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ORIGINAL RESEARCH

Utility of Ultrasound-Guided Erector Spinae Plane Blocks for Postoperative Pain Management Following Thoracolumbar Spinal Fusion Surgery

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Purpose: The primary objective of this study is to determine if ultrasound-guided erector spinae plane blocks (ESPB) prior to thoracolumbar spinal fusion reduces opioid consumption in the first 24 hours postoperatively. Secondary objectives include ESPB effects on administration of opioids, utilization of intravenous patient-controlled analgesia (IV-PCA), pain scores, length of stay, and opioid related side effects.

Methods: A retrospective cohort analysis was performed on consecutive, adult patients undergoing primary thoracolumbar fusion procedures. Demographic and baseline characteristics including diagnoses of chronic pain, anxiety, depression, and preoperative use of opioids were collected. Surgical data included surgical levels, opioid administration, and duration. Postoperative data included pain scores, opioid consumption, IV-PCA duration, opioid-related side effects, ESPB-related complications, and length of stay (LOS). Statistical analysis was performed using chi-squared and *t*-test analyses, multivariable analysis, and covariate adjustment with propensity score.

Results: A total of 118 consecutive primary thoracolumbar fusions were identified between October 2019 and December 2021 (70 ESPB, 48 no-block [NB]). There were no significant demographic or surgical differences between groups. Median surgical time (262.50 mins vs 332.50 mins, p = 0.04), median intraoperative opioid consumption (8.11 OME vs 1.73 OME, p = 0.01), and median LOS (152.00 hrs vs 128.50 hrs, p = 0.01) were significantly reduced in the ESPB group. Using multivariable covariate adjustment with propensity score analysis only intraoperative opioid administration was found to be significantly less in the ESPB cohort.

Conclusion: ESPB for thoracolumbar fusion can be performed safely in index cases. There was a reduction of intraoperative opioid administration in the ESPB group, however the care team was not blinded to the intervention. Extensive thoracolumbar spinal fusion surgery may require a different approach to regional anesthesia to be similarly effective as ESPB in isolated lumbar surgeries.

Keywords: erector spinae plane block, regional anesthesia, local anesthesia, pain management, thoracolumbar fusion

Introduction

Complex thoracolumbar fusion is associated with significant postoperative pain.[1] In turn, pain is a major factor limiting prompt recovery, discharge from the hospital, and contributes to poor long-term outcomes.[2,3] The increasing number and frailty of patients undergoing these types of procedures[4,5] coupled with the ongoing opioid crisis occurring in the United States, has created an urgent need for improved analgesia and interventions which promote rapid recovery after complex spine surgery.

Current best practices call for multimodal analgesia (MMA) emphasizing non-opioid agents (including acetaminophen, non-steroidal anti-inflammatory drugs [NSAIDs], and NMDA receptor antagonists)[6] and judicious use of opioids within enhanced recovery after surgery (ERAS) protocols.[6–9] Local anesthetics for spine surgery in the form of field and fascial plane blocks have become a recent focus of clinical and research interest.[10] Of all published interventions, the erector spinae

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plane block (ESPB) has received the most attention. However, results from systematic reviews and large retrospective series have yielded mixed evidence on the benefits of the block for postoperative pain scores, opioid consumption, and length of stay.[8,11] Indeed, the recent PROSPECT guidelines on MMA for complex spine surgery recommended against ESPB due to insufficient evidence of benefit and overall low quality of evidence.[6] Further, most of the studies to date have focused on lumbar spinal procedures; and the value of the ESPB may be procedure specific. Thus far, the available literature on ESPB for thoracolumbar fusion procedures is limited to case reports[12,13] and a single randomized controlled trial that included 10 patients undergoing fusion procedures in the thoracolumbar spine, only 3 of which had fusions of more than 2 levels.[14]

Accordingly, the purpose of this study was to evaluate the association of ESPB with pain scores and opioid consumption during the first 24 hours after thoracolumbar fusion surgery. Secondary outcomes included associations of ESPB and length of stay (LOS), intravenous opioid patient-controlled analgesia (IV-PCA) use, opioid consumption at other time points, and opioid-related side effects. We hypothesized that there would be a significant reduction in postoperative opioid consumption without adversely effects on pain scores along with reductions in LOS and opioid-related side effects among patients who received ESPB.

