.50	6.000*	**0.006**
After 60 Min	88.31±9.53	83.09±6.82	5.219*	**0.017**
After 75 Min	88.84±9.50	84.26±6.39	4.586*	**0.037**
After 90 Min	90.15±8.39	84.28±6.74	5.874*	**0.016**
After 105 Min	91.75±6.70	83.8±7.09	7.950	0.173
After 120 Min				

Data were represented as mean ± SD; P > 0.05: non-significant (NS); P < 0.05: significant (S)*
MAP: mean arterial blood pressure; HR: heart rate

Table (2): Postoperative valuations among the studied groups

	Control group	PENG group	MD	P value
Total amount of fentanyl (ug)	132.19±32	111.88±20.39	20.31	**0.004**
Inhaled isoflurane	1.84±0.17	1.43±0.11	0.409	**0.000**
Postoperative BP	87.25±5.34	82.41±5.47	4.844*	**0.001**
2 hours	87.00±5.06	82.59±4.84	4.406*	**0.001**
4 hours	88.06±5.27	82.75±4.41	5.313*	**0.000**
6 hours	86.63±6.59	82.94±4.29	3.688*	**0.010**
8 hours	86.06±5.25	82.84±3.33	3.219*	**0.005**
12 hours		83.97±3.52	3.344*	**0.004**
24 hours	87.31±5.20			
Postoperative HR	89.44±10.69	86.28±7.03	3.16	0.17
2 hours	90.66±9.14	87.19±6.69	3.47	0.09
4 hours	90.06±9.90	86.94±6.07	3.13	0.13
6 hours	90.91±10.34	87.75±6.38	3.16	0.15
8 hours	88.56±9.89	87.88±6.61	0.69	0.74
12 hours	90.31±8.56	87.91±6.62	2.41	0.21
24 hours				
Post-operative nalbuphine 1st/24h (mg)	27.66±7.62	14±4.71	13.656	**0.000**
Post-operative Hospital stay	3.218±.906	2.87±.707	.34375	0.096

Data were represented as mean ± SD; P > 0.05: non-significant (NS); P < 0.05: significant (S)*

Table (3): Postoperative NRS measurement among the studied groups at rest

	Control group Mean±SD	**PENG group** Mean±SD	MD	P value
Zero	2.84±0.77	1.31±0.59	1.531*	**0.000**
2 hours	3.16±1.08	1.56±0.67	1.594*	**0.000**
4 hours	2.90±1.08	1.72±0.85	1.281*	**0.000**
6 hours	2.41±0.98	2.09±0.89	1.313*	**0.000**
8 hours	2.72±1.17	2.09±0.73	1.625*	**0.000**
10 hours	٣,٢٩±٠,٦٥	2.٦٩±٠,٨٥	٠,٦*	**0.00٢**
12 hours	2.69±0.97	2.13±1.01	1.563*	**0.000**
18 hours	2.٩٤±٠,٦١	2.٤٣±٠,٥٩	٠,٥١*	**0.00١**
24 hours	2.81±1.15	2.41±0.76	1.781*	**0.000**

Data were represented as mean ± SD; P > 0.05: non-significant (NS); P < 0.05: significant (S)*

Table (4): Postoperative NRS measurement among the studied groups at movement

	Control group	**PENG group**	MD	P value
	Mean±SD	Mean±SD		
zero	2.98±.6	1.5±.627	1.470*	**.000**
2 hours	3.25±1.03	1.9٣±.57	1.327*	**.000**
4 hours	2.8٣±.94	1.68±.657	1.144*	**.000**
6 hours	2.63±.82	2.16±.55	.473*	**.009**
8 hours	2.68±.96	2.24±.536	.442*	**.027**
10 hours	2.80±.67	2.417±.438	.386*	**.009**
12 hours	2.74±.874	2.18±.917	.562*	**.015**
18 hours	2.82±.87	2.18±.531	.638*	**.001**
24 hours	2.58±1.09	2.09±.575	.494*	**.027**

