E-ISSN: 2664-8857
P-ISSN: 2664-8849
www.anesthesiologyjournal.in
IJAR 2025; 7(2): 06-09
Received: 11-05-2025
Accepted: 15-06-2025

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Comparison of USG guided quadratus lumborum block v/s erector spinae block for post-operative pain management in hip arthroplasty: A prospective randomised controlled study

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DOI: https://www.doi.org/10.33545/26648849.2025.v7.i2a.61

Abstract
Background: Postoperative pain is a common concern following hip arthroplasty surgeries, particularly in patients with multitudinous health conditions. This study endeavored to compare the efficacy of quadratus lumborum block (QLB) and lumbar erector spinae block (ESB) in mitigating post-surgical pain who undergoing hip arthroplasty surgeries.
Materials and Methods: In this study, 100 patients were divided into two equal cohorts: Group QLB patients were given USG guided Quadratus Lumborum block with 20 ml of 0.75% Ropivacaine and 20ml of 2% lignocaine with adrenaline. Group ESB patients were given USG guided Erector Spinae block with 20 ml of 0.75% Ropivacaine and 20ml of 2% lignocaine with adrenaline. Block performance time, VAS score, requirement of post-op analgesia, hemodynamic parameters and incidence of adverse events were noted.
Results: In this research, it was observed that demographic variables including age, gender distribution, body weight, ASA physical status and baseline hemodynamic indices were statistically comparable across the groups. Block performance was faster in ESB group (14.97 mins) compared to QLB (15.34 mins) group (P=0.71). No significant difference in VAS scores noted between ESB and QLB groups at 6, 12, and 24 hours postoperatively (p> 0.05). Similarly, the total rescue analgesic requirement was significantly lower in Group ESB (p<0.01). The frequency of adverse effects was analogous between both the groups.
Conclusion: The present analysis infers that while both QLB and ESB provide satisfactory postoperative analgesia following hip arthroplasty, ESB confers a superior analgesic profile in terms of reduced analgesic requirement. Therefore, ESB may represent a more efficacious modality for sustained postoperative analgesia than QLB.

Keywords: Erector spinae plane block, Quadratus lumborum block, Ultrasound guided block, Hip arthroplasty

Introduction
Over the past two to three decades, the use of hip arthroplasty has significantly increased as a definitive treatment for refractory hip pain. Postoperative pain following hip surgery is often moderate to severe and inadequate management in the acute phase may contribute to the development of chronic postoperative pain [1].
Effective post-operative pain management and to reduce the total opioid requirement, several interfacial plane blocks have been developed, which includes quadratus lumborum block (QLB), erector spinae plane block (ESPB), transversus abdominis plane block (TAP) and para-vertebral block. Limited complications were observed by enabling the direct visualization of the needle, nerves and surrounding anatomy provided by ultrasound (USG) guided methods [2].
Erector spinae plane block (ESPB), originally described by Forero et al, for analgesia in thoracic neuropathic pain has since been employed in a variety of clinical settings for both acute and postoperative pain management [3]. Similarly, transmuscular quadratus lumborum block (QLB-t) is also a newly found and popularly used local anesthesia method, initially introduced by Blanco as a modification of the TAP block. It is an inter-fascial plane block,

which is worked solely underneath ultrasound guidance [4].
The present study aims to compare the analgesic efficacy of quadratus lumborum block (QLB) and erector spinae block (ESB) for post-operative pain management in hip arthroplasty surgeries.

Materials and Methods

- **Study design:** A prospective double blinded randomized controlled study
- **Study population:** ASA Grade I, II inpatients of Yashoda Hospital, Secunderabad, posted for hip arthroplasty surgeries.
- **Study site:** The study was conducted at department of Anaesthesiology of Yashoda Hospital, Secunderabad, Telangana, India, which is accredited by the NABH and NABL.
- **Study duration:** This study was conducted from November 2023 to November 2024.
- **Inclusion criteria:** The study includes patients of age above 18 years, belonging to ASA grade I,II and scheduled for hip arthroplasty surgeries.
- **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 and with pregnancy.

