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Comparison of USG guided Pericapsular nerve group block v/s Suprainguinal fascia ILIACA compartment block for post-operative pain management in total hip arthroplasty: A prospective randomised controlled study

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Abstract
Background: To manage pain associated to hip surgeries, pericapsular nerve group block (PCNG) is introduced as an innovative technique aimed to improve analgesia. This study aimed to compare the effectiveness and safety of PCNG block to suprainguinal fascia iliaca compartment block (SFIC) for managing pain following hip operations.
Materials and Methods: In this study, 60 patients were randomized into two groups: Group A (N=30) received PCNG with 20 ml of 0.75% ropivacaine and 10ml of 2% lignocaine with adrenaline, while Group B (N=30) received SFIC with 20 ml of 0.75% ropivacaine and 10ml of 2% lignocaine with adrenaline. Parameters assessed includes, visual analogue scale (VAS) scores, hemodynamic variables, sensory and motor block characteristics, duration of analgesia and the incidence of adverse events.
Results: In this study, no statistically significant differences were noted between the groups with respect to hemodynamic parameters, age, sex or ASA physical status classification. Group A exhibited a faster onset (8.94±1.37 min) and longer duration (11.94±0.74 hours) of sensory blockade compared to Group B (9.31±1.87 min; 11.81±0.86 hours). Similarly, the onset of motor block was marginally quicker and its duration longer in Group A (13.47±2.36 min; 10.31±1.33 hours) than in Group B (13.63±2.35 min; 10.05±1.55 hours). Notably, the duration of analgesia was significantly longer in Group A (13.23±1.17 hours) than in Group B (10.87±0.92 hours), with Group B also reporting higher mean VAS scores. The incidence of adverse drug reactions was low and comparable across both groups.
Conclusion: The PCNG block proved superior to the SFIC block in terms of postoperative analgesia, demonstrating a faster onset, prolonged duration of action, lower VAS scores, and minimal adverse effects.

Keywords: Total hip arthroplasty, pericapsular nerve block, suprainguinal fascia iliaca compartment block, pain management

Introduction

Total Hip Arthroplasty (THA) is considered as one of the most cost-effective and reliable surgical procedures. It consistently provides favorable outcomes for patients with advanced hip osteoarthritis (OA), particularly in terms of pain reduction, improved joint function and enhanced quality of life [1]. In recent years, traditional post-operative treatment has seen efforts to move away from opioid medications and towards long-acting analgesics that effectively decrease pain, increase mobility, reduce opioid use and lowers complications [2].

The Supra-Inguinal Fascia Iliaca Block (SFIC) and Pericapsular Nerve Group (PCNG) block represent recent advancements in multi modal analgesia, offering superior postoperative analgesic efficacy in hip arthroplasty. Their integration reflects a shift toward anatomically targeted, opioid-sparing strategies in perioperative pain management [3].

The SFIC and the PCNG blocks were progressively being assimilated into contemporary multi modal analgesic regimens. Multi modal anesthesia entails the concurrent utilization of pharmacological agents with disparate mechanistic profiles to engender a synergistic antinociceptive effect while attenuating opioid burden.

This integrative strategy not only mitigates perioperative pain but also expedites functional convalescence and culminates in superior patient-centric outcomes [4].

To date, comparative investigations evaluating the analgesic efficacy and adverse effect profile of the pericapsular nerve Group (PCNG) block versus the supra-inguinal fascia iliaca block (SFIC) remain limited. Accordingly, the present study was undertaken to systematically assess and contrast the effectiveness of these two regional anesthesia techniques in the context of postoperative pain management following total hip arthroplasty.

Materials and Methods

Study design: A prospective randomized controlled study.

Study population: ASA Grade I, II in-patients posted for elective total hip arthroplasty (THA).

Study site: Department of Anaesthesia, Yashoda Hospital, a multi-super specialty hospital in Secunderabad, Telangana, India.

Study duration: This study was conducted from November 2023 to November 2024.

Inclusion criteria: The study includes patients age between 18-65 years, belonging to ASA grade I, II patients scheduled for THA.

Exclusion criteria: The study excludes patients who are unable to give consent, allergic to local anesthesia, use of strong opioids, pre-existing neurological deficits, lung disease, ongoing drug abuse or alcohol abuse, liver impairment and pregnancy.

All patients underwent comprehensive pre-anaesthetic assessment on the day preceding surgery. A thorough systemic examination was conducted, including evaluation of the anatomical site designated for block administration. The nature of the procedure and potential sensations such as paresthesia were clearly explained and patients were reassured to mitigate perioperative anxiety. Preoperative fasting was ensured in accordance with established guidelines. Intravenous access was secured using a 20G cannula in the upper limb. Electrocardiogram (ECG), pulse oximetry, and non-invasive blood pressure (NIBP) were attached and baseline hemodynamic parameters were recorded.

