

Ultrasound-Guided Erector Spinae Plane Block Vs. Intramuscular Piroxicam in The Management of Renal Colic

Pain: A Comparative Study

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Abstract

Background: Renal colic is a common urological emergency often causing severe flank pain that radiates to the groin, typically managed with nonsteroidal anti-inflammatory drugs (NSAIDs) or opioids. Ultrasound-guided Erector Spinae Plane Block (ESPB) has recently gained attention as a regional anesthesia technique for acute pain management. This study compares the efficacy and safety of ESPB versus intramuscular (IM) Piroxicam in patients with renal colic presenting to the Emergency Department.

Methods: A prospective, cross-sectional comparative study was conducted in a tertiary care center from September 2022 to March 2024. Adult patients aged 18–45 years presenting with moderate to severe renal colic (NRS score 5–10) were recruited. Patients self-selected either ESPB (Group A) or IM Piroxicam (Group B) after providing informed consent. Pain scores (Numeric Rating Scale, NRS) and vital parameters were recorded at 0, 15, 30, 45, and 60 minutes post-intervention. Need for rescue analgesia and any adverse events were also documented.

Statistical analysis was performed using appropriate tests with $p < 0.05$ considered significant.

Results: A total of 50 patients (25 in each group) were enrolled. Both groups demonstrated a significant reduction in pain at all-time points compared to baseline ($p < 0.05$). However, ESPB consistently showed lower mean NRS scores than Piroxicam at 15, 30, 45, and 60 minutes ($p < 0.05$). Although 4 patients in the Piroxicam group required rescue analgesia, none were needed in the ESPB group ($p = 0.118$). No major complications or adverse events were observed in either group.

Conclusion: Ultrasound-guided ESPB appears to offer superior analgesia compared to IM Piroxicam for renal colic, with faster pain relief and a lower likelihood of requiring rescue analgesia. Further large-scale, randomized controlled trials are recommended to validate these findings.

Keywords: Renal colic, Erector spinae plane block, Piroxicam, Pain management, Emergency medicine

Introduction

Renal colic, characterized by excruciating flank pain radiating to the groin, is a distressing urological emergency encountered frequently in the Emergency Department (ED)¹. The pain primarily arises from abrupt ureteral obstruction, most commonly by kidney stones, leading to increased intraluminal pressure and subsequent activation of nociceptive pathways². Rapid and effective pain control is essential for managing renal colic, as inadequate analgesia may lead to significant patient discomfort, vasovagal episodes, and even compromised diagnostic imaging due to patient agitation³.

Current pain management strategies for renal colic commonly involve nonsteroidal anti-inflammatory drugs (NSAIDs), opioids, or a combination of both. NSAIDs, such as Piroxicam, effectively alleviate pain by reducing the inflammatory response triggered by ureteral obstruction⁴. However, the adverse effects associated with NSAIDs, including gastrointestinal bleeding and renal dysfunction, may limit their use in certain patient populations. Opioids, on the other hand, are potent analgesics but carry the risk of respiratory depression, sedation, and the potential for abuse⁵. Balancing effective analgesia with safety concerns remains a cornerstone of optimal renal colic treatment.

Regional anesthesia techniques have emerged as promising adjuncts or alternatives for pain control in acute settings. Ultrasound-guided Erector Spinae Plane Block (ESPB) has gained traction for its ability to provide effective analgesia in thoracic and abdominal conditions⁶. By depositing local anesthetic in the fascial plane deep to the erector spinae muscle, ESPB can block the dorsal and ventral rami of the thoracic spinal nerves and some of the sympathetic chain, potentially offering broad regional analgesia⁷. Its ease of administration, minimal hemodynamic impact, and relatively low

complication rate make it an attractive option in the acute pain setting, including renal colic.

Nonetheless, there is a paucity of robust, comparative evidence evaluating the efficacy of ESPB versus standard analgesic strategies such as IM Piroxicam for acute flank pain management. The need for timely and effective analgesia in renal colic presents a clear rationale for exploring novel or underutilized interventions that may alleviate pain more efficiently and with fewer adverse outcomes⁸. This study was conducted to compare the analgesic efficacy, hemodynamic effects, and safety profiles of ultrasound-guided Erector Spinae Plane Block against intramuscular Piroxicam in adult patients presenting with renal colic to the ED. We hypothesized that ESPB would provide equivalent or superior pain control, potentially reducing the requirement for rescue analgesia and improving overall patient satisfaction.

