# Ultrasound Guided Erector Spinae Plane Block for Postoperative Analgesia in Patients Undergoing Percutaneous Nephrolithotomy.

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**Abstract**
Postoperative pain encompasses a complex range of sensations and emotions triggered by surgery. Non-pharmacological approaches, such as regional anaesthesia techniques have gained traction for their targeted pain relief and reduced reliance on opioids. The Erector Spinae Plane Block (ESPB) is one such technique showing promise, particularly for thoracic and abdominal surgeries. Our study compares the efficacy, duration and quality of analgesia provided by ESPB and number of rescue analgesics required in the first 48 hour period with conventional method of analgesia in patients undergoing percutaneous nephrolithotomy (PCNL).

This study was carried out on 70 patients undergoing elective PCNL randomly assigned to one of two groups. At the end of surgery, patients in Group R received ESPB and Group T received I.V. Tramadol 12th hourly. The Visual Analogue Scale (VAS) was recorded at rest and on movement, 2 hours, 4 hours, 12 hours, 24 hours and 48hours postoperatively. During the postoperative period, patients of both groups were given Inj. Tramadol 1.5mg/kg IV stat on demand for rescue analgesia.

No significant difference in VAS was seen at 2 hours between group R and T both at rest (p value=0.554) and on movement (p value=0.82). Whereas significant difference in VAS was seen at 4, 12, 24, and 48 hours between group R and T both at rest (4 hours:- p value=0.0007; 12, 24, and 48 hours :- p value<0.0001 ) and on movement ( 4,12, 24, and at 48 hours between:- p value<0.0001 ). Proportion of patients who required rescue analgesia was significantly lower in group R as compared to group T. (14.29% vs 37.14% respectively, p value=0.029). There were no cases of local anaesthetic toxicity in either group

## Introduction

Percutaneous nephrolithotomy (PCNL) stands as a cornerstone in the management of large kidney and upper ureter stones, representing a minimally invasive surgical procedure that has revolutionized the field of urology [1]. Despite its remarkable efficacy in stone clearance, PCNL is accompanied by a significant burden: severe postoperative pain. This pain typically arises from the dilation of the renal capsule and the parenchymal tract, with contributions from both visceral (T10-L2) and somatic (T8-T12) nociceptive pathways [2].

Effective management of postoperative pain requires a multimodal approach that addresses both the nociceptive and non-nociceptive components of pain. Pharmacological interventions, including opioids, nonsteroidal anti-inflammatory drugs (NSAIDs), and adjuvant medications, play a central role in pain management by targeting nociceptive pathways and modulating pain perception [3]. However, the use of opioids, while effective for acute pain relief, is associated with a range of adverse effects, including sedation, respiratory depression, nausea, and constipation, highlighting the need for judicious opioid prescribing and the exploration of alternative analgesic strategies [4].

In recent years, there has been growing interest in non-pharmacological approaches to postoperative pain management, including regional anaesthesia techniques, such as epidural analgesia, peripheral nerve blocks, and fascial plane blocks [5]. These techniques offer targeted analgesia while minimizing systemic opioid exposure,

thereby reducing the risk of opioid-related adverse effects and facilitating early ambulation and rehabilitation [6]. Among these regional anaesthesia modalities, the Erector Spinae Plane Block (ESPB) has gained recognition as a promising method for delivering effective analgesia after thoracic and abdominal surgeries. [7].

This regional anaesthesia technique involves the ultrasound-guided administration of local anaesthetics into the fascial plane underneath the erector spinae muscle. It provides focused pain relief to somatic and visceral pathways as this approach inhibits both the dorsal and ventral branches of spinal nerves and the sympathetic chain[7]. ESPB can provide robust analgesia while minimizing the systemic effects associated with opioids and other systemic analgesics and facilitating early recovery and rehabilitation. However, it is essential for researchers to explore how to optimally use these techniques and their influence on patient outcomes in different surgical settings.