Methods

Study Design and Patients

This is a single-center, retrospective cohort study. The study was conducted in accordance with the ethical principles of the Helsinki declaration and approved by the institutional review board of Hospital for Special Surgery (IRB #2020-1877). Written informed consent was waived.

The electronic medical records (EMR) of all patients who underwent posterior multilevel thoracolumbar spinal fusion (with or without decompression) under general anesthesia between October 2019 and December 2021 were reviewed to identify cases with the following criteria: age >18 years; primary posterior procedure; received either pre-incision bilateral ultrasound-guided ESPB or no ESPBs; and elective surgery. Patients with any of the following factors were excluded from analysis: emergent or revision surgery; known or suspected spinal infection; continuous catheter or neuraxial analgesia; unilateral ESPB.

Patients were grouped into 2 cohorts depending on whether they received ESPBs (ESPB cohort) or no-blocks (NB cohort).

ESPB Technique

Bilateral ultrasound-guided ESPBs were performed with the patient in prone position after induction of GA, prior to surgical incision, as previously described.[8] In brief, the tips of the transverse processes at the relevant spinal level were visualized using a C60 curved array ultrasound probe (FUJIFILM Sonosite, Inc., WA, USA). A 20-Ga 4-inch Ultraplex needle (B. Braun Medical Inc., PA, USA) was placed in-plane and advanced in a cranial-to-caudal direction until the tip was under the erector spinae plane. Depending on patient body mass index (BMI), between 20 and 30 mL 0.25–0.375% bupivacaine was injected bilaterally.

Demographic and Preoperative Clinical Data

Demographics and preoperative clinical data were collected from the EMR, including age, sex, height, weight, BMI, race/ethnicity, American Society of Anesthesiologists (ASA) Classification, smoking status, history of psychiatric illness (anxiety, depression), clinical diagnosis of chronic pain, opioid use for more than 3 months, neuroleptic medication use for more than 3 months, and indication for surgery.

Surgical Data

Intraoperative and surgical data were collected from the EMR, including surgeon and anesthesiologist of record, surgical duration, levels fused, number of levels fused, presence of decompression, presence of osteotomy, and use of adjunctive procedures. Surgical indications were binned for statistical analysis into one of 7 categories: lumbar degenerative scoliosis, thoracolumbar degenerative scoliosis, spondylosis/stenosis, adolescent idiopathic scoliosis in adulthood, adolescent idiopathic

scoliosis, kyphoscoliosis, and other. Fusion constructs were binned into one of 6 categories for statistical analysis: low thoracic to pelvis fusion (upper instrumented vertebra [UIV]: T9-12), mid-thoracic to pelvis fusion (UIV: T5-8), high thoracic to pelvis fusion (UIV: T1-4), thoracolumbar fusion (UIV: thoracic level, lower instrumented vertebra [LIV]: L1-4), thoracic fusion (LIV within the thoracic spine), and short thoracolumbar fusion (UIV: thoracic level, LIV: L5 or S1).

Outcomes

The primary study outcome was opioid consumption in the first 24 hours after surgery (recorded as oral morphine equivalent, OME, milligrams). Secondary study outcomes were length of stay (LOS), intraoperative and total opioid consumption, IV-PCA dose and duration, numeric rating scale (NRS) pain scores (0–10; divided into post anesthesia care unit (PACU) and nursing floor phases of care), opioid related side effects and adverse events related to ESPB. Opioid-related side effects were defined a priori as postoperative nausea/vomiting (indicated by administration of rescue anti-emetic medications), sedation/respiratory depression (indicated by escalation of care and/or need for supplemental oxygen and/or naloxone), constipation/obstipation, and cognitive/ central nervous system (CNS) changes (dizziness, confusion, and disorientation). Complications of ESPB were defined a priori as any motor, sensory, neurologic, or respiratory complication reasonably attributed to the block.

