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Ultrasound guided Fascia Iliaca Block versus Pericapsular Nerve Group for Postoperative Analgesia Prior to Spinal Anaesthesia for Hip Surgeries

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***Abstract*---**Introduction: For evaluating per capsular nerve group (PENG) block's analgesic effect on elderly patient's suffering from femoral neck fracture undergoing hip arthroplasty to provide a basis for optimizing perioperative analgesia in hip arthroplasty. Material and Method: This is a Prospective Observational study conducted in patients scheduled to undergo surgery for hip fracture under spinal anesthesia in Department of Anaesthesiology, Sapthagiri Institute of Medical Sciences and Research centre, Bengaluru, Karnataka. As per previous studies a total of 40 patients were included in the study over a period of 6 months. A prospective study was conducted after obtaining approval by the institutional ethics committee and informed written consent, patient scheduled for hip fracture surgery under spinal anesthesia based on inclusion criteria was randomly divided into two groups as group FIB and group PENG. Results: Total 40 patients were included in the current study. The demographic data of both the groups are presented. There was no statistically significant difference in both groups with respect to demographic characteristics. VAS score for pain before nerve block between Group P (8.4 ± 0.58) and Group F (8.1 ± 0.61) was comparable (p = 0.9983). VAS score 30 minutes after performing the block at rest and during dynamic hip movement as well as during positioning before spinal anesthesia was significantly less in Group P (0.7 ± 0.2) when compared to Group F

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(3.1 ± 1.2). Quality of patient positioning for spinal anesthesia was higher in group P (3.137± 0.734) versus group F (2.167 ± 0.13) (p = 0.004). Patient acceptance was better in group P (26/4 versus 18/22). No patient required additional doses of fentanyl in both the groups. Conclusion: PENG block provides better analgesia for optimal positioning with better patient satisfaction than Fascia iliaca block for central neuraxial block in patients undergoing surgery for hip fractures. It also provides comparable duration of postoperative analgesia with FIB with a good safety profile.

***Keywords*---**Ultrasound, Pericapsular nerve group block, Fascia iliaca block, Hip surgeries.

Introduction

Hip arthroplasty is the main surgical treatment for femoral neck fractures in the elderly, and given China's aging population, hip arthroplasty is frequently performed in clinical practice. [1] Numerous studies have shown that hip arthroplasty can cause severe pain in the perioperative period, which can lead to a series of related complications, which not only increases the perioperative risk but also is detrimental to the long-term prognosis of patients. Fore, an optimal perioperative analgesia can greatly facilitate the patient's postoperative recovery. [2] Fascia iliaca compartment block is often used to relieve patients perioperative pain; however, numerous studies and prior clinical work have identified the risks of neurovascular in-jury, quadriceps weakness, and delayed recovery. [3]

Sensory nerve pattern of the hip capsule is different in anterior or posterior regions. Anterior hip capsule contains most sensory fibers and mechanoreceptors. [4] Anterior capsule of the hip has been innervated by the femoral nerve (FN) and the foramen ovale (ON) branches. Articular branch of the FN provides most of the innervation to the lateral and super medial aspects of the hip capsule, whereas the branch of the ON innervates the medial portion of the capsule. Proximal articular branches of the FN and ON locate all the way between iliopubic eminence and anterior inferior iliac spine, while the ON is located close to medial acetabulum, near the medial aspect of the acetabulum. Posterior hip capsule surface is innervated with sciatic nerve branch: superior gluteal nerve and the nerve of the quadriceps muscle. [5]

Per capsular nerve group (PENG) block refers to a new regional block technology providing analgesia by blocking branches from FN, ON, and accessory obturator (AON). [10] It should only target the anterior branch to the hip joint. Sensory branches from FN appearing distal to the groin are reasonably excluded from this block. It can achieve the ideal analgesia without affecting the patient's muscle strength, thus facilitating the patient's postoperative functional recovery. [6] A distinct advantage of the PENG block is the supine position, which is especially important for patients with chronic pain or acute hip fractures. However, these studies are mostly case reports. Current work compared the analgesic effect and safety of fascia iliaca compartment block (FICB) and PENG block in elderly

patients undergoing femoral neck fractures during the perioperative period and provided a reference for clinical application.