The advantages of ESPB in the context of PCNL are manifold. Firstly, ESPB provides targeted analgesia to the specific dermatomes involved in postoperative pain following PCNL. Additionally, ESPB can be performed with minimal sedation or under local anaesthesia, making it suitable for patients with comorbidities or those at risk of complications from systemic opioids.

Previous studies have indicated that ESPB is efficacious in decreasing postoperative pain and opioid usage in patients undergoing various surgical procedures, including PCNL [8-11]. These findings establishes the potential of ESPB as a valuable adjunct in postoperative pain management following PCNL, offering patients a safer and more effective alternative to traditional analgesic modalities.

Other modalities for postoperative pain management include, IV analgesics, local infiltration, transdermal analgesics. Intravenous administration of tramadol is a widely practiced modality which has stood the test of time. It offers exceptional analgesia, requires no skill for administration, can be given bedside by nursing staff, and is extremely convenient to provide immediate pain relief. It is a universally accepted alternative for Patient Controlled Analgesia (PCA). This study has been designed to evaluate the efficacy of ultrasound guided erector spinae plane block for postoperative analgesia following percutaneous nephrolithotomy. It explores ESPB, delving into the complexities of postoperative pain management and the strategies employed to mitigate its impact on patient outcomes.

**Materials and Methods**

Prior to beginning our study, approval was obtained from Institutional Ethical Committee (Research Protocol Number : IESC/PGS/2022/152). Assuming the effect size of VAS was 0.7 (large), taking alpha error as 5%, power of study 80% and computer generated randomisation, the calculated sample size came to 68 patients, rounding off to 70 patients with 35 in each group. The sample size was calculated using the software G;power 3.1.9.7. The study was carried out on 70 patients belonging to ASA (American Society of Anaesthesiologists) Grade I and Grade II aged between 18-65 years, including either gender, who were hemodynamically stable, had all routine investigations within normal limits, and did not have any other comorbidities, scheduled for elective PCNL under spinal anaesthesia. Patients with ASA Grade III or more, patients below 18 years and above 65 years of age, patients posted for emergency procedures and those with major neurological, cardiac, respiratory, metabolic, renal, hepatic disease with coagulation abnormalities were excluded. After obtaining informed written consent from patients in their own understandable language they were randomly assigned to one of the two groups.

Group R: ESPB with 20ml of 0.5% Ropivacaine + Dexamethasone 8mg: 35 patients
Group T: IV Tramadol 1.5mg/kg: 35 patients

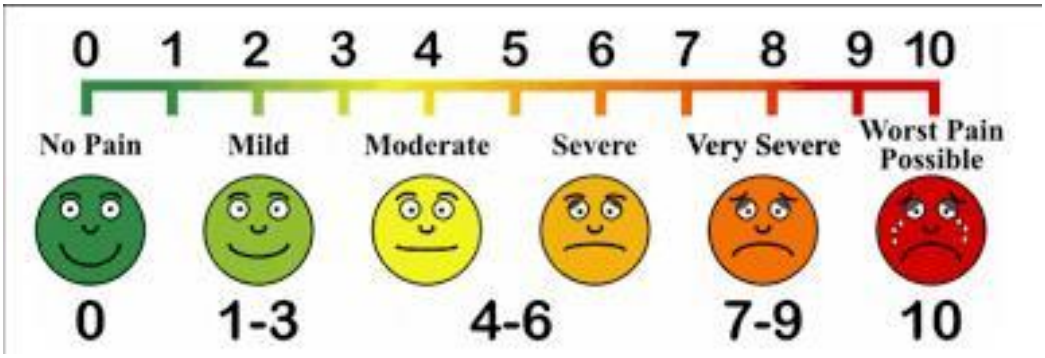
All patients were subjected through pre-anaesthetic evaluation and relevant laboratory investigations. Patients were kept nil by mouth from midnight prior to surgery. Preoperative baseline pulse, non-invasive blood pressure, ECG and oxygen saturation were noted. Peripheral venous access was secured with a 20G intravenous (IV) cannula. Spinal anaesthesia was given in the sitting position with due aseptic precautions with 3ml of 0.5% Inj. BUPIVACAINE HEAVY + 25mcg of Inj. FENTANYL.