Statistical Analysis

Continuous variables are summarized as mean (standard deviation) or median [range]. Categorical variables are summarized as counts (%). Demographic and preoperative and postoperative clinical data were compared using chi-squared for categorical and *t*-testing for continuous variables. In addition to the simple comparisons between no block and ESPB groups and conventional multivariable analyses, we added the analysis of covariate adjustment with propensity score (PS). PS was defined as the probability of undergoing ESPB or not, and PS was calculated using a logistic regression model including all preoperative variables. Linear regression analyses were conducted by setting the outcomes which showed statistical significance in the simple comparisons as response variables, ESPB as the predictor variable, intraoperative factors such as operation time, and the PS as confounding variables. Estimates were calculated using the beta coefficient of linear regression. Statistical analysis was performed utilizing R software (R for 4.1.2). The statistical significance was set at $p < 0.05$.

Results

Demographic and Preoperative Clinical Data

We identified 118 patients for analysis: 70 received bilateral ESPBs and 48 did not. Patient demographics and preoperative clinical data are detailed in Table 1. There were no statistically significant differences between the cohorts.

Surgical Data

Simple analyses of intraoperative clinical data are displayed in Table 2. There were no statistically significant differences between groups in terms of surgical indication, construct type, number of levels fused, use of adjunctive procedures, decompressions, or osteotomies. Median surgical duration in the no-block cohort was over 70 minutes longer than in the ESPB group (332.50 mins vs 262.50 mins, $p = 0.046$).

Simple Comparison of Study Outcomes

Simple comparisons of study outcomes are displayed in Table 3. Median LOS was significantly shorter in the ESPB cohort (128.50 hrs vs 152.00 hrs, $p = 0.011$) and median intraoperative opioid administration was significantly lower in the ESPB cohort (1.73 mg vs 8.11 mg, $p = 0.011$). IV-PCA duration, LOS in PACU and nursing floors, pain scores, postoperative opioid consumption, and opioid-related side effects were similar between cohorts. There were no complications detected due to ESPB.

Table 1 Demographic and Preoperative Clinical Data

Variable	No-Block (n=48)	ESPB (n=70)	*p*-value
Age (yrs)	63 [18.00–84.00]	58 [18.00, 77.00]	0.272
Sex (%)			
Female	35 (72.9)	47 (67.1)	0.547
Male	13 (27.1)	23 (32.9)	
Race (%)			
White or Caucasian	45 (93.7)	60 (85.7)	0.828
Black or African American	1 (2.1)	2 (2.9)	
Asian	0	1 (1.4)	
Other/Decline	2 (4.2)	6 (8.6)	
Unknown	0	1 (1.4)	
BMI (kg/m^2)	23.95 [17.00, 39.80]	23.90 [15.90, 54.00]	0.87
ASA (%)			
I	3 (6.3)	3 (4.3)	0.424
II	35 (72.9)	58 (82.9)	
III	10 (21.0)	9 (12.8)	
Current smoker (%)	0	5 (7.1)	0.077
History of anxiety (%)	13 (27.1)	11 (15.7)	0.166
History of depression (%)	8 (16.7)	8 (11.4)	0.585
History of chronic pain (%)	8 (16.7)	4 (5.7)	0.069
Preoperative opioid use (%)	8 (16.7)	9 (12.8)	0.604
Preoperative neuroleptic use (%)	5 (10.4)	11 (15.7)	0.429

Abbreviation: ESPB, Erector Spinae Plane Block.

Table 2 Surgical Data

Variable	No-Block (n=48)	ESPB (n=70)	*p*-value***
Indication category*			
1	23 (47.9)	31 (44.3)	0.359
2	7 (14.6)	11 (15.7)	
3	1 (2.1)	1 (1.4)	
4	2 (4.2)	2 (2.9)	
5	8 (16.7)	20 (28.6)	
6	4 (8.3)	5 (7.1)	
7	3 (6.2)	0	

(*Continued*)

Table 2 (Continued).