All the patients underwent thorough pre-anaesthetic evaluation on the day prior to surgery. All systems were examined including the surface anatomy where the block was given and the procedure to be carried out was explained to the patients. They were informed about the development of paresthesia. Patients were reassured to alleviate their anxieties. All the patients were kept nil per oral as per the fasting guidelines. Written informed consent was taken. All the necessary investigations including blood were done.
After obtaining approval of institutional ethical committee, the entire procedure was explained to the patient and informed written consent was taken. A thorough preanaesthetic evaluation was done 24 hours prior to the procedure. Patients were premedicated with Tab. pantoprazole 40mg and Tab Alprazolam 0.5mg. On the morning, all patients had an IV access secured. After connecting multiparameter monitors with ECG, pulse oximeter and Non-invasive blood pressure (NIBP), basal parameters were recorded. Spinal Anaesthesia was given with 0.5 percent heavy bupivacaine with additive buprinorphine.
Intraoperative heart rate and blood pressure was monitored and any hemodynamic instability was managed as per hospital protocol. Then Patients were randomized into 2 groups. Group QLB – Patients were given USG guided Quadratus Lumborum block with 20 ml of 0.75% Ropivacaine + 20ml of 2% lignocaine with adrenaline. Group ESB - Patients were given USG guided Erector Spinae block with 20 ml of 0.75% Ropivacaine + 20ml of 2% lignocaine with adrenaline. Both the blocks were performed on table in the operation theater right after the surgery with patient in lateral position under ultrasonographic guidance using a 20G, 100 mm short bevel needle (Jelco needle). After completion of the procedure, a sterile dressing was placed over the insertion site.
Time taken to give the block (Block performance time), VAS Score at immediate post-op, 2nd ,6th, 8th, 12th,24th hours, requirement of post-op analgesia, hemodynamic parameters and adverse effects were noted.

Statistical Analysis

All the data was noted down in a pre-designed study proforma. Qualitative data was represented in the form of frequency and percentage. Association between qualitative variables was assessed by Chi-Square test. Analysis of Quantitative data between the two groups was done using unpaired t-test if data passed 'Normality test' and by Mann-Whitney Test if data failed. $p< 0.05$ was taken as level of significance. SPSS Version 26.0 was used for analysis.

Results

The results presented in Table 1 indicated that the average age of the current study group was 54.47±8.71 years, with no significant difference observed between the study groups ($P = 0.211$). Among the total of 100 cases, 56% were female and 44% were male with no significant difference between the two study groups (P=1). Additionally, Table 1 revealed that 67% of the cases were classified as ASA grade I, while 33% were in grade II with no significant difference between the study groups (P=1.0). Anthropometry parameters height, weight, BMI were comparable between two groups. PONV was observed in both the groups and bradycardia was noted in 2 patients of the ESB group.
Table 2 shows comparable block performance times between QLB and ESB groups (15.34 v/s 14.97 mins; $P = 0.71$). NRS scores were significantly lower in the ESB group from 0 hour to 6 hrs post-op ($p< 0.05$) with no significant difference after 6 hrs ($p> 0.05$). Duration of analgesia was longer in ESB (14.28 v/s 12.54 hrs; $p< 0.01$). Two rescue doses were needed in 54% of QLB v/s 22% of ESB cases ($p< 0.01$), with lower mean analgesic use in ESB (1.22 v/s 1.54 hours; $p< 0.01$). TUG test times were comparable between the groups (15.43 v/s 14.12 sec; $P = 0.32$).
The mean pulse rate and mean systolic blood pressure (SBP) were comparable between study groups at baseline and during the procedure. The pulse rate variations and SBP variations were also comparable between study groups ($p>0.05$) (Table 3).
Table 4 explains that, the mean diastolic blood pressure and mean oxygen saturation levels was comparable between study groups at baseline and during the procedure. The DBP variations and SpO2 variations were also comparable between study groups ($p>0.05$).

