Effectiveness of the erector spinae plane block for the management of persistent pain after lumbar surgery: a prospective study

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ABSTRACT

This prospective study evaluated the effectiveness of erector spinae plane block (ESPB) in managing persistent or recurrent pain following lumbar spine surgery. We analyzed data from 42 patients who received ESPB, assessing their perceived improvement, analgesic consumption, quality of life, and potential predictors of treatment response. Patients reported significant improvement one- and three-months post-treatment, although the level of improvement decreased between these time points. ESPB effectively reduced nonsteroidal anti-inflammatory drug (NSAID) and antiepileptic medication use during the first month. A positive correlation emerged between the frequency of healthcare visits and perceived improvement. Patients with radiculopathy experienced less improvement at three months. This study underscores the importance of a multidisciplinary approach to managing persistent postoperative pain, including close follow-up and individualized treatment strategies. The findings support the use of ESPB within a comprehensive pain management plan for patients experiencing chronic pain after lumbar spine surgery. However, further research is needed to determine the duration of analgesia and effectiveness in specific patient subgroups.

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Introduction

Chronic low back pain (CLBP) is a prevalent global health issue, significantly impacting patients' quality of life and healthcare systems.[1,2] Characterized by persistent lower back pain lasting more than 12 weeks, CLBP is associated with various risk factors, including age, sex, obesity, trauma history, physically demanding work, and psychosocial factors.[1,3] Managing CLBP presents a complex clinical challenge, requiring a multidisciplinary approach that addresses the physical, psychological, and social aspects of pain.[4] Despite various therapeutic options, including pharmacological treatments, physical therapy, and behavioral interventions, a substantial proportion of patients experience persistent pain following spine surgery.[5]

This persistent postoperative pain, often termed chronic postoperative lumbar pain syndrome (CPLPS), also known as failed back surgery syndrome (FBSS) or chronic pain after spine surgery (CPSS), represents a significant clinical problem, negatively impacting patients' quality of life and incurring high healthcare costs.[6,7] CPLPS arises when low back pain persists despite apparently successful surgery, and its etiology is typically multifactorial, encompassing factors such as surgical technique, adhesions, nerve damage, psychological factors, and central sensitization.[8]

Current strategies for managing CPLPS include conservative therapies, pharmacological interventions, and invasive procedures like epidural blocks or epiduroscopy.[9] However, the search for safer and more effective analgesic techniques has led to the development of the erector spinae plane block (ESPB), a promising treatment modality for CPLPS.[10]

This prospective study evaluates the effectiveness of ESPB for managing persistent or recurrent pain following lumbar spine

surgery. Specifically, the study analyzes patient-reported improvement, analgesic consumption, quality of life, and potential predictors of treatment response to ESPB. The aim is to contribute to a better understanding of ESPB efficacy and its potential to improve the quality of life in patients with CPLPS.

Materials and Methods

Study design

This prospective study employed a quantitative, descriptive, and analytical design. The sample comprised 42 patients experiencing persistent or recurrent lumbar or lower extremity pain following lumbar spine surgery. Patients were recruited from the Pain Management Unit of the Lleida University Hospital Arnau Vilanova between July 2020 and January 2021.

All patients provided written informed consent before participating in the study according to a protocol approved by the Ethics Committee of the Lleida University Hospital Arnau Vilanova and aligned with the Spanish Pain Society guidelines for ESPB infiltration.

Patients selection

Inclusion criteria were recurrent and/or persistent lumbar or lower extremity pain following lumbar spine surgery; and age between 18 and 85 years.

Exclusion criteria were lower extremity or hip surgery within the past year; lumbar infiltration within the past 3 months; motor weakness in lower extremities; new spinal lesions since surgery; fibromyalgia; pregnancy; allergy to injected medication; local infection at the injection site; coagulopathy; and severe heart disease and chronic renal insufficiency grade III-IV.

Intervention

Prior to ESPB, patients completed the Lattinen, Oswestry, EQ-5D, and DN4 questionnaires, underwent a physical examination, and reported their current analgesic medication regimen. Pain intensity was assessed using the visual analog scale (VAS), with scores ranging from 0 (no pain) to 10 (worst imaginable pain), sick leave days, and annual healthcare visits were collected.

ESPB was performed at the L4 level under ultrasound guidance using a linear transducer. Following aseptic technique, a 22-gauge Tuohy needle was advanced in-plane from a lateral to medial approach until the tip was positioned in the erector spinae muscle plane deep to the thoracolumbar fascia. A solution of 2.5 mL of 0.125% bupivacaine (3.125 mg), 4 mg of dexamethasone, and 0.9% saline (sufficient to reach a total volume of 20 mL per side) was injected bilaterally.

Data collection

Patient demographics characteristics (age, sex, employment status) were recorded. Thirty minutes after ESPB, the Patient Global Impression of Improvement (PGI-I) was used to categorize patient's perceptions after treatment and the visual analog scale (VAS) were administered, and adverse effects were recorded. Follow-up assessments via telephone (at one month) and *in-person* (at three months) included PGI-I, VAS, analgesic consumption, and adverse effects.