At the end of the surgery, in Group R, Erector Spine Plane Block was performed on the respective operated side. A preliminary scan was done to define and mark the required level (T8), the midline (spinous processes) and bilaterally mark the injection points 3 cm from midline. The field was prepared with povidone iodine 5% and 2-3 ml of 2% lidocaine skin infiltration was given at the site of block. A high frequency curvilinear ultrasound probe was used to identify the ultrasound anatomical landmarks. A 90 mm 22 G spinal needle was then advanced in a cephalad to caudal

direction using in-plane needling technique under ultrasound guidance, aiming toward the tip of transverse process. Once a gentle contact was made with the tip of the transverse process small bolus of local anaesthetic was given through the needle. The erector spinae muscle was observed to be separating from the transverse process which confirmed the proper needle position. A total of 20ml 0.5% Ropivacaine with Dexamethasone 8mg was then injected in 5 ml increments, with aspiration after every 5 ml as a precaution to avoid intravascular injection. All necessary precautions for safe administration of the local anaesthetics were taken.

In group T : Inj. Tramadol IV 1.5mg/kg 12hourly was given as per routine pain management protocol in PCNL.

The Visual analogue Scale (VAS) was recorded at rest and on movement, 2 hours, 4 hours, 12 hours, 24 hours and 48hours postoperatively. During the postoperative period, patients of both groups were given Inj. Tramadol 1.5mg/kg IV stat on demand for rescue analgesia when the pain score was more than 5 on the basis of the VAS. Time of administration the rescue analgesic was noted and chart was maintained.




Picture 9: Visual Analogue Scale

The presentation of the Categorical variables was done in the form of number and percentage (%). On the other hand, the quantitative data were presented as the means ± SD and as median with 25$^{th}$ and 75$^{th}$ percentiles (interquartile range). The following statistical tests were applied for the results:

The comparison of the variables which were quantitative in nature were analysed using Independent t test.

The comparison of the variables which were qualitative in nature were analysed using Chi-Square test. If any cell had an expected value of less than 5 then Fisher's exact test was used.

The data entry was done in the Microsoft EXCEL spreadsheet and the final analysis was done with the use of Statistical Package for Social Sciences (SPSS) software, IBM manufacturer, Chicago, USA, ver 25.0.

For statistical significance, p value of less than 0.05 was considered statistically significant.

**Results and observations**

Distribution of age(years) was comparable between group R and T. (18-30 years:- 37.14% vs 40% respectively, 31-40 years:- 37.14% vs 25.71% respectively, 41-50 years:- 22.86% vs 25.71% respectively, 51-60 years:- 2.86% vs 8.57% respectively) (p value=0.639).

Mean ± SD of age(years) in group R was 35.03 ± 8.5 and in group T was 34.97 ± 10.53 with no significant difference between them. (p value=0.98) (Table 1).

70 patients were studied and it was observed that the age distribution between groups R and T was largely similar, with no significant differences across the age ranges. The largest age group in both of the study groups was 18-30 years with 13 and 14 patients respectively. The average age was similar as well, with group R having a mean age of 35.03 years and group T having a mean age of 34.97 years. Proportions of males and females were effectively the same in both groups. The average weight in group R was 64.29 kg, and in group T, it was 64.17 kg.

Statistical analysis showed no significant difference in age distribution or average age (p-values of 0.639 and 0.98, respectively) , gender distribution (p- value of 0.631), and weight ( p-value of 0.934) between the groups.