Discussion

Optimizing pain control in the post operative period after total hip surgery significantly impacts functional recovery by aiding early mobilization and improves overall patient satisfaction, leading to better clinical outcomes [5]. In these patients using regional anesthesia techniques such as the lumbar erector spinae plane block (ESP) and quadratus lumborum block (QLB), superior pain control can be achieved [6]. Our study juxtaposed the efficacy of ESB and QLB in patients undergoing hip arthroplasty surgeries. There was no statistical discrepancy observed in between the two groups in terms of age, gender, ASA grades and anthropometry parameters.
Abd Ellatif et al., observed that block performing time was significantly shorter in ESB compared to QLB [7]. In our study too, block was performed relatively faster in ESB group, but the difference was not significant. In Group QLB, the total analgesic necessity was significantly longer (1.54±0.50 hours) than in Group ESB (1.22±0.42 hours). On

average, patients in Group QLB required their dose of opioid analgesia longer than those in Group ESB, indicating a prolonged analgesic effect with QLB, especially in the early postoperative hours. Similar results were observed in the study of Ahluwalia MK et al [8].

Present study also demonstrated that the ESB block provided superior postoperative analgesia compared to the QLB in patients undergoing hip arthroplasty. VAS scores were significantly lower in the ESB group from 30 minutes to 6 hours postoperatively, with longer duration of analgesia and reduced need for rescue analgesics, both in terms of frequency and total dosage. These findings are consistent with previous studies. Tulgar et al., reported prolonged analgesia and decreased opioid consumption in patients receiving ESB for hip surgeries, attributing the efficacy to its extensive craniocaudal spread and ability to block both dorsal and ventral rami [9]. Similarly, Adhikary et al., highlighted the effectiveness of lumbar ESB in providing substantial postoperative pain relief with a reduced opioid requirement [10]. In contrast, Dam et al., noted that although QLB provided effective analgesia after total hip arthroplasty, the block had a shorter duration and a higher rescue analgesia requirement compared to other interfascial plane blocks [11].

The significantly higher incidence of two-dose rescue analgesia in the QLB group and greater mean analgesic requirement observed in our study further supports the superior analgesic profile of ESB. This aligns with the findings of Kukreja et al., who reported that ESB led to better early postoperative pain control and reduced analgesic use compared to other regional blocks in orthopedic surgeries [12].

In the present study, timed up and go down (TUG) test was completed in 15.43 minutes in QLB group as compared to 14.12 minutes in ESB group (P=0.32). In none of the studies till date compared the recovery profile between these two blocks in terms of timed up and go test. In our study cohort, both the groups have TUG test time between 10 to 20 minutes, with ESB group performing slightly better than QLB. This can be attributed to the better post-op pain control in this group.

Mean pulse rate, oxygen saturation, systolic and diastolic blood pressure was comparable between study groups at baseline and during the procedure (P>0.05). Incidence of post-op nausea and vomiting was 14% and 16% in QLB and ESB group while incidence of bradycardia was 0% and 4% respectively. No case of hypotension was observed in any of the group. Tiwari P et al (Tiwari P) in their study observed comparable hemodynamics between the group with no difference in the incidence of bradycardia or hypotension between them [13].

Table 1: Comparison of Demographic parameters and Adverse reactions between the groups

Variables	Group QLB (n=50)	Group ESB (n=50)	*P*
Age in years (Mean± SD)	53.32±8.92	55.65±9.34	0.211
Gender (Female/Male)	28/22	28/22	1.0
ASA grade (I/ II)	34/16	33/17	1.0
Height in cm (Mean± SD)	162.52±5.88	163.42±5.51	0.431
Weight in kg (Mean± SD)	55.68±8.70	55.96±8.65	0.872
BMI (Kg/m2)	20.90±2.61	20.86±2.38	0.933
Adverse reactions			
PONV	7	8	1.00
Bradycardia	0	2	0.48

