

Pain Management Strategies in Lumbar Fusion Surgery: A Comparative Retrospective Study of Erector Spinae Plane Block versus Wound Infiltration

Ryan Brennan BS; Vlad Frenk MD, FASA; Haleh Saadat MD, FAAP

Introduction

Lumbar fusion surgeries have become a cornerstone of spine care in the United States, now ranking among the most prominent and costly surgical interventions [1].

- Estimated 1.5 million procedures in 2024 with mean pre, intra, and postoperative costs: \$60,000.00. Dramatic increase in costs due to prolonged hospitalization or readmission, often secondary to inadequate pain management [2, 3].

Postoperative Pain Management Strategies

Direct Wound Infiltration (WI) with liposomal bupivacaine

- Faster, less equipment
- Surrounding nerves not covered, often combined with opioids to achieve adequate analgesia.

Erector Spinae Plane Block (ESPB) - local anesthetic in the deep fascial plane of the erector spinae muscle.

- Broader sensory coverage → potential for reduced opioid use
- Requires ultrasound, inconsistent results

Objective

Evaluate the effectiveness of ESPB compared to WI for postoperative pain management in patients undergoing lumbar fusion surgery by a single surgeon at a single institution using liposomal bupivacaine.

Methods

Population

Adults aged 50 to 89 years who underwent elective, primary lumbar fusion surgery by one surgeon between July 2020 and September 2023.

- Eligibility confirmed by patient ICD codes.
- Exclusion Criteria:** emergent or trauma-related surgeries, chronic opioid users, or a combination of wound infiltration and ESPB for pain management.

Interventions

WI: 20–30 mL of 0.25% bupivacaine and 20 mL of liposomal bupivacaine directly into the surgical wound at the end of the procedure.

ESPB: ultrasound guided injection of 20 mL of 0.25% bupivacaine and 10 mL of liposomal bupivacaine at each side into the deep fascial plane of the erector spinae muscle.