**Table 1:-Comparison of age(years) between group R and T.**

| | Group R(n=35) | Group T(n=35) | Total | P value |
|---|---|---|---|---|
| **Age(years)** | | | | |
| 18-30 | 13 (37.14%) | 14 (40%) | 27 (38.57%) | 0.639* |
| 31-40 | 13 (37.14%) | 9 (25.71%) | 22 (31.43%) | |
| 41-50 | 8 (22.86%) | 9 (25.71%) | 17 (24.29%) | |
| 51-60 | 1 (2.86%) | 3 (8.57%) | 4 (5.71%) | |
| Mean ± SD | 35.03 ± 8.5 | 34.97 ± 10.53 | 35 ± 9.5 | 0.98‡ |
| Median(25th-75th percentile) | 33(28-40.5) | 33(28.5-44) | 33(28-42.75) | |
| Range | 21-55 | 18-55 | 18-55 | |
| **Gender** | | | | |
| | | | | |
| Female | 15 (42.86%) | 17 (48.57%) | 32 (45.71%) | 0.631† |
| Male | 20 (57.14%) | 18 (51.43%) | 38 (54.29%) | |
| Total | 35 (100%) | 35 (100%) | 70 (100%) | |
| | | | | |
| **Weight(kg)** | | | | |
| Mean ± SD | 64.29 ± 6.65 | 64.17 ± 4.72 | 64.23± 5.73 | 0.934‡ |
| Median(25th-75th percentile) | 65(58-69) | 65(62-67.75) | 65(60-68) | |
| Range | 52-81 | 54-72 | 52-81 | |

‡ **Independent t test,** * **Fisher's exact test**

Distribution of gender was comparable between group R and T. (Female:- 42.86% vs 48.57% respectively, Male:- 57.14% vs 51.43% respectively) (p value=0.631) (Table 2).

**Table 2:-Comparison of gender between group R and T.**

| Gender | Group R(n=35) | Group T(n=35) | Total | P value |
|---|---|---|---|---|
| Female | 15 (42.86%) | 17 (48.57%) | 32 (45.71%) | 0.631† |
| Male | 20 (57.14%) | 18 (51.43%) | 38 (54.29%) | |
| Total | 35 (100%) | 35 (100%) | 70 (100%) | |

† **Chi square test**

Mean ± SD of weight(kg) in group R was 64.29 ± 6.65 and in group T was 64.17 ± 4.72 with no significant difference between them.(p value=0.934) (Table 3).

**Table 3:-Comparison of weight(kg) between group R and T.**

| Weight(kg) | Group R(n=35) | Group T(n=35) | Total | P value |
|---|---|---|---|---|
| Mean ± SD | 64.29 ± 6.65 | 64.17 ± 4.72 | 64.23 ± 5.73 | 0.934‡ |
| Median(25th-75th percentile) | 65(58-69) | 65(62-67.75) | 65(60-68) | |
| Range | 52-81 | 54-72 | 52-81 | |

‡ **Independent t test**

No significant difference was seen in VAS at rest at 2 hours (p value=0.554) between group R and T. Mean ± SD of VAS at rest at 2 hours in group R was 1.8 ± 0.63 and in group T was 1.71 ± 0.57 with no significant difference between them.

Significant difference was seen in VAS at rest at 4 hours, at 12 hours, at 24 hours, at 48 hours between group R and T.(p value <.05) Mean ± SD of VAS at rest at 4 hours, at 12 hours, at 24 hours, at 48 hours in group T was 4.49 ± 0.61, 5.43 ± 0.65, 5.09 ± 0.85, 3.97 ± 0.79 respectively which was significantly higher as compared to group R (3.86 ± 0.85(p value=0.0007), 4.14 ± 0.88(p value<.0001), 2.97 ± 0.82(p value<.0001), 2.03 ± 0.51(p value<.0001)) respectively.

