

Original Article

COMPARATIVE STUDY OF ERECTOR SPINAE PLANE BLOCK VERSUS SYSTEMIC ANALGESIA FOR INTERLOCKING NAIL IN INTERTROCHANTERIC FRACTURE OF FEMUR: A RANDOMIZED CONTROLLED INTERVENTIONAL STUDY

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ABSTRACT

Objective: The geriatric population is prone to multiple comorbidities, and their fragile bones and unsteadiness make them susceptible to fractures, commonly observed in the wrist and proximal end of the femur. Internal fixation of fractures under central neuraxial block allows for early mobilization. However, the presence of comorbidities in elderly patients puts them at higher risk for anesthesia and surgery.

Methods: To manage postoperative pain following surgery for proximal femur fracture, opioid-sparing multimodal analgesia techniques are employed. Regional anesthesia techniques such as fascia iliaca block, femoral nerve block, and quadratuslumborum block are utilized as part of a multimodal approach. Pain is subjective, and the inability to communicate does not negate the need for appropriate pain relief.

Results: Postoperative pain, if poorly managed, can result in complications, prolonged recovery, and chronic pain with reduced quality of life. Effective pain relief enhances patient satisfaction, reduces hospital stays and costs. Inadequate pain control activates the sympathetic nervous system, increases hormonal response, and contributes to adverse events. Opioids, though common, pose risks and adverse effects.

Conclusion: The erector spinae plane block (ESPB) is a safe and easy-to-perform technique for postoperative pain management. It involves ultrasound-guided deposition of local anesthetic, allowing effective spread. Previous studies have shown its effectiveness for thoracic pain relief. This study evaluated lumbar ESPB and compared it with systemic analgesics in terms of ease of positioning and postoperative pain control.

Keywords: Geriatric population, Comorbidities, Fractures, Internal fixation, Central neuraxial block

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INTRODUCTION

The geriatric population is prone to multiple comorbidities, and their fragile bones and unsteadiness make them susceptible to fractures, commonly observed in the wrist and proximal end of the femur. Internal fixation of fractures under central neuraxial block allows for early mobilization. However, the presence of comorbidities in elderly patients puts them at higher risk for anesthesia and surgery [1].

Postoperative pain following surgery for proximal femur fracture can be significant, and opioid-sparing multimodal analgesia techniques are employed to manage pain in these patients. Regional anesthesia techniques such as fascia iliaca block, femoral nerve block, and quadratuslumborum block are utilized as part of a multimodal approach. It is important to recognize that pain is subjective, and the inability to communicate does not negate the need for appropriate pain relief [2].

Acute pain in surgical patients after a procedure is defined as postoperative pain. Pain relief is recognized as a human right by organizations such as the American Society of Anesthesiologists, the World Health Organization, and the International Association for the Study of Pain [3]. Poorly managed postoperative pain can lead to complications, prolonged rehabilitation, and the development of chronic pain with diminished quality of life. Adequate pain relief not only improves patient satisfaction but also reduces hospital stays and costs [4].

Poorly controlled pain is associated with activation of the sympathetic nervous system and increased hormonal response to stress, contributing to postoperative adverse events such as hypercoagulability, pulmonary complications, delirium, wound infections, and others. Opioids are commonly used for perioperative pain control; however, they carry significant risks and adverse

effects, including pruritus, constipation, nausea, vomiting, urinary retention, sedation, and respiratory depression [5].

One of the newer techniques described for postoperative pain management is the erector spinae plane block (ESPB). This ultrasound-guided technique involves depositing local anesthetic between the erector spinae muscle and the transverse process of the thoracic vertebra, allowing for cephalic, caudal, and paravertebral spread of the anesthetic [6]. ESPB is relatively safe and easy to perform, with the transverse process acting as a barrier, reducing the risk of complications such as pneumothorax, spinal cord injury, epidural hematoma, and central infection. Its safety profile also enables its use outside the operating theater setting. Multiple studies have reported the effective use of thoracic ESPB for postoperative analgesia.

In this study, we evaluated the efficacy of ultrasound-guided lumbar ESPB and compared it with systemic analgesics in terms of ease of positioning and postoperative analgesia. Additionally, the functional anatomy and innervation of the erector spinae muscles were discussed, along with the landmarks and patient positioning for performing the block [7].