Materials and Methods

Study Type and Design

This was a **prospective, cross-sectional comparative study** carried out in the Department of Emergency Medicine, Mahatma Gandhi Medical College & Hospital, Jaipur (Rajasthan), India. Approval of the research protocol was obtained from the Institutional Research Review Board and Institutional Ethical Committee prior to commencement. Data collection spanned from September 2022 to March 2024.

Study Setting and Participants

Patients aged 18–45 years presenting with flank pain suggestive of renal colic (pain radiating from the loin to the groin, intermittent in nature, associated with nausea/vomiting or urinary complaints) were screened. Those fulfilling the inclusion criteria and consenting to participate were enrolled.

Inclusion Criteria

1. Age 18–45 years.

2. Patients presenting with renal colic (NRS 5–10) willing to participate.
3. All genders.

Exclusion Criteria

1. Unwilling or uncooperative patients.
2. Patients with cardiovascular, liver, or renal disease, or those with a history of gastrointestinal bleeding.
3. Pregnant and lactating females.
4. Known allergy to NSAIDs or local anesthetics.
5. Patients who received any analgesic treatment prior to ED presentation.
6. Any kind of spinal deformity.
7. Hemodynamically unstable patients.

Sample Size and Sampling

All eligible patients with renal colic were enrolled during the study period using **convenient sampling**. Written informed consent was obtained prior to any study-related procedures.

Intervention and Group Allocation

Patients were offered the option to choose between Ultrasound-Guided Erector Spinae Plane Block (Group A, ESPB) or Intramuscular Piroxicam (Group B) for pain management.

- **Group A (ESPB):** Under strict aseptic conditions, patients were placed in a sitting or lateral decubitus position based on comfort. The T8 vertebral level was identified by palpating from the C7 vertebra. A high-frequency linear ultrasound probe (6–13 MHz) was placed in a parasagittal plane approximately 3 cm lateral to the midline at the T8 level to visualize the transverse process. After local infiltration with 1 mL of 1% lidocaine, a 20–22 G spinal needle was inserted in-plane (craniocaudal approach). Correct placement between the transverse process and erector spinae fascia was confirmed by hydrodissection with 2–4 mL of normal saline. Subsequently, 30 mL of

0.25% bupivacaine was administered. Vital signs and NRS scores were documented at 0, 15, 30, 45, and 60 minutes post-injection. Any complications were noted.

- **Group B (IM Piroxicam):** Patients received 40 mg Piroxicam IM (20 mg/mL ampoule) without dilution. The same vital signs and pain score measurements were recorded at 0, 15, 30, 45, and 60 minutes. Any adverse effects were documented.

Following adequate analgesia, all patients underwent appropriate imaging (ultrasound or non-contrast CT) to confirm the diagnosis of renal colic.

Outcome Measures

1. **Primary Outcome:** Pain intensity measured by the **Numeric Rating Scale (NRS)** at baseline, 15, 30, 45, and 60 minutes.
2. **Secondary Outcomes**
 - Hemodynamic parameters (blood pressure and heart rate) at the same time intervals.
 - The need for rescue analgesia within 60 minutes.
 - Adverse events or complications related to the procedure or medications.

Statistical Analysis

All data were entered into MS Excel to create a master chart and analyzed using jamovi (Version 2.5). Categorical variables (e.g., gender, rescue analgesia) were presented as frequencies and percentages. Continuous variables (e.g., age, blood pressure) were expressed as mean \pm standard deviation. Between-group comparisons were done using the unpaired t-test (for normally distributed data) or Mann-Whitney U-test, and within-group comparisons over time were done using the paired t-test. A p-value < 0.05 was considered statistically significant.

Results

Table 1: Gender

Gender	ESPB (Group A), n (%)	Piroxicam (Group B), n (%)
Male	17 (68%)	14 (56%)
Female	8 (32%)	11 (44%)
Total	25	25

Graph 1:

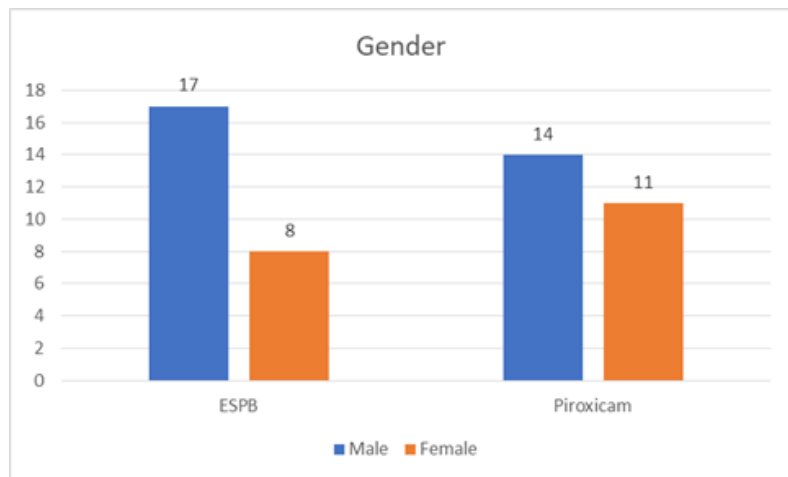


Table 2: Age Composition

Age Group	ESPB (Group A), n (%)	Piroxicam (Group B), n (%)
18–25 years	6 (24%)	7 (28%)
26–35 years	12 (48%)	12 (48%)
36–45 years	4 (16%)	4 (16%)
> 45 years	3 (12%)	2 (8%)
Total	25	25

Graph 2:

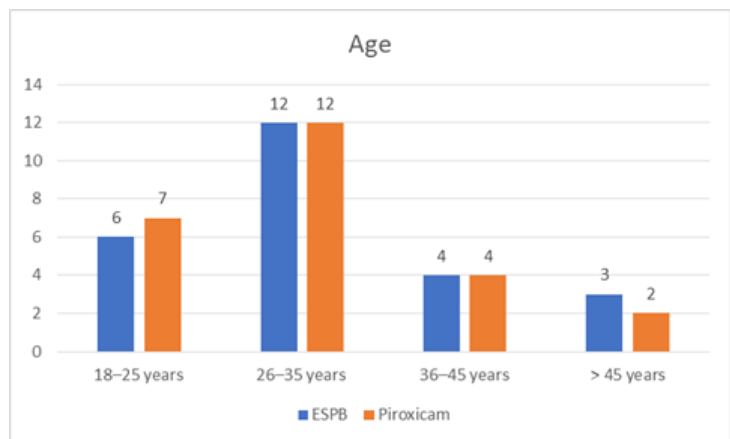


Table 3: Comparison of Pain Intensity (NRS) At Different Time Intervals

Time (min)	ESPB (Group A) Mean (IQR)	Piroxicam (Group B) Mean (IQR)	t-value	p-value
Initially	9 (1)	9 (1)	-0.400	> 0.05
After 15 min	6 (1)	8 (2)	-3.05	< 0.05
After 30 min	5 (1)	6 (2)	-3.37	< 0.05
After 45 min	3 (2)	5 (2)	-3.05	< 0.05
After 60 min	2 (1)	2 (2)	-3.14	< 0.05

The study showed that ESPB (Group A) was more effective in reducing pain intensity compared to Piroxicam (Group B) at various time intervals after treatment. Significant differences were noted at 15, 30, 45, and 60 minutes, with ESPB showing a consistently lower mean pain score, as indicated by the p-values (< 0.05).

Graph 3:

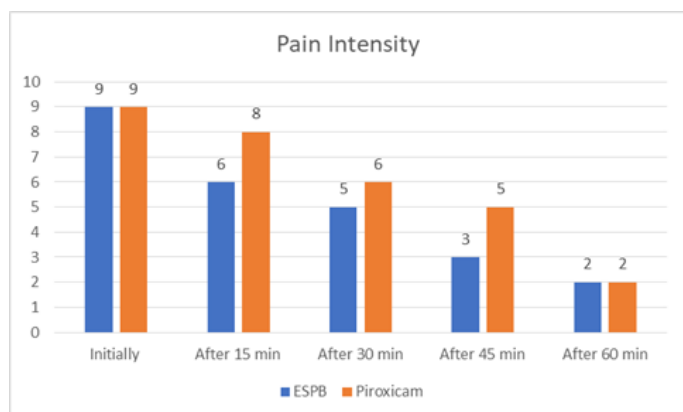
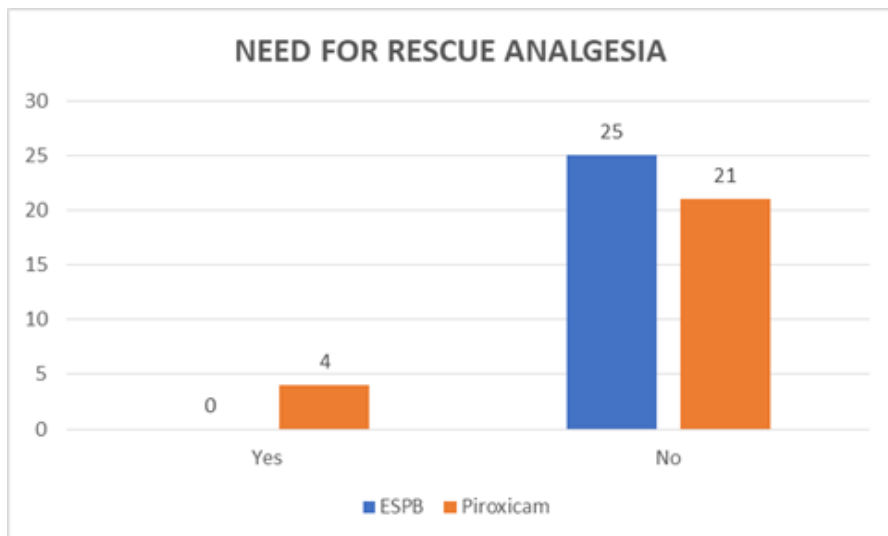


