

Erector spinae plane block in spine surgeries: Single-level versus bi-level, single-shot versus continuous catheter technique

ABSTRACT

Erector spinae plane block (ESPB) is one of the commonly preferred regional anesthesia techniques in the recent past for various procedures including spine surgeries. The main advantages of ESPB are the ease of performing the technique and the lesser chance of complications. Many studies have proven that ESPB plays an important role in reducing perioperative opioid consumption, postoperative nausea and vomiting, as well as the length of stay in the hospital. Thus it has been adopted as one of the measures for the enhanced recovery after surgery (ERAS) protocol. Nevertheless, the role of bi-level ESPB and a continuous catheter technique are the major research gaps and thus require further research in this population. The details of these two methods are discussed elaborately here.

Key words: Bi-level erector spinae plane block, continuous catheter technique, erector spinae plane block, spine surgeries

Introduction


Erector spinae plane block (ESPB) has become popular in the past few years and has become a regional technique of choice for various procedures including spine surgeries. Many studies including meta-analyses were published regarding the role of ESPB in spine surgeries.^[1-4] ESPB has also been studied by applying specifically the parameters of enhanced recovery after surgery (ERAS) in spine surgeries.^[1] Also, a recently published meta-analysis concluded that ESPB significantly reduces perioperative opioid consumption, postoperative nausea and vomiting, as well as the length of stay in the hospital.^[4]

The mechanism of action of ESPB is complex because of the spread of the local anesthetic solution in various directions.^[5,6] Hence, the volume of injectate that spreads to the paravertebral space varies greatly between patients, and it is dependent on many factors.^[6] Furthermore, the spread of the injectate to a number of dermatomal segments, i.e. “cranio-caudad spread,” while using a volume of 20 ml, also varied due to multiple factors.^[6] This was the same in the cadaveric studies too.^[6] Despite this “elusive mechanism of action,”^[6] ESPB has become an acceptable choice of regional anesthesia technique for a variety of procedures. This is mainly because of the “easy to adopt” nature of the technique as it requires less expertise than to perform a

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paravertebral block. In ESPB, both the visualization of the target by ultrasound and the trajectory of the needle are very simple.^[7] Also, because the structures such as pleura, major vessels, or other important structures (injury to them can cause serious complications) are far from the intended target or the needle trajectory of the block, this technique *per se* has a low rate of complications.^[7] Above all, sensory coverage of the ESPB over the posterior aspect of the trunk is unquestionable, thus it should produce a proper pain relief in posterior approach spine procedures. In this article, the effects of ESPB in spine surgeries particularly focusing on the details of single level versus bi-level, single-shot versus continuous technique are discussed.

Single-Level Versus Bi-Level ESPB in Spine Surgeries

To the best of my knowledge, no prospective, randomized study is available to evaluate the effects of bi-level ESPB or to compare it with the single level in this population. A retrospective analysis performed on patients who underwent scoliosis correction found that the ESPB blocks provided at T4 and T10 levels bilaterally reduced the pain scores and consumption of morphine significantly besides increasing the patient's satisfaction scores significantly when compared to the control group. There was also a decrease in the length of the hospital stay in the ESPB group as per that study.^[8] A case report involving two adult patients who underwent posterior spinal fusion at 12 vertebral levels for scoliosis correction also received bilateral ESPB at two levels (T4 and T10) before incision. Both cases had minimal pain on recovery, and the pain scores were low throughout their hospital stay. Furthermore, they could be switched to oral analgesia on postoperative day 1, requiring only a modest amount of opioids, without any side effects.^[9] Another case report of a patient who underwent kyphosis correction observed low pain scores until 48 hours for whom ESPB was performed at T12 and L3 (above and below the angle of kyphosis respectively).^[10] Based on these reports, bi-level ESPB would be a better option if the surgery involves multiple levels. This is especially true in the background of the “cranio-caudad spread” of the injectate after ESPB being highly variable^[6] as mentioned earlier.

