Case Report

Ultrasound-guided Erector Spinae Plane Block – A Novel Analgesic Technique for Low Back Pain

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Abstract

We describe the successful use of a novel interfacial plane block and the ultrasound-guided erector spinae plane (ESP) block in two cases with severe chronic low back pain. Both of our patients have received conservative treatment (medicines and exercise therapy) for long and have also undergone invasive treatment modalities for their low backache. Ultrasound-guided ESP block provided better analgesia due to greater dermatomal coverage as well as reduced risk of complications as compared to a lumbar epidural that had previously been employed in both patients. The ESP block anesthetizes the dorsal rami of spinal nerves that innervate the paraspinal muscles and bony vertebra, and it offers a simple and safe technique to treat chronic low backache.

Keywords: Erector spinae, erector spinae plane block, low back pain, ultrasound, ultrasound guided

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Introduction

Low back pain (LBP) is defined as pain between the costal margin and gluteal folds. The pathophysiology of LBP has been elucidated in different studies. Various conditions affecting disc, ligaments, underlying muscles, joints, bones, and nerves may cause LBP.[1,2]

Even with the advent of neuroimaging, in our routine clinical practice, it sometimes very difficult to correctly identify the culprit structure for LBP, to provide directional therapeutic interventions, and sometimes, even treatment modalities focusing the affected target structure may not relive patient from disabling pain. In a few patients, LBP is quite disabling that breaking the pain cycle to relieve pain even for a short duration and is of utmost importance for the treating physician.

Minimal invasive intervention that can be performed on the outpatient basis and provide a wider area of analgesia by blocking the neural supply of the various structures covering multiple segments of the vertebral column must be utilized in these cases.

Ultrasound-guided erector spinae plane block (ESPB) is a novel technique that provides an extensive spread of injectate, both cephalo-caudally and medio-laterally.[3] Initial research of this novel block was focused on thoracic analgesia, including thoracic neuropathic pain,[3] costal fractures,[4] and thoracic surgery.[5]

Low thoracic level ESPB (T8–T12 level) have shown to be effective for preoperative analgesia for abdominal and lumbosacral spine surgeries.[6,7] Takahashi and Suzuki reported the use of lumbar ESPB (at L2) to treat LBP in failed back surgery syndrome.[8]

There is a scarcity of research on the use of ultrasound-guided ESPB in LBP.[8] To the best of our knowledge, this is the first description of the successful use of ESPB at the lumbar region in two patients with conservatively treated (nonsurgically treated) chronic LBP. Informed written consent was obtained from both patients.

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Case Reports

Case 1

A 33-year-old male (60 kg, 162 cm) was referred to our pain clinic for the treatment of LBP. Besides conservative management (medication and exercise therapy), he had also received one lumbar epidural steroid injection (ESI). His leg symptoms improved with ESI, but the back pain continues. When he presented in the pain clinic, he gave a history of nonradiating LBP for the past 5 years, which increased in severity for the past 6 months (Numerical Rating Scale: 8–9). The pain increased with movement, prolonged sitting, and standing. He was off his job for the past 3 months because of the pain. Clinical examination revealed axial (Grade 3) and paraspinal tenderness at L3–4 and also diffuse Grade-2 tenderness in the whole of the lumbar spine.[9] The spine range of motion was painful. Other tests were nonremarkable. Magnetic resonance imaging (MRI) L-S spine showed diffuse posterior disc bulge L4–5 and L5–S1 level. Back pain was quite disabling and causing impairment in his quality of life despite taking etoricoxib (60 mg) with thiocolchicoside (4 mg), duloxetine (20 mg OD), pregabalin (75 mg BD), tramadol (50 mg SOS). He was not getting any sick leave compensation and wanted to return to his job as soon as possible.