Primary objective

To study the efficacy of ultrasound guided Fascia iliaca block technique and ultrasound guided Pericapsular nerve group block technique in positioning the patient for hip fracture.

Material and Methods

This is a Prospective Observational study conducted in patients scheduled to undergo surgery for hip fracture under spinal anesthesia in Department of Anaesthesiology, Sapthagiri Institute of Medical Sciences and Research centre, Bengaluru, Karnataka. As per previous studies a total of 40 patients were included in the study over a period of 6 months.

Inclusion criteria

- Patient posted for surgical management of hip fracture.
- Age: 18 years up to 80 years.

Exclusion criteria

- Patient refusal.
- Pregnancy & Lactating mothers
- Altered coagulation profile or bleeding diathesis.

Methods of collection of data

A prospective study was conducted after obtaining approval by the institutional ethics committee and informed written consent, patient scheduled for hip fracture surgery under spinal anesthesia based on inclusion criteria was randomly divided into two groups as group FIB and group PENG.

Group FIB was receive Fascia iliaca block with Inj. 0.25% Bupivacaine 25ml, by ultrasound guided landmarks which include Internal oblique muscle, Sartorius muscle, Iliacus muscle and bone, Fascialata, Fascia iliaca by point of injection between Fascia iliaca and Iliacus muscle.

Group PENG was receive pericapsular nerve group (PENG) block with 0.25% Bupivacaine 25ml, by ultrasound guided landmarks which include Anterior inferior iliac spine, Ilio-pubic eminence, Ilio-psoas muscle and tendon, the Femoral artery and Pectineus muscle, with point of injection at musculo-fascial plane between the Psoas tendon and Ilio-pubic eminence.

After shifting patient to the operation theatre baseline heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure, SpO2 was recorded. The intervention as described above was given. After this patient was positioned for spinal anesthesia and VAS score was noted and SAB was administered.

After surgery patient was shifted to post-anesthetic care unit and the duration of the pain relief was noted by communicating with the patient with 0 hour as time of block, 2nd hour, 4th hour, 6th hour, 8th hour, 12th hour and 24th hour.

Result

40 patients were included in the current study. The demographic data of both the groups are presented in Table 1. There was no statistically significant difference in both groups with respect to demographic characteristics

Table 1
Demographic characteristics

	Group P (n=40)	Group F (n=40)	P value
Age(years)	55.43±21.37	51.28±23.27	0.4837
Weight(kg)	62.1±15.54	64.3±12.7	0.5820
Male	24	21	0.2344
Female	16	19	
ASA I	8	9	
II	21	22	0.8468
III	7	5	
Fracture neck of Femur	13	9	0.5237
Inter trochanteric	16	17	0.5710
Proximal femur Fracture	7	10	0.5391

Table 2
VAS scores, mean reduction in pain

	Group P	Group F	p Value
VAS score before nerve block	8.4 ± 0.58	8.1 ± 0.61	0.9983
VAS score 30minutes after nerve block at rest	0.7 ± 0.2	3.2 ± 1.4	<0.001***
VAS score 30minutes after nerve block during dynamic hip movement	0.7 ± 0.2	3.1 ± 1.2	<0.001***
VAS score 30minutes after nerve block during positioning	0.7 ± 0.5	3.1 ± 1.5	<0.001***
Mean reduction in pain	8.3 ± 0.9	6±1.1	<0.001***

VAS score for pain before nerve block between Group P (8.4 ± 0.58) and Group F (8.1 ± 0.61) was comparable (p = 0.9983). VAS score 30 minutes after performing the block at rest and during dynamic hip movement as well as during positioning

before spinal anesthesia was significantly less in Group P (0.7 ± 0.2) when compared to Group F (3.1 ± 1.2) (Table 2).