After obtaining approval of institutional ethical committee, the entire procedure was again explained to the patient and informed written consent were taken. Patients were randomized into 2 groups. Group A patients were given USG guided pericapsular nerve group block (PCNG) approach with 20 ml of 0.2% ropivacaine + 10ml of 2% lignocaine with adrenaline. Group B-patients were given USG guided supra inguinal fascia illaca block (SFIC) approach with 20 ml of 0.2% ropivacaine + 10ml of 2% lignocaine with adrenaline.

Onset and duration of sensory and motor block characteristics, VAS score and duration of analgesia, hemodynamic parameters and adverse effects were noted.

Statistical Analysis

All data were recorded in a pre-designed study proforma. Quantitative variables were expressed as Mean ± Standard Deviation (SD). Intergroup comparisons of quantitative data were performed using the unpaired t-test for normally distributed variables and Mann Whitney U test for non-normally distributed data. $p<0.05$ was considered statistically significant. Statistical analyses were conducted using SPSS software, version 26.0.

Results

Table 1 presents the demographic characteristics of the study participants. The mean age was slightly higher in Group A (67.75 years) compared to Group B (66.63 years), though the difference was not statistically significant (P=0.58). Gender distribution was predominantly female in both groups (66%), with no significant intergroup difference (P=1.00). The ASA physical status (Grade I/II) was similarly distributed across groups, also without statistically significant difference (P=1.00).

Table 2 illustrates that mean onset of sensory block (8.94±1.37 v/s 9.31±1.87 mins; P=0.36) and motor block (13.47±2.36 v/s 13.63±2.35 mins; P=0.79) occurred significantly more quickly in the Group A compared to Group B. Additionally, mean duration of sensory block (11.94±0.74 v/s 11.81±0.86 hours; P=0.534) and motor block (10.31±1.33 vs 10.05±1.55 hours; P=0.465) occurred significantly longer in the Group A compared to Group B. Furthermore, the mean duration of analgesia was significantly greater in the Group A compared to the Group B (13.23±1.17 v/s 10.89±0.92 hrs; $p<0.01$). VAS scores were significantly lower in Group A at all time points ($p<0.01$).

Table 3 delineates the systolic blood pressure and diastolic blood pressure variations between the two study groups from baseline up to 120 minutes postoperatively. The mean blood pressures at each time point, along with corresponding *P* values, demonstrates no statistically significant differences between the groups throughout the observation period.

Table 4 presents the heart rate variations between the two study groups from baseline up to 120 minutes postoperatively. The mean heart rates at each time point, along with corresponding *P* values, demonstrate no statistically significant differences between the groups throughout the observation period.

Discussion

Postoperative pain induces significant neuroendocrine and immunologic disturbances, adversely affecting healing and recovery. Its incidence remains high in hip surgeries [5], where inadequate analgesia delays mobilization and prolongs hospitalization. Elderly patients with hip fractures often have multiple comorbidities, necessitating cautious use of systemic analgesics [6]. Regional techniques such as femoral nerve (FN) block, suprainguinal fascia iliaca compartment (SFIC) block, and pericapsular nerve group (PCNG) block have thus become integral to enhanced recovery after surgery (ERAS) protocols. This study compares the efficacy and procedural performance of PCNG and SFIC in optimizing postoperative analgesia.

In the present study, the mean age across both cohorts was 66.69 years, with a female predominance. This aligns with findings by Mishra *et al*. [7], who reported a mean age of 67 years and similar gender distribution. Numerous studies corroborate that femoral neck fractures predominantly affect the elderly, with a higher incidence in females likely

attributable to increased osteoporosis prevalence in this demographic [8].

In the current investigation, Group A manifested a comparatively expedited onset and an extended duration of sensory blockade relative to Group B (P=0.36 and P=0.53, respectively); however, these intergroup variances did not attain statistical significance. Analogously, the initiation of motor blockade occurred marginally earlier in Group A, accompanied by prolonged duration, though these distinctions likewise failed to reach statistical significance. These observations are consonant with the findings of Kulkarni *et al*. [9], who discerned no statistically meaningful disparities in block characteristics between PCNG and SFIC cohorts (p>0.05). In parallel, Amin *et al.* [10], also documented analogous temporal profiles for the onset and duration of both sensory and motor blockade across the two techniques. In the postoperative period, the present study demonstrated that Group A persistently manifested lower visual analogue scale (VAS) scores relative to Group B, with statistically significant differences emerging from the fourth postoperative hour onwards. These findings underscore the superior analgesic efficacy associated with Group A. Furthermore, the duration of analgesia was markedly prolonged in Group A compared to Group B. These observations align with those of Mosaffa *et al*. [11], who similarly reported enhanced analgesic effectiveness of the pericapsular nerve group (PCNG) block when juxtaposed with the fascia iliaca compartment block (SFIC). Concordantly, Chaudhary *et al*. [12], documented significantly attenuated postoperative pain scores and extended duration of analgesia in recipients of the PCNG block as opposed to those administered the SFIC.