At 2 hours, there was no significant difference in VAS between group R (1.8 ± 0.63) and group T (1.71 ± 0.57). However, at 4 hours, group T had a higher average pain score of 4.49 ± 0.61 compared to group R's 3.86 ± 0.85, with a significant difference (p = 0.0007). This trend continued at 12 hours, where group T's average pain score was 5.43 ± 0.65 versus 4.14 ± 0.88 for group R (p < 0.0001). At 24 hours, group T had a score of 5.09 ± 0.85, significantly higher than group R's 2.97 ± 0.82 (p < 0.0001). By 48 hours, group T's pain level was 3.97 ± 0.79, compared to 2.03 ± 0.51 in group R (p < 0.0001).(Table 4).

**Table 4:-Comparison of VAS at rest between group R and T.**

| VAS at rest | Group R(n=35) | Group T(n=35) | Total | P value |
|---|---|---|---|---|
| **At 2 hours** | | | | |
| Mean ± SD | 1.8 ± 0.63 | 1.71 ± 0.57 | 1.76 ± 0.6 | 0.554‡ |
| Median(25th-75th percentile) | 2(1-2) | 2(1-2) | 2(1-2) | |
| Range | 1-3 | 1-3 | 1-3 | |
| **At 4 hours** | | | | |
| Mean ± SD | 3.86 ± 0.85 | 4.49 ± 0.61 | 4.17 ± 0.8 | 0.0007‡ |
| Median(25th-75th percentile) | 4(3-4) | 4(4-5) | 4(4-5) | |
| Range | 2-6 | 3-6 | 2-6 | |
| **At 12 hours** | | | | |
| Mean ± SD | 4.14 ± 0.88 | 5.43 ± 0.65 | 4.79 ± 1.01 | <.0001‡ |
| Median(25th-75th percentile) | 4(4-4) | 5(5-6) | 5(4-6) | |
| Range | 3-6 | 3-6 | 3-6 | |
| **At 24 hours** | | | | |
| Mean ± SD | 2.97 ± 0.82 | 5.09 ± 0.85 | 4.03 ± 1.35 | <.0001‡ |
| Median(25th-75th percentile) | 3(2.5-3) | 5(5-6) | 4(3-5) | |
| Range | 2-6 | 2-6 | 2-6 | |
| **At 48 hours** | | | | |
| Mean ± SD | 2.03 ± 0.51 | 3.97 ± 0.79 | 3 ± 1.18 | <.0001‡ |
| Median(25th-75th percentile) | 2(2-2) | 4(4-4) | 3(2-4) | |
| Range | 1-3 | 1-5 | 1-5 | |

‡ **Independent t test**

No significant difference was seen in VAS on movement at 2 hours (p value=0.82) between group R and T. Mean ± SD of VAS on movement at 2 hours in group R was 1.8 ± 0.63 and in group T was 1.83 ± 0.38 with no significant difference between them.

Significant difference was seen in VAS on movement at 4 hours, at 12 hours, at 24 hours, at 48 hours between group R and T.(p value <.05) Mean ± SD of VAS on movement at 4 hours, at 12 hours, at 24 hours, at 48 hours in group T was 5.34 ± 0.48, 5.66 ± 0.59, 4.31 ± 0.93, 3.49 ± 0.61 respectively which was significantly higher as compared to group R (4.03 ± 0.66(p value<.0001), 3.74 ± 0.51(p value<.0001), 2.91 ± 0.66(p value<.0001), 2.46 ± 0.51(p value<.0001)) respectively.

At 2 hours, there was no significant difference in pain levels on movement between group R and group T, with both groups reporting similar scores (group R: 1.8 ± 0.63, group T: 1.83 ± 0.38, p = 0.82). However, significant differences emerged at 4, 12, 24, and 48 hours. At 4 hours, group T reported a higher average VAS score of 5.34 ± 0.48 compared to 4.03 ± 0.66 in group R (p < 0.0001). By 12 hours, the average pain score for group T was 5.66 ± 0.59, significantly higher than group R's 3.74 ± 0.51 (p < 0.0001). At 24 hours, group T's pain level was 4.31 ± 0.93, while group R's was 2.91 ± 0.66 (p < 0.0001). At 48 hours, group T had a mean score of 3.49 ± 0.61 compared to 2.46 ± 0.51 in group R (p < 0.0001). (Table 5).

