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Research Article

Effectiveness of a Single Ultrasound-Guided Erector Spinae Plane Block for Lumbar Spinal Surgery - ə

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ABSTRACT

Background: Spinal surgery can cause severe postoperative pain. The aim of this study was to evaluate the effects of a single Ultrasound-Guided Erector Spinae Plane Block (US-ESPB) in patients undergoing lumbar decompression surgery.

Material and Methods: A total of 100 patients were included in this prospective randomized controlled study. The patients were randomly allocated into one of 2 groups: a US-ESPB group (n = 50) or a non (n)-ESPB group (n = 50). The main outcome measure was the pain score, as determined by a Numeric Rating Scale (NRS), on postoperative day POD 1, 2, 3, 4, 5, and 6. Need for analgesia was also assessed over the 6 PODs. For mild, moderate, and severe pain, NSAIDs alone, NSAIDS plus opioids (5-10 mg/day), or NSAIDS plus opioids (10-20 mg/day), respectively, were administered.

Results: The NRS significantly decreased over time in both patient groups, and between-group differences were not significant, except at POD 2. On POD 2, the NRS was significantly lower in the US-ESPB than in n-ESPB patients. The difference between the numbers of patients in each group who obtained/needed analgesics was not significant.

Conclusion: In patients undergoing lumbar spine surgery, a single US-ESPB performed at the lumbar level was not effective after POD 3.

INTRODUCTION

Spinal surgery can cause severe postoperative pain [1-3]. Gan reported that inadequate postoperative pain control can result in increased morbidity, functional impairment, poor quality-of-life, and increased cost of healthcare. [4]. By contrast, sufficient postoperative pain control provides early ambulation and discharge, and reduces the development of another complications [5, 6].

The Erector Spinae Plane Block (ESPB) is a novel method for administering regional anesthesia to control postoperative pain and chronic neuropathic pain of the thoracoabdominal region [7-11]. ESPB produces an extensive multidermatomal sensory block, with its likely site of action being at the dorsal and ventral rami of the thoracic spinal nerves [12]. The effect of ESPB spreads to the epidural and neural foraminal spaces over 2 to 5 vertebral levels and is associated with increased extent of craniocaudal spread along the paraspinal muscles [13].

Furthermore, according to recent reports, ESPB administered at the lumbar level provides good postoperative analgesia for lumbar surgery [9,10,14-16]. In addition, bilateral ultrasound-guided (US)-ESPBs have been found to be safe and effective for postoperative pain management after lumbar spine surgery [17]. However, the follow-up in this latter study only included the first 24 hours after surgery.

The purpose of this study was to investigate the effect of a US-ESPB on the pain scores of patients undergoing decompression surgery of the lumbar spine.

METHODS

A total of 100 patients were enrolled in this prospective randomized controlled study. Our Institutional Review Board approved the study protocol, and every patient provided written informed consent. The patients were divided into 2 groups as follows: US-ESPB or non (n)-ESPB, depending on the mode of application of the treatment. The inclusion criterion was elective open lumbar discectomy spine surgery for lumbar spinal stenosis.

US-ESPB (n = 50) was performed with the patient in the prone position after general anesthesia. The skin of the lower lumbar region was disinfected with betadine. An ultrasound transducer (SonoSite Edge, Bothell, WA, USA) with a disinfected vinyl cover in a sterile sleeve was used in a transverse orientation while counting up from the sacrum, to identify the targeted lumbar level. After identification of the tip of the transverse process of the targeted lumbar spine a 21G 100-mm block needle was inserted along the plane of the ultrasound beam until it gently made contact with the transverse process. After aspiration, a solution of 10 mL of 0.25% bupivacaine was injected. ESPB was not performed for the n-ESPB patients (n=50).

General anesthesia was maintained in both patient groups by propofol with a remifentanil infusion. All patients were extubated prior to transfer to the postanesthesia-care unit. All patients received intravenous patient-controlled analgesia containing 80 mL normal saline, 10 mL fentanyl solution, and 10 mL nefopam (100 mg) for a total of 100 mL administered at a basal rate of 2 mL/hr, with a lockout time of 15 min.

The main outcome measure was the pain score, as determined by the Numeric Rating Scale (NRS) on Postoperative Day (POD) 1, 2, 3, 4, 5, and 6. The patients' analgesic requirements were also assessed over the 6 PODs. A Nonsteroidal Anti-Inflammatory Drug (NSAID) alone was given for mild pain and an NSAID plus an opioid was prescribed for moderate or severe pain at 5–10 or 10–20 mg/day, respectively.

The independent *t*-test, chi-squared test, and Analysis Of Variance (ANOVA) were used to analyze the data, equating statistical significance with Type I error rates of <0.05. All computations were performed by standard software (SPSS, v23; SPSS Inc [IBM], Chicago, IL, USA).

RESULTS

A total of 100 patients divided into 2 gropus participated in the study, with 1 group of 50 participants who underwent US-ESPB and the other group of 50 who underwent n-ESPB. A summary of patient characteristics is provided in table 1. The differences between age, weight, height, gender, duration of surgery, and surgical level in the 2 patient groups were not significant ($p > 0.05$).