In this research, hemodynamic indices including mean heart rate, systolic blood pressure and diastolic blood pressure remained comparable between the two cohorts throughout the 120-minute post-intervention period, with no statistically significant intergroup variations detected at any recorded interval (p>0.05). Likewise, the incidence of postoperative complications did not differ significantly between groups (p>0.05). Postoperative nausea and vomiting were observed in 13.3% of patients in Group A and 10% in Group B, while hypotensive episodes were absent in Group A and noted in 3.3% of Group B (P=1.0). These outcomes align with findings by Vamshi *et al*. [13], who documented quadriceps weakness following SFIC administration, albeit without significant disparities in other adverse effects.

Table 1: Comparison of demographic parameters and adverse reactions between the groups

Variables	Group A (N=30)	Group B (N=30)	P
Age in years (Mean ±SD)	67.75±8.10	66.63±8.12	0.58
Gender (Female/Male)	20/10	20/10	1.00
ASA grade (I/ II)	19/11	18/12	1.00
Adverse reactions			
PONV	4	3	0.79
Bradycardia	0	1	1.00
Hypotension	0	0	NA

Table 2: Assessment parameters comparison between two groups

Characteristics	Group A (Mean ±SD)	Group B (Mean ±SD)	P
Onset of sensory block (min)	8.94±1.37	9.31±1.87	0.36
Onset of motor block (min)	13.47±2.36	13.63±2.35	0.79
Duration of sensory block (Hrs)	11.94±0.74	11.81±0.86	0.534
Duration of motor block (Hrs)	10.31±1.33	10.05±1.55	0.465
Duration of analgesia (Hrs)	13.23±1.17	10.89±0.92	<0.01
VAS score			
0 hour	0.00±0.00	0.00±0.00	NA
2 hour	0.20±0.41	0.43±0.57	0.073
3 hour	0.33±0.48	0.57±0.73	0.148
4 hour	0.82±0.76	1.18±0.64	0.047
5 hour	0.60±0.50	1.33±0.48	<0.01
6 hour	1.33±0.48	1.87±0.73	<0.01
8 hour	1.50±0.89	2.13±1.23	<0.01
10 hour	1.87±1.05	2.35±1.01	< 0.01

Table 3: Systolic blood pressure (SBP) and Diastolic blood pressure comparison between two groups

Characteristics	SBP		P	DBP		P
	Group A, Mean ±SD	Group B, Mean ±SD		Group A, Mean ±SD	Group B, Mean ±SD	
Base line	121.19±11.19	124.94±12.00	0.55	83.20±4.44	84.07±4.33	0.447
5 min	121.03±11.32	123.22±11.49	0.46	76.97±6.04	78.23±5.35	0.394
10 min	120.88±10.74	123.06±10.61	0.42	78.53±6.93	79.80±6.48	0.468
15 min	121.47±9.57	122.84±9.74	0.57	78.70±6.58	79.47±5.81	0.634
30 min	120.19±9.40	122.00±8.96	0.43	77.50±6.88	78.83±5.63	0.415
45 min	120.25±10.43	122.53±9.53	0.36	77.10±7.64	75.87±14.11	0.675
60 min	116.57±9.23	117.61±9.84	0.58	76.37±7.85	80.40±5.10	0.07
75 min	119.94±8.72	121.19±8.60	0.56	76.13±8.80	79.20±4.89	0.1
90 min	120.09±8.77	121.31±9.08	0.58	75.50±9.61	78.27±5.29	0.172
105 min	119.19±9.49	120.38±9.12	0.61	74.77±10.34	78.17±5.84	0.122
120 min	119.08±7.92	120.81±7.20	0.37	73.80±10.46	77.00±6.29	0.156

Table 4: Heart rate comparison between two groups

Characteristics	Heart rate		P
	Group A (Mean ±SD)	Group B (Mean ±SD)	
Base line	79.56±10.09	80.91±10.01	0.59
5 min	79.56±8.85	80.31±9.09	0.74
10 min	79.31±8.87	80.63±8.97	0.59
15 min	79.25±8.92	80.44±9.35	0.61
30 min	78.91±8.82	79.91±9.24	0.66
45 min	77.72±9.02	79.59±8.93	0.41
60 min	76.69±8.45	78.66±8.17	0.35
75 min	74.59±10.21	76.50±10.59	0.47
90 min	75.34±7.94	77.56±8.19	0.27
105 min	76.81±8.00	78.28±7.84	0.46
120 min	75.78±7.79	77.66±8.58	0.36

Conclusion

Pericapsular nerve group (PCNG) block is superior to fascia iliaca block (SFIC) in terms of its ability to alleviate post-operative pain in patients who have undergone total hip arthroplasty. After the operation, PCNG provided superior advantages in terms of a reduction in post-operative pain and the number of narcotics that were used during the first twenty-four hours after total hip arthroplasty.

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Declarations

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- **Conflict of interest:** None declared
- **Financial Support:** Not available

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