**Table 5:-Comparison of VAS on movement between group R and T.**

| VAS on movement | Group R(n=35) | Group T(n=35) | Total | P value |
|---|---|---|---|---|
| **At 2 hours** | | | | |
| Mean ± SD | 1.8 ± 0.63 | 1.83 ± 0.38 | 1.81 ± 0.52 | 0.82‡ |
| Median(25th-75th percentile) | 2(1-2) | 2(2-2) | 2(2-2) | |
| Range | 1-3 | 1-2 | 1-3 | |
| **At 4 hours** | | | | |
| Mean ± SD | 4.03 ± 0.66 | 5.34 ± 0.48 | 4.69 ± 0.88 | <.0001‡ |
| Median(25th-75th percentile) | 4(4-4) | 5(5-6) | 5(4-5) | |
| Range | 3-5 | 5-6 | 3-6 | |
| **At 12 hours** | | | | |
| Mean ± SD | 3.74 ± 0.51 | 5.66 ± 0.59 | 4.7 ± 1.11 | <.0001‡ |
| Median(25th-75th percentile) | 4(3-4) | 6(5-6) | 4(4-6) | |
| Range | 3-5 | 4-6 | 3-6 | |
| **At 24 hours** | | | | |
| Mean ± SD | 2.91 ± 0.66 | 4.31 ± 0.93 | 3.61 ± 1.07 | <.0001‡ |
| Median(25th-75th percentile) | 3(2.5-3) | 4(4-5) | 3.5(3-4) | |
| Range | 2-4 | 3-6 | 2-6 | |
| **At 48 hours** | | | | |
| Mean ± SD | 2.46 ± 0.51 | 3.49 ± 0.61 | 2.97 ± 0.76 | <.0001‡ |
| Median(25th-75th percentile) | 2(2-3) | 3(3-4) | 3(2-3) | |
| Range | 2-3 | 2-5 | 2-5 | |

‡ **Independent t test**

Proportion of patients who required rescue analgesia was significantly lower in group R as compared to group T. (14.29% vs 37.14% respectively). (p value=0.029)(Table 6).

**Table 6:-Comparison of requirement of rescue analgesia between group R and T.**

| Requirement of rescue analgesia | Group R(n=35) | Group T(n=35) | Total | P value |
|---|---|---|---|---|
| No | 30 (85.71%) | 22 (62.86%) | 52 (74.29%) | 0.029† |
| Yes | 5 (14.29%) | 13 (37.14%) | 18 (25.71%) | |
| Total | 35 (100%) | 35 (100%) | 70 (100%) | |

† **Chi square test**

Proportion of patients who did not require rescue analgesia was significantly higher in group R as compared to group T. (85.71% vs 62.86% respectively). Proportion of patients who required rescue analgesia required once was significantly lower in group R as compared to group T. (1:-11.43% vs 37.14% respectively). (p value=0.024)(Table 7).

**Table 7:-Comparison of number of times rescue analgesia required between group R and T.**

| Number of times rescue analgesia required | Group R(n=35) | Group T(n=35) | Total | P value |
|---|---|---|---|---|
| 0 | 30 (85.71%) | 22 (62.86%) | 52 (74.29%) | 0.024* |
| 1 | 4 (11.43%) | 13 (37.14%) | 17 (24.29%) | |
| 2 | 1 (2.86%) | 0 (0%) | 1 (1.43%) | |
| Total | 35 (100%) | 35 (100%) | 70 (100%) | |

* **Fisher's exact test**

**Discussion**

PCNL, often heralded as a gold standard procedure for the treatment of renal calculi, involves the percutaneous removal of stones from the kidney and upper ureter through a small incision, typically guided by fluoroscopy or ultrasound [1]. PCNL offers patients a less invasive alternative to traditional open surgery with reduced morbidity and faster recovery times. However, postoperative pain following PCNL is a significant concern. It is multifaceted, stemming from various sources including the dilation of the renal capsule and parenchymal tract during stone removal. This pain manifests along both visceral and somatic nociceptive pathways, with contributions from thoracolumbar segments spanning from T8 to L2. The complexity of pain experienced by patients undergoing PCNL, necessitates a comprehensive approach to pain management.