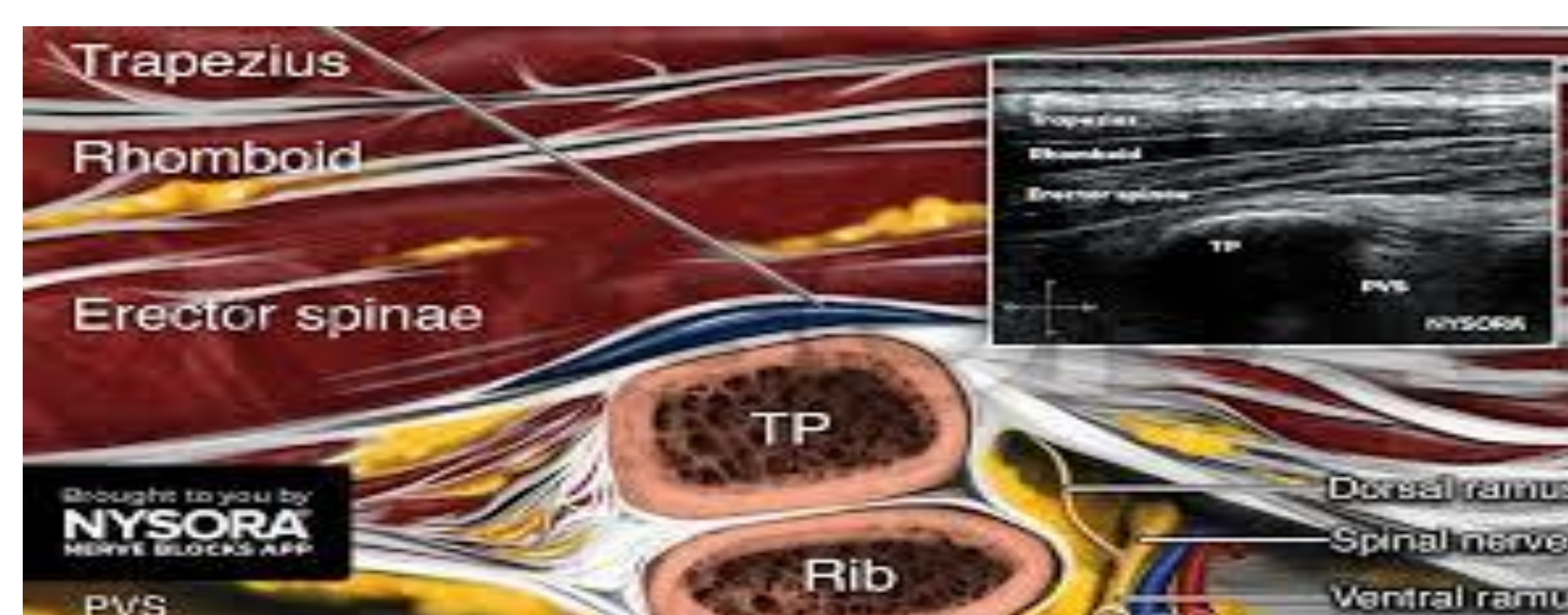
Outcomes

Primary: Total Opioid Consumption in standardized morphine milligram equivalents (MME) within 72 hours postop.

Secondary: Visual Analog Scale (VAS) pain scores in PACU.

Data Analysis

Between groups: Independent samples t-tests and Mann-Whitney U tests. Categorical variables: chi-square or Fisher's exact tests.