Data were represented as mean ± SD; P > 0.05: non-significant (NS); P < 0.05: significant (S)*

Table (5): First time to request analgesia (hour) and time for ability to walk

	Control group		**PENG group**		**P value**
	Mean ±SE	**95% CI**	**Mean ±SE**	**95% CI**	
First time to request analgesia (hrs)	2.86±0.28	2.3, 3.4	28.2±0.7	14.9, 31.02	**0.00**
Time for ability to walk (hrs)	19.18±0.56	18.097, 20.278	13.5±.424	12.67, 14.33	**0.00**

Kaplan-Meier analysis, SE: standard error, CI: confidence interval

Table (6): Measurement for motor recovery of the hip joint (degree) among the studied groups

	Control group (n=32)	**PENG group (n=32)**	MD	P value
	Mean±SD	Mean±SD		
At 6 hours	17.81±2.37	16.59±2.31	1.2٢*	**0.042**
At 12 hours	27.03±3.16	30.41±4.51	-3.3٨*	**0.001**
At 24 hours	36.36±3.47	59.94±4.93	-23.5٨ *	**0.000**

Data were represented as mean ± SD; P > 0.05: non-significant (NS); P < 0.05: significant (S)*

Table (7): Post-operative Complications among the studied groups

	Control group (n=32)	**PENG group (n=32)**	Exact fisher test or Chi-sqaure	P value
Nausea & vomiting	11(34.4%)	6(18.75%)	2.005	0.15
hypotension	1(3.1%)	3(9.7%)	1.137	.355
Tachycardia	6(18.8%)	1(3.1%)	4.01	.104
bradycardia	0(0.0%)	0(0.0%)	----	----
Respiratory depression	4 (12.5%)	3 (9.37%)	٠,١٦	٠,٩٨

Data were represented as number and percentage (cross-tabulation and Exact fisher test)

DISCUSSION

After hip replacement surgery, pain management increases patient satisfaction and comfort and makes it possible for patients to fully engage in rehabilitation, which enables an earlier return home and lessens the strain on resources **(10,11)**.

A newly developed localized analgesic technique called the pericapsular nerve group block (PENG block) can lessen pain perception without impairing motor performance **(12,13)**.

The present study showed that the PENG group provided effective and long-lasting postoperative analgesia during rest and movement than control group, the time to first rescue analgesic requirement was significantly increased in PENG group compared to control group, the total dose of nalbuphine consumed in the 1st 24 hours was significantly decreased in PENG group. As well, there was no motor blockage nor quadriceps muscle affection, there was insignificant difference between both group in time to first sit and time to do active exercise but there was significant decrease in time to stand and walk in PENG group compared to control group.

The results of the present study strongly indicate that the implementation of PENG block in conjunction with general anesthesia give a notable advantage in terms of maintaining hemodynamic stability during THA procedures. The group receiving PENG block exhibited more modest increases in heart rate and blood pressure during critical intraoperative phases. These results highlight the potential of PENG block to attenuate the sympathetic response to surgical stimuli and contribute to enhanced cardiovascular stability during THA procedures.

These findings align with previous research that has also underscored the role of regional anesthesia techniques, such as peripheral nerve blocks, in mitigating hemodynamic responses to surgical stress. For instance, a study by **Memtsoudis et al. (14)** proved that peripheral nerve blocks for lower limb surgery patients resulted in less hemodynamic fluctuations and a decreased need for intraoperative vasopressors support **(15).** Similarly, **Smith et al. (16)** observed a consistent pattern of increased hemodynamic stability in patients undergoing nerve blocks during their examination of regional anesthesia for significant orthopedic surgeries **(2)**. Together, these studies support our own findings and point to an increasing body of evidence supporting the advantages of regional anesthesia techniques for cardiovascular health in surgical procedures.