Variable	No-Block (n=48)	ESPB (n=70)	*p*-value***
Fusion category**			
1	23 (47.9)	28 (40.0)	0.737
2	5 (10.4)	4 (5.7)	
3	5 (10.4)	8 (11.4)	
4	11 (22.9)	22 (31.4)	
5	1 (2.1)	4 (5.7)	
6	3 (6.2)	4 (5.7)	
Adjunctive anterior procedure			
All	6 (12.5)	7 (10.0)	0.766
1 level ALIF/LLIF	0	0	
2 level ALIF/LLIF	2 (4.2)	0	
3 or more level ALIF/LLIF	3 (6.2)	6 (8.6)	
Other	1 (2.1)	1 (1.4)	
Surgery duration (mins)	332.50 [84.00, 836.00]	262.50 [118.00, 630.00]	**0.046**
Number of levels fused	9 [0, 17]	9 [4, 16]	0.813
Decompression (%)	23 (47.9)	28 (40.0)	0.252
Osteotomy (%)			
All	28 (58.3)	41 (60.3)	0.85
Ponte	3 (6.2)	5 (7.1)	
SPO	23 (47.9)	37 (52.9)	
PSO	3 (6.2)	3 (4.3)	
VCR	1 (2.1)	0	
Methadone intraoperative (%)	18 (37.5)	14 (20.0)	0.057

Notes: *Indication categories: (1) lumbar degenerative scoliosis, (2) thoracolumbar degenerative scoliosis, (3) spondylosis/stenosis, (4) adolescent idiopathic scoliosis in adulthood, (5) adolescent idiopathic scoliosis, (6) kyphoscoliosis, and (7) other. **Fusion categories: (1) low thoracic (UIV: T9-12) to pelvis fusion, (2) mid-thoracic (UIV: T5-8) to pelvis fusion, (3) high thoracic (UIV: T1-4) to pelvis fusion, (4) thoracolumbar (LIV: L1-4) fusion, (5) thoracic fusion (LIV: within the thoracic spine), and (6) short thoracolumbar (LIV: L5 or S1) fusion. ***Bold value indicates statistical significance.
Abbreviations: ALIF, Anterior Lumbar Interbody Fusion; LLIF, Lateral Lumbar Interbody Fusion.

Table 3 Simple Comparison of Study Outcomes

Variable	No-Block (n=48)	ESPB (n=70)	*p*-value*
IV-PCA duration (mins)	1430.00 [0.00, 9049.00]	1456.00 [0.00, 80.42]	0.704
LOS (hrs)			
PACU/ICU	10.5 [3.00, 110.82]	8.00 [2.00, 26.00]	0.340
Nursing Floor	132.00 [40.00, 660.00]	104.35 [22.00, 515.00]	0.013
Overall	152.00 (57.00, 771.00)	128.50 [32.00, 539.00]	**0.011**

(*Continued*)

Table 3 (Continued).

Variable	No-Block (n=48)	ESPB (n=70)	*p*-value*
NRS Pain Score (%)			
PACU/ICU	4.95 [0.00, 9.50]	4.70 [0.70, 6.90]	0.121
Nursing Floor	5.05 [2.20, 7.10]	4.70 [0.00, 10.00]	0.457
OME Administration (mg)			
Intraoperative	8.11 [0.05, 84.25]	1.73 [0.12, 44.50]	**0.011**
0–24 hours postoperative	50.57 [0.00, 244.00]	55.14 [0.21, 131.73]	0.386
24 hours – discharge	235.88 [0.00, 1099.74]	202.50 [0.00, 1052.99]	0.398
IV-PCA	3.77 [0.00, 110.00]	3.95 [0.00, 17.78]	0.288
Opioid related side effects (%)			
CNS alteration	3 (6.8)	12 (17.4)	0.155
Constipation	27 (56.3)	46 (65.7)	0.118
Required antiemetic	33 (70.2)	41 (59.4)	0.071
Required naloxone	0	6 (8.7)	0.080
Adverse event related to ESPB (%)	-	0	-

Note: *Bold value indicates statistical significance.
Abbreviations: IV-PCA, Intravenous Patient Controlled Anesthesia; LOS, Length Of Stay; NRS, Numeric Rating Scale; PACU, Post Anesthesia Care Unit; ICU, Intensive Care Unit; CNS, Central Nervous System.

Multivariable Analysis

Multivariable analyses and covariate adjustment with propensity score analyses are displayed in Table 4 and 5, respectively. On multivariable analyses, surgical duration was significantly associated with LOS (0.29 [0.16–0.41]), but ESPB was not (−21.67 [−58.24–14.89]). Intraoperative opioid administration was significantly associated with ESPB (−7.96 [0.26–18.3]) and preoperative opioid use (9.14 [0.26–18.3]).