The NRS significantly decreased over time (Table 2), with no significant differences between the groups (Table 2), except on POD 2. On POD 2, the US-ESPB patients had a significantly lower NRS compared with the n-ESPB patients. The difference between the number of patients in the 2 groups who obtained/needed analgesics was not significant (Table 3). No serious complications, including epidural bleeding, dural or neural injuries, or infection were observed in either group of patients.

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DISCUSSION

In our study, the postoperative pain scores of patients undergoing spinal decompression surgery who received US-ESPB did not differ significantly compared with the control (n-ESPB) patients. However, on POD 2, patients who had received US-ESPB had a significantly lower pain score than the n-ESPB patients. This finding was not consistent with those of previous studies. [9,14,16]. In addition, US-ESPB for patients did not reduce additional analgesia requirements compared to patients without ESPB.

Pain relief by ESPB that provides parietal and visceral analgesia is supposed to be the result of the diffusion of local anesthetic into the paravertebral or epidural space. [12] However, in our study, the US-ESPB patients did not report pain relief that was superior to that of the n-ESPB patients. In 1 study of spinal surgery combined with general anesthesia and ESPB, opioid consumption (< 24 postoperative hrs) and the pain score were significantly reduced in patients receiving ESPB compared with n-ESPB patients [16]. The reason that no difference was seen for pain relief in our study between the US-EPSB and n-EPSB patients might be that only 10 mL of local anesthetic was injected because of our concern about the development of unintended motor block [18]. Immediately after the procedure in our study, the operating surgeon checked the motor state of the patient. In some reported cases when ESPB was administered at the lumbar level, 15–20 mL of local anesthetic was used [9,16]. The use of 20 mL of local anesthetic might suggest that the effect of the anesthetic extends 3–4 vertebral levels or more from the site of injection in a caudal direction [2, 12].

In our study, US-ESPB was performed at the level of the lumbar spine. The optimal vertebral level for ESPB used for lumbar spine surgery is variable and not well defined. [9,11,14-16]. Bilateral ESPB has been performed at L4 for a lumbar laminectomy and fusion at L4-5 [9]. Yayik et al. performed ESPB at L3 in patients undergoing lumbar spine decompression surgery. [16] In our study, 2 levels above the operative site were chosen as the site for administration of ESPB. Even if the ESPB was in the lumbar region, the effect of local anesthesia extends to the epidural and neural foraminal spaces over 2 to 5 levels [13] and covers the lumbar dermatome region [16].

Of previously published studies of ESPB, 80% used a single-shot technique [19]. To the best of our knowledge, no studies have compared single and continuous ESPBs. Macaire et al. reported that continuous bilateral ESPBs significantly decreased intraoperative and postoperative opioid consumption and optimized rapid patient mobilization and chest tube removal after open cardiac surgery [20]. In our study, ESPB was performed before surgery. The timing was advantageous for using an ultrasound-guided block, because there was no deterioration of anatomical structure.

In our study, 0.25% bupivacaine was used. However, 0.375% bupivacaine instead of 0.25% bupivacaine significantly reduced postoperative tramadol consumption after radical mastectomy surgery [8].

Our study has limitations. First, preoperative ESPB can be used to reduce intraoperative analgesic requirements to maintain cardiovascular stability and reduce surgical stress, but our study did not investigate these effects. Second, our study was single-blinded, and we did not perform a sham injection in the n-ESPB patients. Therefore, the placebo effect could not be investigated. Finally, side effects were not investigated, and the sample size small. Further studies of the side effects of EPSB for lumbar spine surgery and larger study samples are needed.

In summary, in patients undergoing lumbar spine surgery, a single US-ESPB performed at the lumbar level was not effective after POD 3.

Table 1: Patients characteristics.

Block (N = 100)	ESPB (n = 50)	Non-ESPB (n = 50)
Age	70.0 ± 8.3	64.7 ± 13.5
Gender (M : F)	24:26:00	28:22:00
Weight (kg)	60.2 ± 10.0	65.5 ± 13.0
Height (cm)	158.7 ± 8.9	160.3 ± 9.5
Level		
L23	2	3
L34	16	13
L45	23	24
L5S1	8	10
Operation time (min)	125.6 ± 41.0	128.5 ± 57.2

Table 2: Changes of numeric rating scale score.

POD	1 day	2 days	3 days	4 days	5 days	6 days
ESPB (n=50)	6.2 ± 1.2	5.4 ± 1.3	4.6 ± 1.3	3.9 ± 1,2	3.7 ± 1.2	3.4 ± 1.2
Non-ESPB (n=50)	6.5 ± 1.1	6.1 ± 1.2	5.1 ± 3.9	4.4 ± 1.3	3.8 ± 1.3	3.3 ± 1.2

POD: Postoperative Day.

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Table 3: The number of needed analgesics.

POD	1 day			2 days			3 days			4 days			5 days			6 days		
Pain	MI	MO	SE	MI	MO	SE	MI	MO	SE	MI	MO	SE	MI	MO	SE	MI	MO	SE
ESPB (n=50)	44	4	3	44	4	3	45	3	2	45	3	3	45	3	2	45	3	2
Non-ESPB (n=50)	45	1	4	45	1	4	45	1	4	45	1	4	46	2	3	45	3	2

POD: Postoperative Day, MI: Mild; MO: Moderate; SV: Severe.

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