Statistical analysis

Data were analyzed using IBM SPSS Statistics version 25. Descriptive statistics (mean, standard deviation, minimum, maximum, variance, skewness, and kurtosis) were used to characterize the sample. Chi-squared tests were used to evaluate associations between categorical variables and improvement status. T-tests and Mann-Whitney U tests were employed to compare continuous variables between groups. Spearman's rank correlation coefficient (rho) was used to assess the correlation between healthcare visits and PGI-I scores. Logistic regression was used to assess potential predictors of improvement. Repeated measures ANOVA was employed to compare changes in EQ-5D, Oswestry, and Lattinen scores over time. Multiple Correspondence Analysis (MCA) was used to explore associations between the PGI-I and quality-of-life questionnaires. A p-value of <0.05 was considered statistically significant, except for correlations where $p<0.01$ was used.

Results

A total of 42 patients with persistent or recurrent lumbar or lower extremity pain following lumbar spine surgery were included in the study. The demographic characteristics of the study population are summarized in Figure 1. The average age of the patients with improvement was 52.73 years and without improvement 54.08 years with a majority being male (53.3%). Patient-reported improvement, assessed using the Patient Global Impression of Improvement (PGI-I) scale, demonstrated significant improvement at both one and three months post-ESPB administration. Specifically, 71.4% of patients reported improvement at one month, which decreased to 64.3% at three months. Although a slight decrease was observed, both time points showed statistically significant improvement compared to baseline ($\chi^2 = 15.8$, $p<0.001$ at one month; $\chi^2 = 12.3$, $p<0.001$ at three months). This suggests that while the analgesic effect of ESPB may diminish over time, it remains clinically relevant at three months. Further analysis of PGI-I scores at three months revealed a statistically significant difference between patients with and without radiculopathy ($p=0.048$, *t*-test). Patients without radiculopathy reported a higher mean PGI-I score (2.8, ±0.6) compared to those with radiculopathy (2.2, ±0.7). This suggests that radiculopathy might influence perceived treatment benefit.

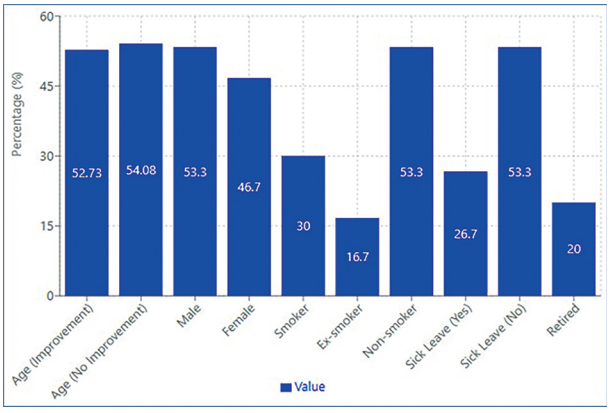

Figure 1. Demographic characteristics of the sample.

Analgesic consumption also showed notable changes following ESPB treatment, as detailed in Table 1. Quality of life, measured by the EQ-5D VAS, also improved significantly following ESPB (Table 1). The mean EQ-5D VAS score increased from 42.6 (±12.5) at baseline to 58.5 (±10.8) at one month and 56.9 (±11.2) at three months. This improvement was statistically significant at both follow-up points ($p<0.001$ for both comparisons, paired *t*-tests).

A significant reduction in both NSAID and antiepileptic medication use was observed during the first month. Specifically, mean monthly NSAID consumption decreased from 5.8 (±2.1) tablets at baseline to 2.6 (±1.5) tablets at one month, and mean antiepileptic consumption decreased from 2.3 (±1.3) tablets to 0.8 (±0.7) tablets. Although consumption of both medications trended upward again at three months, the reductions at one month remained statistically significant ($p<0.001$ for both, paired *t*-tests). No statistically significant changes were observed in neuroleptic or opioid consumption ($p>0.05$ for both, paired *t*-tests). These changes are visualized in Figure 2. To explore potential predictors of improvement, logistic regression analysis was performed. Neither pre-existing work disability, presence of radiculopathy, nor frequency of healthcare visits were significant predictors of improvement group membership. However, as shown in Table 2, a moderate positive correlation was observed between the frequency of healthcare visits and PGI-I scores at all assessed time points.

Discussion

This study suggests that ESPB may be an effective treatment for managing persistent postoperative pain following lumbar spine surgery. The significant improvements observed in patient-reported outcomes, including quality of life and reduced analgesic consumption, align with existing research on ESPB's efficacy in pain management. The observed reduction in NSAID and antiepileptic use during the first month post-ESPB further supports its potential in minimizing reliance on pharmacological interventions. This reduction in medication use could contribute to improved quality of life and a decrease in potential adverse effects associated with long-term medication use.