After covariate adjustment with PS, the only variable which remained significantly associated with LOS was surgical duration (0.27 [0.15–0.39]). Both ESPB (−7.96 [−14.49- −1.44]) and surgical duration (0.02 [0.00–0.05]) were significantly associated with intraoperative opioid administration.

Table 4 Multivariable Analysis

Factor	Estimate*	*p*-value**
LOS Overall		
ASA I	Reference	-
ASA II	55.13 (−30.8–141.05)	0.21
ASA III	36.21 (−60.23–132.65)	0.46
ESPB	−21.67 (−58.24–14.89)	0.24
Intraoperative methadone	−23.10 (−66.17019.97)	0.29
Preoperative Opioid Use	−18.47 (−67.50–30.57)	0.46

(*Continued*)

Table 4 (Continued).

Factor	Estimate*	*p*-value**
Intraoperative Opiate Administration		
Surgery duration	0.29 (0.16–0.41)	**<0.001**
ASA I	Reference	-
ASA II	−18.13 (−32.77- −3.5)	**0.016**
ASA III	−25.45 (−41.58- −9.32)	**0.002**
ESPB	−7.96 (−14.49- −1.44)	**0.017**
Preoperative Opioid Use	9.14 (0.26–18.3)	**0.044**
Surgery duration	0.02 9–0.01-0.04)	0.16

Notes: *Estimate is calculated using the beta coefficient of linear regression. **Bold value indicates statistical significance.
Abbreviation: ASA, American Society of Anesthesiologists.

Table 5 Covariate Adjustment with Propensity Score Analysis

Factor	Estimate*	*p*-value**
LOS Overall		
ESPB	−19.37 (−59.49–20.75)	0.34
Intraoperative methadone	−28.98 (−70.01–12.04)	0.16
Surgery duration	0.27 (0.15–0.39)	**<0.001**
Intraoperative Opiate Administration		
ESPB	−11.06 (−18.26- −3.85)	**0.003**
Surgery duration	0.02 (0.00–0.05)	**0.036**

Notes: *Estimate is calculated using the beta coefficient of linear regression. **Bold value indicates statistical significance.

Discussion

In this retrospective cohort study, we found a positive association between bilateral ESPB and a reduction of intraoperative opioid administration among 118 patients who underwent multilevel thoracolumbar fusion. There were no differences in postoperative opioid consumption at any time, utilization of IV-PCA, NRS pain scores, or opioid-related side effects between the groups. While LOS and surgical duration were shorter among patients who received ESPB on simple comparisons, this effect was lost on multivariable analyses.

Emerging literature supports ESPB to improve pain and opioid-related outcomes after lumbar spinal procedures.[10] Results from systematic reviews/meta-analyses, prospective randomized clinical trials, and large retrospective series show no or small effects of the blocks on outcomes of interest.[8,11,15,16] Where demonstrated, ESPB appears to modestly lower early postoperative pain scores (at rest and with movement) and opioid consumption, and limit opioid-related side effects. The block has predominately been studied in lumbar surgery, with thoracic and thoracolumbar procedures being relatively underexplored. Given the possibility of differential benefits of ESPB for these latter procedures (with larger anticipated pain burden), we sought to establish associations of ESPB on clinically relevant outcomes after complex thoracolumbar spinal fusion procedures.

Surprisingly minor benefits have been described when adding ESPB to ERAS pathways for lumbar spine surgery which include comprehensive MMA, raising the question whether the lumbar spine is the appropriate anatomic target for

ESPB.[8,16] Forero et al initially described the ESPB technique for use in thoracic neuropathic pain. Their test cases were rib fracture nonunion and metastatic disease to the ribs.[17] Subsequent anatomic studies demonstrated that ESPB performed in the lower thoracic spine had excellent diffusion through the thoracic and lumbar spine compared with other fascial plane blocks (eg, quadratus lumborum block).[18,19] Prakash et al suggested that the origin of the spinalis thoracis muscle at about T11 to L2 may block inferior spread of injectate.[20] While this may be a limitation when utilized in isolated lumbar surgeries, spread cranially to thoracic levels may be a benefit in thoracolumbar procedures.