Effective postoperative pain management is paramount in optimizing patient outcomes and satisfaction following PCNL. Poorly controlled pain can impede recovery, prolong hospital stays, and exacerbate patient discomfort, highlighting the need for tailored analgesic strategies.

In our study we have observed that ultrasound guided Erector Spinae Plane Block (ESPB) is significantly more effective than intravenous (IV) Tramadol in managing postoperative pain for patients undergoing percutaneous nephrolithotomy (PCNL). The VAS scores at rest and on movement were consistently lower in the ESPB group at all measured postoperative intervals (4, 12, 24, and 48 hours), indicating superior pain control.

In a study namely "The erector spinae plane block: A novel analgesic technique in thoracic neuropathic pain" Forero M. et al.,[7] first described the ESPB as an effective analgesic technique for thoracic neuropathic pain, demonstrating its potential for broader applications in pain management. Our findings indicate that ESPB is not only effective in thoracic and abdominal surgeries but also provides significant pain relief in urological procedures.

Subsequent studies have explored the use of ESPB in a range of surgical contexts, including abdominal and thoracic surgeries, where effective pain management is crucial for patient recovery. In a study by Restrepo-Garces et al., [8] "The Erector Spinae Plane Block for Postoperative Analgesia after Percutaneous Nephrolithotomy: A Prospective Study" confirmed that ESPB provided excellent analgesia in patients undergoing upper and lower abdominal surgeries, reducing the reliance on opioids and their associated side effects. The ability of ESPB to cover a wide dermatomal area with a

single injection made it particularly useful in abdominal surgeries, where multiple nerve territories might be involved. Our study supports these results and suggests that the analgesic benefits of ESPB extend to a wide variety of surgical disciplines, making it a and valuable technique in multimodal analgesia strategies for perioperative pain management.

Similarly, in another study by Kim et al., [9] "Erector Spinae Plane Block for Postoperative Analgesia after Percutaneous Nephrolithotomy: A Case Report" they demonstrated that ESPB significantly reduced postoperative pain scores and opioid consumption compared to traditional analgesic techniques. These findings were reinforced by our study which showcased similar results with reduced VAS scores and significantly lower postoperative opioid consumption.

In another study by Pandey SP. Et al., [10] named "Efficacy of Ultrasound-Guided Erector Spinae Plane Block in Percutaneous Nephrolithotomy" came to a conclusion that ultrasound-guided ESP block provided efficient postoperative pain relief, prolonged duration of analgesia, and reduced tramadol intake after PCNL. Our study, also consistently found that ESPB provided superior analgesia with fewer side effects owing to reduced tramadol intake promoting faster recovery and improved patient satisfaction.

In another study, by Ibrahim M. et al., [11] " Analgesic efficacy of erector spinae plane block in percutaneous nephrolithotomy" determined that patients who received the block exhibited lower intraoperative fentanyl usage, an extended time to initial use of Patient Controlled Analgesia (PCA), and less rescue morphine consumption within 24 hours. The results of this study align with our research on the efficacy of ESPB for postoperative pain management.

Similarly in a systematic review carried out by Winoker JS. Et al., [12] namely "Opioid-Sparing Analgesic Effects of Peripheral Nerve Blocks in Percutaneous Nephrolithotomy: A Systematic Review" verified that studies observed lower pain scores in patients who received Peripheral Nerve Blocks throughout the 24-hour postop period. Total analgesic and opioid requirements were significantly lowered as well. Throughout our study, participants in the ESPB group consistently indicated lower VAS scores during both rest and movement, and reduced opioid consumption.