Table 3
Quality of patient positioning, patient acceptance, and additional fentanyl doses required

	Group P	Group F	p value
Quality of patient positioning	3.137 ± 0.734	2.167 ± 0.13	0.004***
Patient acceptance(yes/no)	36/4	18/22	
Additional fentanyl requirement	Nil	nil	

Quality of patient positioning for spinal anesthesia was higher in group P (3.137± 0.734) versus group F (2.167 ± 0.13) (p = 0.004). Patient acceptance was better in group P (26/4 versus 18/22). No patient required additional doses of fentanyl in both the groups (Table 3).

Table 4
Vital parameters before nerve block and during positioning

Vital parameters	Group P	Group F	p value
Heart rate	78.45 ± 10.1	79.38 ± 10.1	0.5338
Baseline	78.13 ± 9.8	80.23 ± 9.7	0.3867
At positioning Mean arterial pressure	90.63 ± 6.2	83.4 ± 8.6	0.3227
Baseline	89.68 ± 6.8	82.6 ± 8.4	0.087
At positioning SpO2	98.68 ± 1.02	98.39 ± 1.17	0.973
Baseline At positioning	98.6 ± 0.6	98.3 ± 0.6	0.5129

Table 5
VAS score in postoperative period

Parameter	0min	30min	1hr	4hr	12hr	24hr
Group P	0.08 ± 0.38	1.96 ± 0.8	1.83 ± 0.91	2.95 ± 1.38	6.67 ± 1.37	6.6 ± 1.1
Group F	0.9 ± 0.34	1.9 ± 0.83	2.0 ± 0.69	2.54 ± 1.12	6.7 ± 1.38	6.8 ± 1.2
p value	0.6	0.71	0.728	0.43	0.40	0.49

Table 6
Duration of postoperative analgesia

Parameter	Group P	Group F	p value
Duration of postoperative analgesia	502.21 ± 42.4	491.6 ± 42.53	0.083

Table 7
Total analgesic in 1st 24 hrs. Time to mobility, complications

Parameters	Group P	Group F	p value
Total analgesic required in 1st 24hrs	1.2 +/- 0.53	1.3 +/- 0.67	0.3941
Time of mobility	Within 6hrs	Within 6hrs	
Complications	Nil	Nil	

Discussion

In this study, both S-FICB and PENG block provided a significant reduction in NRS pain scores. However, immediate reduction in NRS pain scores was significantly better in the PENG block compared to FICB at rest. The better pain control possibly contributed to significantly higher EOSP scores in the PENG block. The pain scores at various time points were comparable in both the groups except, at 12 hours where NRS was lower in the PENG group at rest and higher at 24 hours during movement compared to the FICB group.

Similarly, S-FICB is a relatively new approach and comparative data is insufficient to draw any conclusion. The claimed advantage of FICB is that it is considered a 3-in-1 block involving femoral nerve (FN), lateral femoral cutaneous nerve (LFCN) and obturator nerve (ON). However, the results were inconsistent due to either variability in the volume of local anesthetic or the technique of FICB. Shariat *et al.* [7] reported no significant difference in postoperative pain score and 24-hour opioid consumption between FICB with 0.5% ropivacaine and sham block with 0.9% normal saline in THA. In their study, the proximal spreading of local anesthetic (LA) was not achieved because the infra-inguinal technique and transverse plane were used rather than the longitudinal plane. [8, 9] Supra-inguinal technique (S-FICB) blocks the three nerves more consistently than the infra-inguinal approach. [10] Kumar *et al.* [11] observed that S-FICB has a superior postoperative analgesic efficacy compared to infra-inguinal approach of FICB along with significantly less morphine consumption in the first 24 hours.

The FICB is a compartmental block and high volumes of LA (40–60 ml) have been used for successful block in infra-inguinal approach. [12] However, the studies on the S-FICB approach have offered differing opinions about the effective/ideal volume. One cadaveric study of S-FICB based on computed tomography (CT) scan and dissection findings suggested that 40 ml of injectate can reach the FN, ON, and LFCN. [13] Other clinical studies have suggested that effective block can be achieved with lower volumes. Yamada *et al.* [14] studied the minimum effective volume of LA in S-FICB. They found that the EV50 and EV95 of 0.25%

ropivacaine for S-FICB were 15.01 ml and 26.99 ml, respectively. Bhattacharya *et al.* [15] compared S-FICB and PENG block by using 20 ml of 0.25% levobupivacaine in both the groups and found it to be effective. We used a 25-ml mixture of 0.25% bupivacaine and dexamethasone (8 mg) in both the groups and found it clinically effective as no patient required an additional dose of fentanyl and all the patients had a significant reduction in the NRS after block.