While the current study emphasizes the potential hemodynamic benefits of PENG block with general anesthesia, it is important to acknowledge that conflicting evidence exists within the literature. An investigation by **Morrison et al. (17)** found little evidence to indicate a significant reduction in hemodynamic responses with nerve blocks when studying the effects of regional anesthesia in joint replacement procedures. The study's findings revealed that although regional anesthesia might have some effect on cardiovascular stability, it might not have as much of an overall effect as previously believed.

Additionally, **White et al. (18)** questioned whether the benefits of regional anesthesia, including nerve blocks, are consistently beneficial to the cardiovascular system (19). These divergent viewpoints emphasize the necessity of more investigation and careful examination to completely clarify how regional anesthesia affects hemodynamics.

In consistence with our results, **Remily et al. (20)** who evaluated no block with pericapsular nerve group (PENG) block. However, fascia iliaca block was given to both groups. Retrospective in nature, the study involved 96 patients (each with 48 subjects).

The study showed that, in comparison to the control group, the PENG group's postoperative pain scores were significantly lower. In addition, compared to the control group, patients who received the PENG block had a longer therapeutic window before needing their first opioid. Additionally, the PENG group's overall nalbuphine requirement was much lower.

In terms of walking, the PENG group's time to ambulation was shorter and their initial walking distance was greater, enabling patients to be discharged more quickly and properly. According to the study, there were comparable complications in both groups.

In addition, **Pascarella et al. (2)** examined the effects of pericapsular nerve group (PENG) block versus no block on patients receiving total hip

replacement regarding postoperative analgesia and functional recovery. During the first 48 hours following surgery, patients undergoing PENG block had lower maximum pain scores than the control group overall. Additionally, while 10 patients (33%) in the PENG group did not take any sufentanil tablets, every patient in the control group did. In addition, the PENG group's consumption of opioids was significantly lower than that of the control group. Furthermore, in comparison to the control group, the PENG group had a considerably longer period before needing rescue analgesia.

Furthermore, PENG group had no motor block postoperatively as same as the control group and no quadriceps muscle weakness in both groups. In addition, PENG group had significant shorter time to ambulation (time to first walk) with better range of hip motion compared to control group. Lastly, there was no difference in the incidence of postoperative complication.

Also, **Aliste et al. (21)** compared suprainguinal fascia iliaca compartment block (FICB) and PENG block in total hip arthroplasty. Forty people (20 patients in each group) participated in a prospective, randomised, double-blind trial. 48 hours after surgery, it was stated that both groups' static and dynamic pain levels were similar. Regarding the total amount of opioids consumed at 24 and 48 hours as well as opioid-related side effects, there were no clinically significant differences between the two groups. In contrast to supra-inguinal FICB, quadriceps motor block was less common at 3 and 6 hours after THA when PENG block was used.

Moreover, Natrajan **et al. (19)** evaluated the effectiveness of fascia iliaca compartment (FIC) block over pericapsular nerve group (PENG) block. In both groups, there was a significant decline from the baseline NRS ratings. In comparison to the FIC block group, the initial rescue analgesia arrived much later in the PENG block group. Nevertheless, neither group's adverse effects nor the overall dosage of rescue analgesia were statistically significant.

Also, **Jadon et al. (22)** examined the simplicity of placement during spinal anesthesia between pericapsular nerve group block and supra-inguinal fascia iliaca block. 66 patients were randomly assigned to receive a PENG block or an S-FICB block (33 patients in each group). The NRS score in the PENG group was considerably lower at rest, during movement, and while positioning for spinal anesthesia thirty minutes after the block than in the S-FICB group. Additionally, the NRS ratings during rest and activity were similar, with the exception of a significant drop in PENG block after 12 hours and a significant decrease in fascia iliaca block at 24 hours. Additionally, the patient's happiness, the length of the analgesic, and the rescue analgesic doses were all comparable. No block-related problems were noted by any of the patients.