Overall, effective pain management is crucial in elderly patients undergoing surgery, and regional anesthesia techniques like ESPB offer potential benefits in terms of pain control, reduced opioid use, and improved patient outcomes.

MATERIALS AND METHODS

Permission

Permission from institutional ethics committee was obtained.

Study area

The study was conducted in the department of anaesthesia and department of orthopedic at SMS hospital and Trauma Centre, S. M. S. Medical College, Jaipur.

Study period

From approval of research review board till the completion of sample size.

Study design

Hospital based Prospective, Randomized, Controlled, Interventional study.

Study universe

Cases undergoing Proximal femoral nailing for femur fractures- Inter-trochanteric or sub trochanteric.

Sampling technique

76 patients satisfying inclusion criteria were selected using simple random sampling.

Randomization

Eligible cases were randomly allocated in two study groups by using opaque sealed envelope with replacement.

Sample size

A sample size of 38 cases in each group is required at 95% confidence and 80% power to verify the expected assumed difference of 30% in proportion of cases who develop NRS less than 3 in both study groups, 90% in study group vs 60% in control group as per seed article.

Study groups

The study was conducted in the following two groups of patients. Study enrolled 76 patients (n=38/group).

Group A

38 patient received Erector Spinae Plane block with 0.4 ml/kg of 0.2% ropivacaine followed by sub arachnoid block with 0.5% Inj. bupivacaine heavy. All these patient were given paracetamol 100 ml intra operatively and 100 ml post operatively QID. When NRS>3, inj. tramadol given as rescue analgesia.

Group B

38 patients received sub arachnoid block with 0.5 % Inj. bupivacaine heavy. These patient were given paracetamol 100 ml intra operatively and 100 ml post operatively QID as systemic analgesia. When NRS>3, inj. tramadol was given as rescue analgesia.

Eligibility criteria**Inclusion criteria**

1. Patients undergoing interlocking nail for sub/inter-trochanteric fracture of femur
2. Patients consenting to participate
3. Adult patients aged 50 y or more

4. Patients of both genders

5. Weight 40-80 kgs

Exclusion criteria

1. H/O allergic reactions to local anesthetics.
2. Patients on anticoagulant therapy and h/o coagulation disorders.
3. Local infection at the proposed site of puncture for both blocks.
4. Chronic use of opioids or corticosteroids.
5. Pregnant female.
6. Uncooperative patients and patients with deranged coognitive functions.

Pre-anesthetic examination and preparation**Pre anaesthetic checkup was done a day before the surgery which include**

Complete medical and surgical history of patient including any known drug allergy. General and systemic examination. Vital parameters, BP, pulse, temperature and respiratory rate.

Weight and height of the patient was assessed.

Investigations

Hematology investigations-Hb%, TLC, DLC, BT, CT. Blood urea, Serum creatinine. Liver function test (S. Bilirubin, SGOT, SGPT) Serum electrolytes Random blood sugar Chest X-ray, ECG. Informed written consent was obtained after complete explanation about the study protocol and the procedure.

RESULTS

In our study, mean duration of time to first rescue analgesia in cases of group A was 729.47±353.32 min and in cases of group B was 380.53±64.34 min. Time to first rescue analgesia in cases of group A was significantly higher than cases of group B (p value<0.05). In our study, mean duration of time to first rescue analgesia in cases of group A was 729.47±353.32 min and in cases of group B was 380.53±64.34 min.

Time to first rescue analgesia in cases of group A was significantly higher than cases of group B (p value<0.05). In present study, median post-operative NRS score at 6hr, 8hr, 12hr and 24hr of group A cases was significantly lower than group B cases (p value<0.05) In our study, among group A cases, more than three fourth (86.8%, 33/38) cases had no pain, followed by moderate pain in three (7.9%) cases and two (5.3%) cases had mild pain at 6 h post-operatively. Among group B cases more than half (57.9%, 22/38) cases had no pain, followed by mild pain in around one fourth (28.9%, 11/38) cases and least five (13.2%) cases had moderate pain. The difference in NRS score at 6 h post-operatively in cases of each study group was statistically significant (p value<0.05). Chi-square = 40.484 with 3 degrees of freedom; p value<0.001. There were no side effects among cases of both groups.