In a study by, Shah B et al., [13] "Erector spinae plane block for postoperative analgesia following percutaneous nephrolithotomy under spinal anaesthesia- A randomised controlled study" observed that conventional analgesia with injection tramadol 1.5 mg/kg intravenously immediately after PCNL resulted in patients with higher VAS scores, inadequate analgesia and requiring more rescue analgesia when compared to patients who received ESPB. Similar results were observed in our study with IV tramadol emerging as an inferior alternative to ESPB in managing postoperative pain, and was also associated with more adverse effects when compared to ESPB.

In another study by Gao Y. et al., [14] "Postoperative analgesia efficacy of erector spinae plane block in adult abdominal surgery: A systematic review and meta-analysis of randomized trials." compared with transversus abdominal plane block (TAPB) and ESPB in patients undergoing laparoscopic cholecystectomy, percutaneous nephrolithotomy and bariatric surgery. They confirmed that analgesic efficacy of ESPB is superior than TAPB. Their observations are in alignment with our study which certifies that ESPB proves to be a significantly effective and safe anaesthesia approach, improving postoperative pain response, decreasing analgesic consumption, and prolonging the time before the first request for postoperative analgesia, without significant postoperative complications.

In another study by Zehra Hatipoglu, et al., [15] "Comparative study of ultrasound-guided paravertebral block versus intravenous tramadol for postoperative pain control in percutaneous nephrolithotomy" drew a conclusion that Ultrasound-guided PVB provided superior analgesia in comparison to tramadol. VAS and total PCA Tramadol was statistically higher in patients receiving IV Tramadol than in patients receiving PVB. Our study also reinforces that patients receiving Tramadol experienced inadequate analgesia when compared to patients receiving ESPB.

In a study by Chin et al., [6] "The analgesic efficacy of pre-operative bilateral erector spinae plane (ESP) blocks in patients having ventral hernia repair" They demonstrated that superior pain control and prolonged analgesia was provided by ESPB make it a valuable addition to multimodal analgesia protocols, which aim to optimize pain management by combining different analgesic technique. In our study we observed that this approach not only enhances pain relief but also reduces the need for high doses of any single medication, thereby

minimizing side effects and improving overall patient safety.

Moreover, the use of ESPB can contribute to addressing the broader public health issue of opioid overuse and dependency. By This aligns with the findings of Winoker JS. et al., [12] in their study "Opioid-Sparing Analgesic Effects of Peripheral Nerve Blocks in Percutaneous Nephrolithotomy: A Systematic Review" who highlighted the potential of ESPB to reduce opioid consumption in postoperative pain management. The reduction in opioid use not only benefits individual patients by decreasing the risk of addiction and adverse effects but also has positive implications for public health by contributing to the broader efforts to curb opioid abuse. Our study supports these findings as we found that ESPB offers a promising alternative in the fight against the opioid crisis by providing effective and sustained pain relief with minimal reliance on opioids.

**Limitations of the study**

The study was conducted at a single institution.
Cost effectiveness of the stud was not performed.
Only patients with ASA Grade I and II belonging to age group 18 to 65years of age were included in the study.
Patient posted for emergency procedures were not included.
Patients with major neurological, cardiac, respiratory, metabolic, renal. Hepatic disease with coagulation abnormalities were not a part of our study.

## CONCLUSION

This study provides strong evidence that Ultrasound Guided Erector Spinae Plane Block is significantly more effective than intravenous Tramadol for postoperative analgesia in patients undergoing percutaneous nephrolithotomy.

The lower VAS scores, extended duration of analgesia, reduced need for rescue analgesics, and lower incidence of adverse effects observed in the ESPB group establishes its potential as a superior pain management technique.

These revelations hold profound significance for enhancing postoperative care, thereby substantially elevating patient outcomes.