We found significantly lower intraoperative opioid administration among patients who received ESPB versus no block. This is consistent with at least one recent systematic review with meta-analysis,[21] but also with other reported literature, including a randomized controlled trial that included simulated injections.[22] Reductions in anesthetic and analgesic requirements are biologically plausible if ESPB attenuates the patient response to surgical stimulation, thereby lowering anesthetic and analgesic requirements. Although we hypothesize that this explains our findings, due to the retrospective nature of the current study the anesthesia teams were not blinded to treatment group. It is possible that block performance introduced a bias towards administering less opioid analgesia. However, we propose that this was not the case, given that NRS pain scores and opioid consumption were not different between the groups in the PACU or at early recovery times.

Indeed, we found no differences in postoperative opioid consumption at each time interval or when analyzed by route (oral or IV-PCA). Available literature on this topic is mixed, with most (but not all) studies in lumbar spine surgery cohorts concluding significant reductions in postoperative opioid consumption at multiple time points.[10] Goel et al performed a randomized, case–control study comparing ESPB with MMA to MMA only after single-level lumbar fusions. They found that opioid consumption during the first 24 hours was significantly lower in the block group, but total opioid consumption was very low in both groups (105.0 ± 15.15 vs 158.00 ± 23.38mcg, $p < 0.001$).[23] Zhu et al performed a randomized controlled trial comparing ESPB versus simulated injection for patients undergoing lumbar fusion surgery. Patients required fewer rescue doses of sufentanil in PACU (2 vs 10, $p < 0.001$) and the authors found a significant reduction in oral oxycodone administered during each 6-hour interval for the first 24 hours. Between 24 and 48 hours there was no difference, however the total amount consumed over 48 hours was significantly less in the block group (36.40 vs 23.10mg, $p < 0.001$).[22] Zhang et al performed a randomized controlled trial comparing ESPB to no-block on patients undergoing open lumbar laminectomy surgery. All patients received a morphine IV-PCA which included a basal rate of 0.25mg/hr. Total morphine consumed at 24 and 48 hours postoperatively was significantly less in the block group.[24] Several recent systematic reviews and meta-analyses which included studies from Chinese language literature support these findings of significant reduction of opioid consumption in the first 24 hours and need for rescue analgesics in lumbar surgeries.[21,25–27] The thoracolumbar fusions presented here had an average of 9 levels fused in each group which is represents a substantially different cohort than available literature, the bulk of which reports on single level lumbar fusions.[22,23] All of our patients were treated using an MMA regimen which includes IV-PCA.

We did not find significant differences in LOS between the 2 groups. Recovery after extensive thoracolumbar fusion is anticipated to be longer compared to other spinal surgeries, particularly when compared with the single level lumbar fusions and lumbar decompression surgeries typically studied for ESPB. A recent retrospective analysis of mixed lumbar procedures including 1 and 2 level fusions and multilevel decompressions reported a statistically significant reduction in overall LOS of 5 hours between ESPB and no-block cohorts. The unadjusted median LOS was 80.6 hours versus 74.9 hours for ESPB and no-block cohorts, respectively.[8] Owen et al retrospectively reviewed 1 and 2 level lumbar fusions that received ESPB versus no block and found that ESPB reduced overall LOS by 19.2 hours (2.4 vs 3.2 days, $p < 0.05$).[28] Similarly, van den Broek et al reviewed 20 single-level PLIF with ESPB versus 20 controls and found a significant reduction in LOS of approximately 12 hours (3.23 vs 2.74 days, $p = 0.012$).[29] By comparison, Zhang et al in their investigation of ESPB effects on lumbar decompression showed a tendency towards shorter LOS, however it was not statistically significant (6.0 vs 6.5 days, $p = 0.054$).[24] It is perhaps unsurprising that in our investigation single-shot ESPBs had no effect on overall LOS considering reported modest effects in less invasive procedures.