Single-Shot Versus Continuous Infusion Technique

Although ESPB has been proven to provide a good quality of pain relief and is considered one of the measures of ERAS,^[1] its duration of action is limited,^[11] thus necessitating a continuous erector spinae plane (cESP) catheter technique to extend the duration of analgesia for a longer period. Similar to the previous point, no prospective, randomized study

is available to evaluate the effects of cESP catheters. Only case reports^[12-14] and retrospective analysis^[15] are available, and no complication was reported in these small numbers of patients.^[12-15]

Unfortunately, “neuraxial spread,” which means excess spread of local anesthetic to epidural space has been observed as per a recently published case report in which the authors stated that they had to terminate their study because of this undesirable event.^[16] We need to dig deeper to understand this complication, so we can find some solutions. Amoroso *et al.*^[16] stated that no report was available about the epidural spread in the cESP catheter technique, while a few case reports are available describing this complication for single-shot ESP block in this population. However, this statement needs a careful interpretation. If the neuraxial spread could happen in the single-shot technique itself, then it can happen very well in the cESP catheter technique. Indeed, the chances are higher, especially after spine surgeries. Furthermore, Tseng *et al.*^[17] also discussed this potential complication in their case report published in 2019 that described a cESP catheter technique for laminectomy and fusion of T4-T7 spines. Interestingly, this patient was on invasive ventilation initially for his bilateral multiple rib fractures and subsequently underwent spine surgery. Pain relief through a cESP catheter facilitated the weaning. Although Tseng *et al.*^[17] paid attention to assessing the weakness of the upper/lower extremities, they could not confirm it because of the “deep sedation” they had to administer for the patient to tolerate the mechanical ventilation in that case.

A recently published study did not report any complication due to the cESP catheter technique in mitral valve surgeries through a mini-thoracotomy incision, and indeed better than continuous serratus anterior plane block with regard to postoperative morphine, other analgesics, and metoclopramide consumption.^[18] Hence, the problem of neuraxial spread is mainly because of the nature of the surgical procedure that results in disruption of anatomy thereby making the patients vulnerable to develop this complication.

I would like to suggest a few points to prevent the “neuraxial spread.” Primarily, for one or two levels/simple spine procedures, a single-shot ultrasound-guided ESPB before the surgery but after induction of general anesthesia and prone positioning, and a repeat single injection ESPB preferably by the surgeon (surgeon-placed or “Surgical” ESPB) at the end of the procedure would suffice. I believe that these measures are advantageous in many aspects such as reduction of the operating room utilization time, comfort of the patient

and operating room personnel, avoiding the problems of second-time positioning, etc., The cESP catheter technique should be reserved for multiple levels/complex spine procedures. Ultrasound-guided bi-level ESPB can be provided before the incision and the cESP catheters can be placed by the surgeon at the end of these procedures. It will be prudent to use an ultra-low concentration of local anesthetic with a suitable adjuvant for infusion. Also, it is better to stop the infusion intermittently, say for 2 hours after every 6-8 hours, or titrate it according to individual requirements with constant vigilance. Alternatively, a simple administration of intermittent bolus doses according to the duration of action of the drugs chosen can also be considered.

Research Gaps and Planning of Future Study Designs

Bi-level ESPB and the cESP catheter technique are the major research gaps in this population. However, designing a clinical study is a great challenge as it requires concurrence and cooperation from the surgeon as the block is performed closer to the surgical domain. Furthermore, ethical concerns also need to be considered especially for the cESP catheter technique because of the potential “neuraxial spread.” Proper selection of cases, detailed explanation to the patient, elaborate discussion with the surgical team, modification of the infusion technique as mentioned earlier, etc., will be helpful.

Conclusion

Erector spinae plane block is one of the techniques of choice for pain relief in spine procedures because of its efficacy, ease of performing the technique, and lesser chance of complications. The potential research gaps warranting further studies are the comparison of single-level versus bilevel and single-shot versus cESP catheter technique or evaluation of cESP alone (with simple solutions suggested here to avoid the “neuraxial spread”) in this population.

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Conflicts of interest

There are no conflicts of interest.

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