The PENG block is a recently described regional analgesic technique that targets the articular branches to the anterior hip joint with a single injection based on the cadaveric study that showed a significant contribution of the accessory obturator nerve (in addition to femoral and obturator nerves) towards anterior hip joint innervations. Hence, it is supposed to be motor sparing and that is the major difference from FICB. Following the initial description of PENG block, there have been a significant number of publications of case reports and case series highlighting the excellent analgesic benefit for perioperative analgesia in hip surgery. [16] The initially suggested technique was an in-plane technique; however, out-of-plane and landmark-based techniques have also been suggested. [17]

In a randomized comparative study by Bhattacharya *et al.*, [15] 50 patients with fractured neck of femur received either PENG or S-FICB. The PENG group had a significantly quicker onset of action (signified by a reduction of pain score by 5) compared to the S-FICB group (average of 13.6 and 22 minutes, respectively). The average duration of action was almost similar between the two groups (9.9 hours in PENG and 10.32 hours in the S-FICB group). [18] We did not focus on the onset of block; rather, we observed the pain relief after 30 minutes expecting the complete action as observed by other studies. In our study, the duration of analgesia was assessed by the time to first analgesic request. The duration was not significantly different between the S-FICB and PENG groups (the mean in FICB was 11.8 hours and 11.21 hours in PENG) (P = 0.524). In another double-blinded randomized comparative study by Shankar *et al.*, [19] the duration of block was comparable between the FICB and PENG (7.85 and 8.16 hours, respectively).

As far as reduction in the pain score after PENG block is concerned, most of the studies have found a mean reduction of 5–7 in the NRS pain scores. [20] We also observed a similar reduction in NRS scores at rest as well as on movement. The reduction of the NRS in the PENG block group was significantly more than the S-FICB. During positioning for SA, patients of the PENG group were significantly more comfortable than S-FICB. The mean EOSP score in the FICB group was 1.39 and in the PENG block group, it was 2.15, which was similar to previously reported studies. [21]

We observed that in patients with hip fracture scheduled for open surgery, PENG block provided significantly superior analgesia than S-FICB 30 minutes after the block and during positioning for SA. The NRS scores at rest and on movement were comparable except at 12 and 24 hours. The duration of analgesia, the doses of rescue analgesic (tramadol) and patient's satisfaction were comparable.

Conclusion

PENG block provides better analgesia for optimal positioning with better patient satisfaction than Fascia iliaca block for central neuraxial block in patients undergoing surgery for hip fractures. It also provides comparable duration of postoperative analgesia with FIB with a good safety profile.