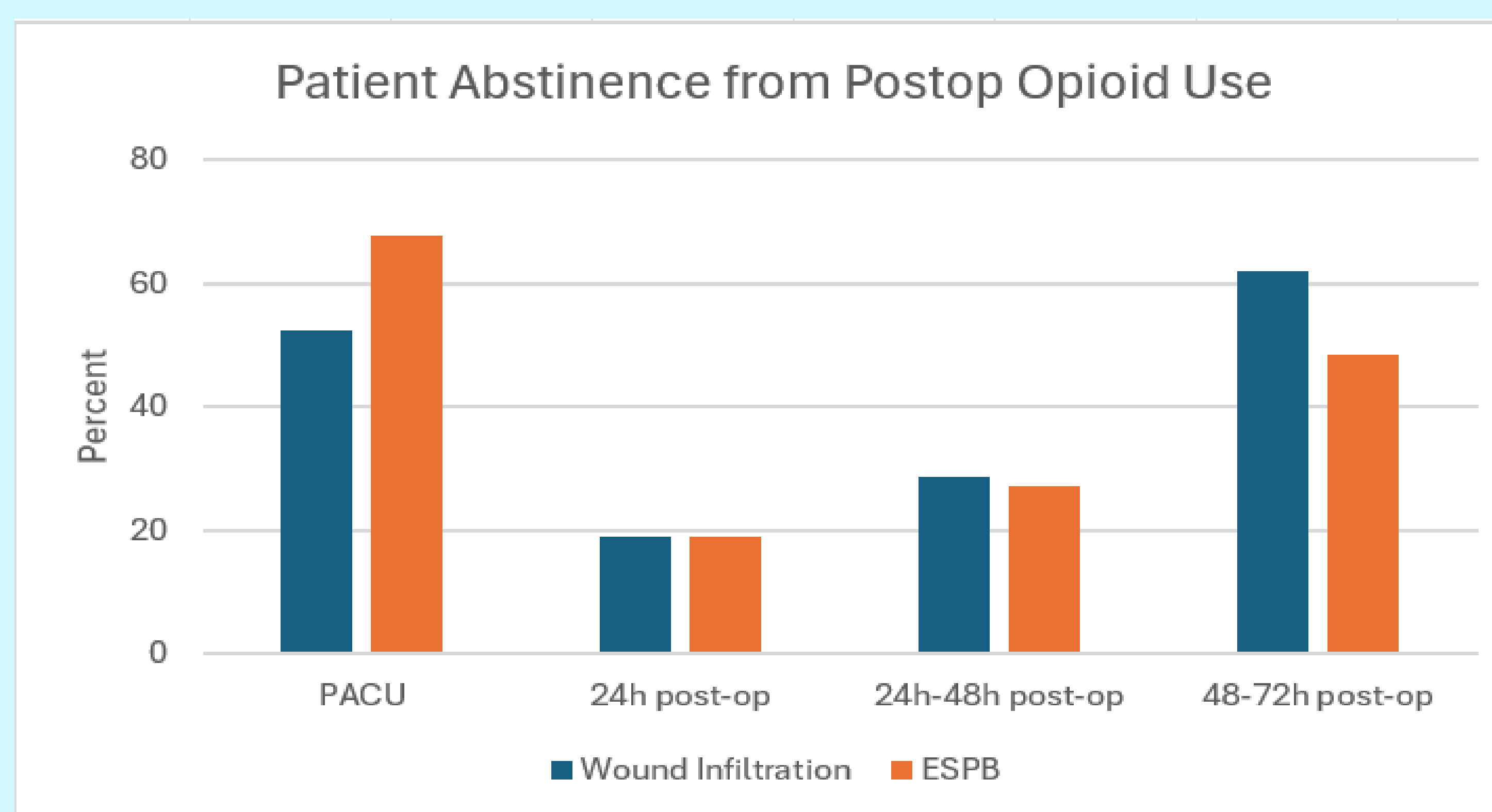
Results

58 patients underwent elective lumbar fusion surgery between July 2020 and September 2023, comparing ESPB (n=37) and WI (n=21)

No significant differences in patient age, gender, race, ethnicity, preexisting comorbidities (DM, PVD, cancer), ASA classification, or lumbar spinal fusion type (one level vs. multi level)

Table 2. Postoperative Pain Scores and Opioid Consumption

Outcome Measure	Total (n=58)	Wound Infiltration (n=21)	ESPB (n=37)	p-value ^{a,b}
VAS PACU Min, median [IQR]	0 [0]	0 [0]	0 [0]	0.671
VAS PACU Max, median [IQR]	5 [6]	6 [7]	5 [6]	0.737
Opioid usage in MME, median [IQR]	2.0 [0.7-3.8]	1.6 [0.4-4.4]	2.3 [0.7-3.5]	0.901
- PACU	0.0 [3.2]	0.0 [4.4]	0.0 [3.0]	0.278
- 0-24 hours postoperatively	15.0 [41.4]	15.0 [41.2]	20.2 [41.8]	0.897
- 24-48 hours postoperatively	26.3 [61.0]	22.5 [49.8]	30.0 [69.5]	0.487
- 48-72 hours postoperatively	0.0 [40.0]	0.0 [33.8]	2.0 [50.3]	0.209
- Total up to 72-hours postoperatively	63.3 [110.5]	69.5 [97.7]	62.5 [125.3]	0.522



Discussion

Our findings revealed that ESPB and WI provided comparable immediate postoperative analgesia, with no statistically significant difference in Visual Analog Scale (VAS) scores in the post-anesthesia care unit (PACU) or total opioid consumption.

Several factors could explain this discrepancy, including variations in block efficacy, technical differences in block performance, or individual patient factors such as pain perception and opioid tolerance.

This study has several limitations, including its retrospective design, relatively small sample size, and single-center nature. These factors may limit the generalizability of our findings and emphasize the need for larger, prospective, multi-center studies to confirm and expand upon our results.

While our study does not demonstrate clear superiority of ESPB over WI, it provides valuable insights into the temporal dynamics of postoperative pain management in lumbar fusion surgery. The goal remains to enhance recovery, improve patient satisfaction, and minimize opioid consumption in the perioperative period. An individualized approach to pain management, informed by both patient factors and surgical considerations, remains essential for achieving optimal outcomes in lumbar fusion surgery.

Future Directions

Future directions should consider procedural changes which may help the study's internal and external validity

- Utilizing a multi-center approach to not only increase the subject pool, but to also expand the generalizability of the study
- Pre-op pain score collection
- Collection of additional post-op measures (nausea, vomiting, etc.)
- Standardized providers
- Consider other comorbidities (obesity, substance use, etc.)
- Longitudinal data collection

References

- Agency for Healthcare Research and Quality. Spine fusions. Available from: <https://www.ahrq.gov/data/infographics/spine-fusions.html>. Accessed January 8, 2025.
- Prabhakar NK, Chadwick AL, Nwaneshiudu C, et al. Management of Postoperative Pain in Patients Following Spine Surgery: A Narrative Review. *Int J Gen Med.* 2021;15:4535-4549.
- Marrache M, Harris AB, Raad M, et al. Preoperative and postoperative spending among working-age adults undergoing posterior spinal fusion surgery for degenerative disease. *World Neurosurgery.* 2020;138:e930–e939.