Allard et al. (23) examined 42 individuals (21 in each group) between femoral nerve block and PENG block. Regarding the overall amount of morphine taken or the postoperative pain scores, there is no discernible difference between the two groups. In addition, the PENG group's quadriceps muscular power was significantly preserved when compared to the femoral nerve block group; nevertheless, the two groups' times to take their first steps did not differ statistically significantly. This can be explained by the fact that physiotherapists did not mobilize patients following THA until 48 hours following the end of the block effect. Furthermore, no statistically significant variation in the incidence of surgical side effects was found.

Moreover, **Hua et al. (24)** compared the analgesic effects of fascia iliaca block against pericapsular nerve group (PENG) block in elderly patients with femoral neck fractures undergoing hip arthroplasty. 48 patients were involved in the study (24 in each group). When comparing the PENG block group to the FICB group, the pain score was much lower. Additionally, the PENG block consumed analgesics for a much longer period of time following surgery than the FCIB group did, and the PENG block consumed a significantly smaller total dose of morphine over the course of a 24-hour period than the FICB group did. Furthermore, there were no appreciable variations in side effects between the two groups.

Furthermore, **Güllüpınar et al. (25)** assessed PENG block (18 patients in the PENG group, 21 patients in the control group) with traditional analgesic therapy for hip fracture pain management. Following PENG block, NRS values were substantially lower in the passive movement and at rest than in the control group. Because of its efficient analgesia, quickness of action, safety from hazardous regions, and ability to preserve motor function, it can also be a great regional anesthesia treatment for emergency physicians.

In the contrary to our results **Zheng et al. (26)** stated that, in total hip arthroplasty, assess PENG block to intra-articular local anaesthetic injection using a placebo (20 ml saline). On 71 patients, a randomised, placebo-controlled experiment was

conducted. They observed that the PENG group had a considerable reduction in pain levels after they were discharged from the recovery room, but the difference did not continue. The postoperative pain levels at rest for the two groups were comparable. These variations from the current study can be attributed to the fact that the authors examined the use of PENG in conjunction with intra-articular injections of local anaesthetic, which are commonly administered for pain management following major joint replacement surgery. Thus, the overall low pain levels during the postoperative period may possibly be attributed to the use of intra-articular injection of local anaesthetic.

Also, **Lin et al. (27)** investigated the effects of PENG block in conjunction with Local Infiltration Analgesia (LIA) with placebo and LIA in 60 patients undergoing hip replacement surgery (30 individuals in each group). While there is a significant decrease in pain levels, there is no discernible difference in the overall number of opiates consumed by the two groups. The inclusion of intra-articular injections of local anaesthetic in both groups would decrease pain score in both groups, which explains the differences from the present. Another possible reason for the differences could be the advanced age of the included patients (mean age 68.6 years). Additionally, there is no discernible difference between the two groups' times to initial mobilisation. This makes reasonable given that the exams were scheduled for Day 1 postoperatively, after the PENG block's analgesic effects had worn off. However, the PENG group's motor function and quadriceps muscular strength were maintained, much like in the placebo (sham PENG) group.

The study is limited by the small sample size included in the study. Sensory assessment was not conducted because block was performed following anesthesia induction.

CONCLUSIONS

Ultrasound guided PENG block is an effective method for postoperative analgesia in patients undergoing total hip arthroplasty as it prolongs time to first rescue analgesia, decreases of postoperative total Nalbuphine consumption, decreases postoperative pain scores, increases of patient satisfaction without significant effect on motor power or the incidence of complications.

Recommendations

PENG block is used during total hip replacement surgery because, when paired with general anesthesia, it provides good analgesia .

To give complete hip capsule analgesia, more research is required to evaluate the effectiveness of combining PENG block with sciatic block or the local infiltration analogue approach. To find the ideal local anaesthetic dose, volume, and concentration, more research is needed.

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