References

1. Jadon A, Kedia SK, Dixit S, et al. Comparative evaluation of femoral nerve block and intravenous fentanyl for positioning during spinal anaesthesia in surgery of femur fracture. Indian J Anaesth 2014 Nov-Dec; 58(6):705–708.
2. Haines L, Dickman E, Ayvazyan S, Pearl M, Wu S, Rosenblum D, et al. Ultrasound-guided fascia iliaca compartment block for hip fractures in the emergency department. J Emerg Med 2012; 43:692– 697. 6.
3. Unneby A, Svensson O, Gustafson Y, Olofsson B. Femoral nerve block in a representative sample of elderly people with hip fracture: a randomised controlled trial. Injury 2017; 48:1542–1549.
4. Beaudoin FL, Haran JP, Liebmann O. A comparison of ultrasound-guided three-in-one femoral nerve block versus parenteral opioids alone for analgesia in emergency department patients with hip fractures: a randomized controlled trial. AcadEmerg Med 2013; 20: 584–591.
5. Guay J, Parker MJ, Griffiths R, Kopp S. Peripheral nerve blocks for hip fractures. Cochrane Database Syst Rev 2017; 5:CD001159.
6. Swenson JD, Davis JJ, Stream JO, Crim JR, Burks RT, Greis PE. Local anesthetic injection deep to the fascia iliaca at the level of the inguinal ligament: the pattern of distribution and effects on the obturator nerve. J Clin Anesth 2015; 27:652–657.
7. Shariat AN, Hadzic A, Xu D, Shastri U, Kwofie K, Gandhi K, *et al*. Fascia iliaca block for analgesia after hip arthroplasty: A randomised double-blind, placebo-controlled trial. Reg Anesth Pain Med 2013;38:201-5.
8. Gerhardt M, Johnson K, Atkinson R, et al. Characterisation and classification of the neural anatomy in the human hip joint. Hip Int 2012; 22:75–81
9. Short AJ, Barnett JJG, Gofeld M, et al. Anatomic study of innervation of the anterior hip capsule: implication for image-guided intervention. Reg Anesth Pain Med 2018; 43:186–192.
10. Bhatia A, Hoydonckx Y, Peng P, Cohen SP. Radiofrequency procedures to relieve chronic hip pain. An evidence-based narrative review. Reg Anesth Pain Med 2018; 43:72–83.
11. Kumar K, Pandey RK, Bhalla AP, Kashyap L, Garg R, Darlong V, *et al*. Comparison of conventional infrainguinal versus modified proximal suprainguinal approach of Fascia Iliaca Compartment Block for postoperative analgesia in Total Hip Arthroplasty. A prospective randomised study. Acta Anaesthesiol Belg 2015;66:95-100.
12. Girón-Arango L, Peng PW, Chin KJ, Brull R, Perlas A. Pericapsular nerve group (PENG) block for hip fracture. Reg Anesth Pain Med 2018 Nov 1;43(8):859-63
13. Ueshima H, Otake H, Clinical experiences of pericapsular nerve group (PENG) block for hip surgeries. J Clin Anesh 2018;51;60-1

14. Yamada K, Inomata S, Saito S. Minimum effective volume of ropivacaine for ultrasound-guided supra-inguinal fascia iliaca compartment block. Sci Rep 2020;10:21859.
15. Bhattacharya A, Bhatti T, Haldar M. Pericapsular nerve group block – Is it better than the rest for pain relief in fracture neck of femur? Reg Anesth Pain Med 2019;44:A116.
16. Vaughan B, Manley M, Stewart D, Iyer V. Distal injection site may explain lack of analgesia from fascia iliaca block for total hip. Reg Anesth Pain Med 2013;38:556-7.
17. Murgatroyd H, Forero M, Chin KJ. The efficacy of ultrasound-guided fascia iliaca block in hip surgery: A question of technique? Reg Anesth Pain Med 2013;38:459-60.
18. Vermeylen K, Desmet M, Leunen I, Soetens F, Neyrinck A, Carens D, *et al*. Supra-inguinal injection for fascia iliaca compartment block results in more consistent spread towards the lumbar plexus than an infra-inguinal injection: A volunteer study. Reg Anesth Pain Med 2019;rapm-2018-100092. doi: 10.1136/rapm-2018-100092.
19. Shankar K, Srinivasan R, Ashwin AB, Nandini U, Chandra M, Kadlimatti DV. Comparative study of ultrasound guided PENG block and FIB for positioning and postoperative analgesia prior to spinal anaesthesia for hip surgeries: Prospective randomised comparative clinical study. Indian J Anesth Analg 2020;7:798-803.
20. Dulaney-Cripe E, Hadaway S, Bauman R, Trame C, Smith C, Sillaman B, *et al*. A continuous infusion fascia iliaca compartment block in hip fracture patients: A pilot study. J Clin Med Res 2012;4:45-8.
21. Vermeylen K, Soetens F, Leunen I, Hadzic A, Van Boxtael S, Pomes J, *et al*. The effect of the volume of supra-inguinal injected solution on the spread of the injectate under the fascia iliaca: A preliminary study. J Anesth 2018;32:908-13.