Table 2: Assessment parameters comparison between two groups

Variables	Group QLB (n=50)	Group ESB (n=50)	*P*
Block performance time (mins)	15.34±2.32	14.97±3.01	0.71
Total Duration of Analgesia	12.54±1.22	14.28±3.42	<0.01
Requirement of rescue analgesia (One dose/Two dose)	23/27	39/11	p<0.01
Total requirement of rescue analgesic (24 hrs)	1.54±0.50	1.22±0.42	0.01
TUG test (sec)	15.43±2.17	14.12±2.22	0.32
NRS score			
0 hrs	2.22±0.68	1.22±1.06	<0.01
30 mins	2.96±0.97	1.58±1.21	<0.01
2 hrs	3.58±1.16	2.50±1.36	<0.01
6 hrs	3.32±0.91	2.96±1.18	0.04
12 hrs	2.84±0.98	3.10±1.13	0.221
24 hrs	2.46±0.76	2.50±0.84	0.803

Table 3: Heart rate and systolic blood pressure (SBP) comparison between two groups

	Heart rate		*P*	SBP		*P*
	Group QLB Mean± SD	Group ESB Mean± SD		Group QLB Mean± SD	Group ESB Mean± SD	
Base line	72.34±7.28	73.28±9.66	0.58	114.10±10.03	111.62±8.12	0.18
0 min	75.26±7.34	76.32±8.68	0.51	116.02±9.65	112.74±8.14	0.07
5 min	77.48±7.35	79.16±7.05	0.25	122.86±9.55	119.52±8.79	0.13
15 min	78.14±6.78	77.34±8.31	0.60	121.90±9.18	118.70±7.88	0.19
30 min	75.44±6.77	77.88±8.28	0.09	120.56±8.59	118.06±11.9	0.22
45 min	75.34±9.83	77.04±8.19	0.35	117.00±11.38	113.54±9.05	0.10
60 min	73.80±6.96	74.80±9.00	0.54	115.06±9.28	112.18±7.57	0.09
90 min	76.37±7.01	77.74±7.65	0.35	119.44±8.80	117.13±7.38	0.31
120 min	77.81±6.41	78.25±7.18	0.75	122.38±8.47	120.11±7.45	0.41

Table 4: Diastolic blood pressure and SPo2 comparison between two groups

	DBP		*P*	SpO2		*P*
	Group QLB Mean± SD	**Group ESB Mean± SD**		**Group QLB Mean± SD**	**Group ESB Mean± SD**	
Base line	73.68±8.26	72.40±5.70	0.71	98.74±0.57	98.64±0.53	0.18
0 min	76.52±8.02	74.78±6.49	0.46	98.59±0.54	98.70±0.61	0.07
5 min	79.28±8.55	77.66±7.69	0.09	98.74±0.63	98.66±0.56	0.13
15 min	77.32±6.99	75.08±5.88	0.21	98.2±0.61	98.82±0.69	0.19
30 min	79.62±7.23	77.92±7.73	0.19	98.72±0.64	98.68±0.62	0.22
45 min	77.60±6.87	75.20±8.15	0.23	98.74±0.57	98.64±0.53	0.10
60 min	75.10±7.67	74.09±5.12	0.61	98.61±0.54	98.70±0.61	0.09
90 min	77.90±7.50	75.22±6.51	0.31	98.72±0.52	98.68±0.55	0.31
120 min	78.30±5.99	76.37±5.61	0.40	98.73±0.52	98.74±0.47	0.41

Conclusion

To summarize, present study thus concluded that erector spinae block (ESB) results in a more effective block with a steady analgesic effect than quadratus lumborum block (QLB) in hip arthroplasty surgeries. Post-operative requirement of analgesics and pain scores were significantly less in the ESB group. No difference was observed between the two methods in regards to incidence of post-op nauseas and vomiting or hemodynamic parameters.

Acknowledgements: Authors would like to thank Management Yashoda Hospitals and Dr.Amidyala Lingaiah (Director-Medical Services) for the continuous support

Declarations
Funding: No funding sources
Conflict of interest: None declared

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How to Cite This Article
Fultambkar G, Raghuram M, Raju D, Rajeshwar P, Kukreja V, Reddy S. Comparison of USG guided quadratus lumborum block v/s erector spinae block for post-operative pain management in hip arthroplasty: A prospective randomised controlled study. International Journal of Anesthesiology Research. 2025; 7(2): 06-09.