Surprisingly, we found no effect on postoperative NRS pain scores, particularly in immediate PACU or subsequent phases of care following the operating room. Lack of ESPB effects on NRS scores has been described in lumbar spine cohorts. For example, a recent prospective randomized trial compared morphine consumption and pain after surgery for lumbar disc herniation. Patients randomized to ESPB consumed less morphine, but there were no differences in pain

scores between ESPB and control.[30] Our group reported a similar phenomenon wherein we observed a significant reduction in opioid consumption in the first 24 hours after lumbar fusion, but no effect on NRS pain scores over the same interval.[8] Finally, a recent prospective clinical trial randomized 50 patients undergoing lumbar surgery to ESPB or no block plus MMA. The authors found no differences in opioid consumption or NRS scores at any time in the postoperative period.[16] Where reported, the benefits of ESPBs on pain scores appear to be limited to the first 6 hours after lumbar surgery.[11,15,26,31] Interestingly, our median duration of surgery was greater than 4 hours, so the early assessments of pain in the PACU may have coincided with block resolution in the ESPB group. This raises the possibility that continuous erector spinae catheters may be necessary for prolonged analgesia after extensive spinal fusion surgeries.[32] An alternative explanation for these results is that the otherwise comprehensive MMA provided was sufficient to create a ceiling effect on NRS scores which nullifies the additive benefit of ESPBs.

Finally, we did not identify any differences in opioid-related side effects between the groups or in prespecified complications of ESPB. These results are perhaps unsurprising given that we did not find any differences in opioid consumption over time. Likewise, existing literature supports an incidence of complications related to ESPB for lumbar surgery approximating zero.[33]

Limitations

This study has several limitations. This is a retrospective cohort study and is therefore subject to confounding and selection bias. Although we have attempted to control for bias by excluding revision surgeries, limiting surgical indications, and utilizing covariate adjustment with propensity score analyses there are several key weaknesses inherent in any retrospective study design. The lack of prospective randomization and blinding allows for significant selection bias. There are several sources, including the patient, surgeon, and anesthesia team who may influence the choice to perform ESPBs. Patients and practitioners were not blinded to their treatment. The intraoperative dosage of opioid medication and selection of opioid (such as methadone or hydromorphone) may have been influenced by the anesthesia team's awareness of the ESPB. Our cohort is heterogeneous, including both adult spinal deformity and pediatric spinal deformities in adulthood (eg patients with adult idiopathic scoliosis over 18 years of age). It is possible that these represent distinct clinical entities in terms of pain burden and management. In addition to some heterogeneity, our cohorts are relatively small which may limit our statistical power. In our institution, ultrasound-guided ESPB is routinely performed and documented, but several details are lacking in the procedure notes which could reasonably affect the interpretation of block effectiveness. Specifically, the spinal level and needle position relative to the transverse processes are not always recorded, and when recorded are subject to the judgement of the performing anesthesiologist. Likewise, the qualitative and quantitative spread of local anesthetic is neither assessed nor confirmed. Multiple anesthesiologists performed the blocks reported in this study and, while all were fellowship trained or grandfathered in regional anesthesia, individual practice and consistency of block performance may have been variable. This study only evaluated short-term outcomes after ESPB, essentially 24 hours after surgery and during their hospital stay. Long-term outcomes after blocks have not been evaluated in this patient cohort. We restricted our findings to those available in the inpatient medical record, which is high fidelity. Long term outcomes may be an interesting avenue of future research.

Conclusions

Here, we report that ESPB can be added as an adjunct to an MMA regimen for thoracolumbar fusion, however there is limited evidence to support regular use. We found the main association of ESPB was with a reduction in intraoperative opioid utilization. We did not identify concomitant reductions in postoperative opioid needs, pain scores, opioid-related side effects, or LOS. ESPB has emerged as a potential adjunct as part of analgesic regimens for spine surgery and a growing body of evidence supports ESPB for minor benefits on important outcomes after 1 and 2 level fusions, decompressions, and discectomy, including pain scores, opioid consumption and- related side effects, and LOS. Block performance appears to be associated with few complications and can be rapidly administered under ultrasound or fluoroscopic guidance. Given the ongoing need for better pain management strategies after complex thoracolumbar procedures, offering ESPB may be reasonable, despite these minor clinical effects. More rigorous study is necessary to make a definitive recommendation on the routine use of ESPB in thoracolumbar fusion surgeries.

Ethical Approval

The study was conducted in accordance with the ethical principles of the Helsinki declaration and approved by the institutional review board of Hospital for Special Surgery (IRB# 2020-1877).

Informed Consent

This was a retrospective study of procedures performed as standard of care, thus informed consent was not required.

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