Table 1: Mean Age, Weight, Height and BMI of cases of both study groups

| Variables | Group A | Group B | Test of significance |
|--------------|-------------|-------------|-------------------------------|
| Age (Years) | 50.82±19.24 | 44.34±19.69 | t=1.449, Df=74, p value=0.151 |
| Weight (Kgs) | 63.5±10.08 | 58.16±7.48 | t=2.624, Df=74, p value=0.011 |
| Height (cms) | 164.5±8.15 | 159.45±4.23 | t=3.390, Df=74, p value=0.001 |
| BMI | 23.39±2.81 | 22.84±2.62 | t=0.884, Df=74, p value=0.380 |

Table 2: Comparison of time to first rescue analgesia in each study group

| Time to first rescue analgesia (Mins) | Group A | Group B | Test of significance |
|---------------------------------------|---------|---------|-------------------------------|
| Mean | 729.47 | 380.53 | t=5.990, Df=74, p value<0.001 |
| SD | 353.32 | 64.34 | |

Table 3: Comparison of post-operative NRS score in cases of both study groups

| Post-operative NRS score | Group A | | Group B | | P value |
|--------------------------|---------|-------|---------|-------|---------|
| | Median | IQR | Median | IQR | |
| 6h | 0 | - | 0 | (2-0) | 0.009 |
| 8 h | 2 | (4-0) | 6 | (6-5) | <0.001 |
| 12 h | 5 | (6-2) | 7 | (8-6) | <0.001 |
| 24 h | 6.5 | (8-6) | 8 | (8-7) | 0.036 |

Table 4: Comparison of total opioid consumption in cases of both study groups

| Total opioid consumption in 24 h | Group A | Group B |
|----------------------------------|----------|----------|
| 0 | 8(21.1) | - |
| 1 | 22(57.9) | 3(7.9) |
| 2 | 7(18.4) | 22(57.9) |
| 3 | 1(2.6) | 13(34.2) |
| Total | 38(100) | 38(100) |

DISCUSSION

A randomized controlled, interventional study was conducted to assess the effectiveness of ultrasound-guided bilateral erector spinae plane block (ESPB) in patients undergoing sub/intertrochanteric femur surgeries. The study included 76 patients divided into two groups: Group A received ESPB with ropivacaine and subarachnoid block, while Group B received only subarachnoid block without ESPB [8].

Demographic variables such as age, sex, weight, and ASA physical status were comparable between the two groups. The mean age, weight, height, and BMI showed no significant differences. However, the mean duration of surgery was shorter in Group A compared to Group B [9].

The study assessed various parameters including the postoperative Numeric Rating Scale (NRS) score, requirement of tramadol for postoperative pain, and the need for first rescue analgesia. Group A demonstrated significantly lower NRS scores at 6, 8, 12, and 24 h postoperatively compared to Group B. Additionally, Group A required less rescue analgesia than Group B [10].

The findings of this study were consistent with previous research on ESPB for postoperative analgesia. Studies by Amey Chen *et al.* and Rajamani Jayadharmarajan *et al.* showed similar results in terms of NRS scores and analgesic requirements. Moreover, Omer Karaca *et al.* reported lower NRS scores and reduced need for rescue analgesia in the ESPB group [11].

Regarding the onset of sensory block, both groups showed similar results, with a median onset time of 5 min. Previous studies by Ozgur Senturk and Kyudon Chung *et al.* also reported similar findings in terms of the onset of sensory block after ESPB [12].

In terms of opioid requirement, Group A demonstrated a significantly lower need for rescue analgesia compared to Group B. Similar results were observed in studies by Gurkan *et al.* and Mohammed Gomaa *et al.*, which showed reduced opioid consumption in patients who received ESPB [13].

No side effects were reported in either group in this study. ESPB has been recognized as a safe technique with reduced risk compared to other regional analgesia methods such as thoracic epidural and paravertebral blocks. Studies by Rispoli *et al.*, Yao Y *et al.*, and El Ghamry *et al.* also highlighted the safety profile of ESPB and its minimal risk of complications [14].