However, the decrease in the percentage of patients reporting improvement on the PGI-I scale from one to three months post-treatment suggests that the analgesic benefits of ESPB may

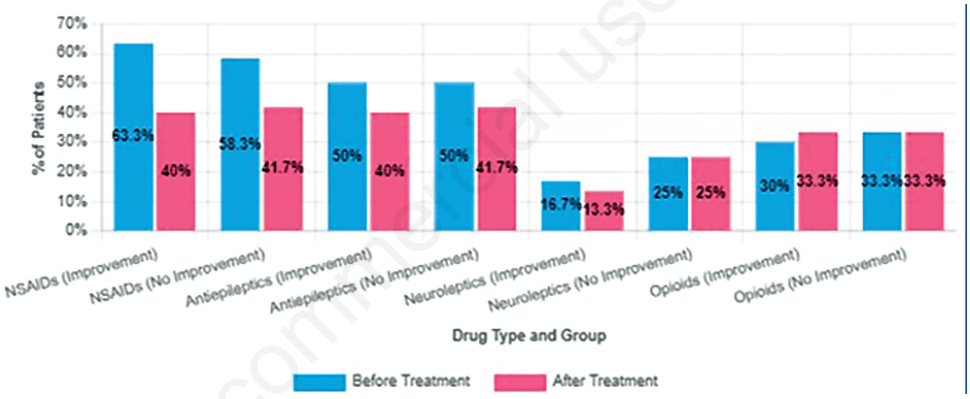

Figure 2. Effect of erector spinae block on monthly drug consumption.

Table 1. Changes in analgesic consumption and quality of life following ESPB.

Variable	Baseline (mean±SD)	1 month (mean±SD)	3 months (mean±SD)	p-value*
NSAID consumption (tablets)	5.8±2.1	2.6±1.5	3.1±1.9	<0.001
Antiepileptic consumption (tablets)	2.3±1.3	0.8±0.7	1.1±0.9	<0.001
Neuroleptic consumption	1.2±0.8	1.1±0.7	1.0±0.6	0.15
Opioid consumption	0.9±0.5	0.8±0.4	0.7±0.5	0.08
EQ-5D VAS Score	42.6±12.5	58.5±10.8	56.9±11.2	<0.001

p-value from repeated measures ANOVA with Greenhouse-Geisser correction; *post-hoc* analysis with Bonferroni correction revealed statistically significant differences between baseline and 1 month ($p<0.001$), and baseline and 3 months ($p<0.001$) for the EQ-5D VAS score.

Table 2. Correlation between visits to professionals and perceived improvement (PGI-I).

Time point	Spearman's rho	p*
Baseline	0.300	0.053
1 month	0.485	0.001
3 months	0.513	0.001

*p-value from Spearman's rank correlation test.

be transient. This highlights the importance of a multidisciplinary approach to chronic pain management, which includes close monitoring, individualized treatment plans, and the potential integration of other therapeutic modalities to address long-term pain relief.[5,6]

The transient nature of ESPB's analgesic effects also underscores the need for further research to determine the optimal treatment frequency and duration for maintaining long-term pain relief.

The finding that patients with radiculopathy experienced less perceived improvement at three months compared to those without radiculopathy raises important considerations. This difference suggests that ESPB might be less effective for neuropathic pain compared to other types of postoperative pain. This could be attributed to the underlying neuroplastic changes and alterations in pain signaling pathways associated with neuropathic conditions. Further research is needed to explore the efficacy of ESPB in specific patient subgroups, such as those with neuropathic pain components, to determine whether tailoring treatment approaches or combining ESPB with other targeted interventions may improve outcomes.

The moderate positive correlation between the frequency of healthcare visits and patient-reported improvement, while not indicative of a direct causal relationship, suggests the potential importance of patient engagement and follow-up care in managing chronic pain. Increased interaction with healthcare professionals might provide opportunities for ongoing assessment, adjustment of treatment strategies, and support for self-management, which could contribute to improved patient outcomes.

This study has limitations that warrant acknowledgment. The relatively small sample size limits the generalizability of the findings to larger populations. Furthermore, the absence of a control group restricts the ability to make definitive conclusions about ESPB's efficacy compared to other interventions. Future research with larger, randomized controlled trials is crucial to validate these findings and compare ESPB with other established pain management strategies. Specifically, future studies should investigate the long-term efficacy of ESPB, explore its effectiveness in different patient subgroups (e.g., with and without neuropathic pain), and evaluate the optimal combination of ESPB with other therapeutic modalities, such as psychological interventions, physical therapy, and multidisciplinary rehabilitation programs. This comprehensive approach is essential for optimizing persistent postoperative pain management and improving long-term patient outcomes.

Conclusions

ESPB demonstrates efficacy in managing persistent or recurrent pain following lumbar surgery, resulting in significant short-term improvements in patient-reported outcomes, including quality of life and reduced NSAID and antiepileptic medication use. However, the observed decrease in perceived improvement at three months and the influence of radiculopathy on treatment response suggest that the analgesic benefits may be transient and warrant further investigation into long-term efficacy and optimized treatment strategies, especially for patients with neuropathic pain components. The correlation between healthcare visit frequency and perceived improvement highlights the potential role of patient engagement and follow-up care in chronic pain management. Further research with larger, controlled trials is needed to confirm these findings and compare ESPB with other pain management approaches.

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