Table 4: Need for Rescue Analgesia after 60 Minutes

Need for Rescue Analgesia	ESPB (Group A), n (%)	Piroxicam (Group B), n (%)	p-value
Yes	0 (0%)	4 (16%)	0.118
No	25 (100%)	21 (84%)	

Table 4 indicates that rescue analgesia was not required for any patients in ESPB (Group A) after 60 minutes, compared to 16% of patients in Piroxicam (Group B) who needed additional pain relief. Although the difference was not statistically significant (p-value = 0.118), the trend suggests better pain control in Group A.

Graph 4:



Discussion

The present study evaluated the effectiveness of ultrasound-guided Erector Spinae Plane Block (ESPB) versus intramuscular Piroxicam in managing renal colic pain in an emergency setting. Consistent with emerging literature on ESPB, we observed that patients receiving ESPB reported superior and more rapid pain relief compared to those given Piroxicam⁹. Notably, while both groups experienced a reduction in pain intensity, the ESPB group demonstrated significantly lower NRS scores from 15 minutes onward and did not require rescue analgesia. This aligns with prior observations that regional anesthesia techniques can provide targeted, long-lasting analgesia with fewer systemic side effects¹⁰. Hemodynamic stability is a critical factor in the emergency management of acute pain. Our findings indicated that ESPB produced a modest but significant reduction in systolic blood pressure at 60 minutes. This could be attributed to the sympathetic blockade effect, which can reduce stress-related surges in blood pressure¹¹. Meanwhile, diastolic pressure changes were less pronounced, and pulse rates remained statistically comparable in both groups for most time points. From a clinical standpoint, these outcomes suggest that ESPB is

hemodynamically well-tolerated in otherwise healthy patients with renal colic.

In the Piroxicam group, four patients required rescue analgesia within 60 minutes, although the difference did not reach statistical significance. Even so, the absence of rescue analgesia in the ESPB group underscores the potency of the block. However, in certain patient subgroups, NSAIDs remain a viable first-line due to their accessibility and simple administration¹². Caution must be exercised, given that NSAIDs pose gastrointestinal, renal, and cardiovascular risks, particularly in vulnerable populations¹³. On the other hand, ESPB requires expertise in ultrasound guidance and sterile techniques, which might not be universally available in all emergency departments¹⁴.

No major side effects were observed, suggesting favorable safety profiles for both interventions. Mild gastrointestinal discomfort in the Piroxicam group and negligible complications in the ESPB group are consistent with existing safety data¹⁵. While larger randomized controlled trials are warranted to confirm these results, our findings contribute to growing evidence that ESPB can be a viable alternative to systemic analgesics, offering prompt and robust pain control while

mitigating some of the risks inherent to NSAIDs and opioids.

Overall, ultrasound-guided ESPB shows promise as a safe and efficacious modality for managing severe pain in renal colic. By providing better pain relief and minimizing the need for additional analgesics, it may enhance patient satisfaction and expedite the diagnostic process, as patients remain more cooperative during imaging studies. Future research should focus on a broader patient population, cost-effectiveness analyses, and long-term outcomes to establish comprehensive practice guidelines.

Conclusion

Ultrasound-guided Erector Spinae Plane Block significantly reduces pain intensity in patients with renal colic compared to intramuscular Piroxicam, with faster onset of analgesia and zero need for rescue medication in our cohort. Both interventions demonstrated acceptable safety profiles, although ESPB led to more substantial and sustained pain relief. Incorporating ESPB in the emergency management protocol for renal colic could optimize pain control and patient satisfaction. Further large-scale studies are warranted to confirm these findings and explore the broader applicability of this technique.

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