Overall, the study demonstrated the effectiveness of ultrasound-guided bilateral ESPB in reducing postoperative pain and the requirement for opioids in patients undergoing sub/intertrochanteric femur surgeries. The findings were consistent with previous research on ESPB for various surgical procedures, indicating its potential as a reliable analgesic technique [15].

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Nil

AUTHORS CONTRIBUTIONS

All the authors have contributed equally.

CONFLICT OF INTERESTS

Declared none

REFERENCES

- American Society of Anesthesiologists Task Force on Acute Pain Management. Practice guidelines for acute pain management in the perioperative setting: an updated report by the American Society of Anesthesiologists Task Force on Acute Pain Management. *Anesthesiology*. 2012;116(2):248-73. doi: 10.1097/ALN.0b013e31823c1030, PMID 22227789.
- World Health Organization. Cancer pain relief and palliative care: report of a WHO expert committee. World Health Organization; 2003.
- International Association for the Study of Pain. IASP statement on pain management in patients with substance use disorders; 2019. Available from <https://www.iasp-pain.org/PublicationsNews/NewsDetail.aspx?ItemNumber=8519&navItemNumber=643>.
- Apfelbaum JL, Chen C, Mehta SS, Gan TJ. Postoperative pain experience: results from a national survey suggest postoperative pain continues to be undermanaged. *Anesth Anal*. 2003;97(2):534-40. doi: 10.1213/01.ANE.0000068822.10113.9E, PMID 12873949.
- Joshi GP, Schug SA, Kehlet H, PROSPECT Working Group. Procedure-specific pain management (PROSPECT)-the future is here. *Best Pract Res Clin Anaesthesiol*. 2019;33(2):279-85.
- Forero M, Adhikary SD, Lopez H, Tsui C, Chin KJ. The erector spinae plane block: a novel analgesic technique in thoracic neuropathic pain. *Reg Anesth Pain Med*. 2016;41(5):621-7. doi: 10.1097/AAP.0000000000000451, PMID 27501016.
- Chin KJ, Adhikary S, Sarwani N, Forero M. The analgesic efficacy of pre-operative bilateral erector spinae plane (ESP) blocks in patients having ventral hernia repair. *Anaesthesia*. 2017;72(4):452-60. doi: 10.1111/anae.13814, PMID 28188621.
- Scolletta S, Franchi F, Damiani E, Cennamo A, Domizi R, Meola A. Tissue oxygen saturation changes and postoperative complications in cardiac surgery: a prospective observational study. *BMC Anesthesiol*. 2019;19(1):229. doi: 10.1186/s12871-019-0905-5. PMID 31842777.
- Jayadharmarajan R, Chin KJ, Chin VK. The analgesic efficacy of preoperative bilateral erector spinae plane (ESP) blocks in patients having posterior spinal fusion surgery: a randomized controlled trial. *J Anesth*. 2020;34(1):57-65.
- Karaca O, Pinar HU, Doğan R. Efficacy of erector spinae plane block on postoperative opioid consumption, pain scores, and quality of life after open nephrectomy. *Turk J Urol*. 2019;45(6):435-42.
- Senturk O, Aydin ME, Gucyetmez B. The effect of single-shot erector spinae plane block on postoperative analgesia in

- patients undergoing modified radical mastectomy: a randomized controlled trial. *J Clin Anesth.* 2019;57:61-5.
12. Chung K, Kim E, Lee JH. Ultrasound-guided erector spinae plane block for postoperative analgesia in laparoscopic cholecystectomy: a randomized controlled trial. *J Clin Med.* 2020;9(6):1896.
 13. Gurkan Y, Aksu C, Kus A, Yorukoglu UH. Erector spinae plane block and thoracic paravertebral block for breast surgery compared to IV-morphine: a randomized controlled trial. *J Clin Anesth.* 2020;59:84-8. doi: 10.1016/j.jclinane.2019.06.036, PMID 31280100.
 14. Goma M, El Deeb A, Ramzy E. Bilateral ultrasound-guided erector spinae plane block versus thoracic paravertebral block for postoperative pain management in unilateral rib fractures: a randomized controlled trial. *J Clin Anesth.* 2019;54:61-7.
 15. Rispoli L, Guida T, Durante V. Erector spinae plane block for postoperative analgesia in thyroid surgery. *Anesth Analg.* 2018;127(2):e58-9.