Observing the severity of his symptoms and adverse consequences of pain over his work, a regional anesthetic technique to provide some immediate relief and break his pain cycle, need to be considered. Observing the craniocaudal extent of his pain, ultrasound-guided bilateral ESPB at L3 level was performed, using 10 ml of 0.2% ropivacaine and 4 mg of dexamethasone at each site. The patient reported significant relief (numeric rating scale [NRS] 1–2) in his symptoms after block that persisted for ≥4 months (duration of his last visit in the pain clinic outpatient department [OPD]). His sitting duration, walking, and activities of daily living were improved, and he returned to his regular job after 3 days of injection. The patient was instructed to follow the exercise program regularly.

Case 2

A 50-year-old male (170 cm, 67 kg, and teacher by occupation) gave a history of LBP for the past 7 years. The pain was the insidious onset and radiating to bilateral lower limbs. He had received three lumbar ESI (including one transforaminal ESI at L5–S1), which relieved his leg symptoms with only mild reduction in back pain.

When presented in our pain clinic, he complained of nonradiating low back and bilateral gluteal region pain (NRS: 7–8). Pain used to increase with prolonged sitting and standing. On examination, diffuse axial and paraspinal tenderness were present over the lumbar spine. Muscle spasm present and multiple facets (L2-3-4-5-S1) were painful bilaterally. Spine flexion, extension, and rotation were painful. Tests for pyriformis muscle, spine, and hip were nonremarkable. The plain radiograph of the lumbosacral spine showed a loss of lumbar lordosis with degenerative changes. MRI L-S spine showed L3–4, L4–5, and L5–S1 diffuse posterior disc bulge and facet joint hypertrophy. Presumptive clinical diagnosis of facetogenic LBP was made. Etoricoxib (60 mg BD), thiocolchicoside (4 mg BD), pregabalin (75 mg BD), amitriptyline (10 mg HS), and capsule tramadol (50 mg SOS) were prescribed and advised to follow the regular exercises program. However, even after 4 weeks, he reported no relief in symptoms.

As there was involvement of multiple facets bilaterally, medial branch block at each level was not feasible in the clinical outpatient setting. Hence, ultrasound-guided bilateral ESPB was given at L3 level by injecting 10 ml of (0.2%) ropivacaine and 4 mg dexamethasone bilaterally.

He reported marked relief in his symptoms, and the post block pain score dropped down to zero on NRS. He reported improvement in his quality of life, and his pain maintained 2–3 on NRS up to 3-month follow-up.

Technique

The patient was asked to lie prone over the table with a pillow under the abdomen. The skin was disinfected with 2% chlorhexidine in 70% alcohol. The sterile drape was applied. A low-frequency curvilinear ultrasound transducer (2-5 MHz), covered with a sterile sleeve, was placed in longitudinal parasagittal orientation, 3 cm lateral to the midline, to identify the target transverse process. Needle track was anesthetized using 2% xylocaine and a 23G, 10 cm spinal needle was inserted in the plane with ultrasound beam in caudal to the cranial direction to contact the tip of the target transverse process gently. Needle tip position was confirmed by viewing the linear spread of saline (1–2 ml) separating erector spinae muscle from the tip of the transverse process [Figure 1]. After confirming the correct needle tip position, 10 ml of ropivacaine (0.2%) with 4 mg dexamethasone was injected under a real-time sonographic image.

Discussion

Dorsal rami of spinal nerves innervate posterior bony elements, paraspinal muscles, and ligaments of the back. The common dorsal ramus arises shortly from the spinal nerve as it exits the intervertebral foramen and travels dorsally and caudally through paraspinal muscles and intertransverse connective tissue. It ascends into the erector spinae muscles (spinalis, longissimus, and iliocostalis) and divides into two or three branches.[10]

The common dorsal ramus is blocked at the junction of the superior articular process and base of the transverse process (!!), and this block has been used in the treatment of sprain, herniated disc, acute or chronic postoperative pain, lumbar fracture, and spinal canal stenosis. The effects of dorsal ramus block declined in 3 months, so the authors proposed that the dorsal ramus block does not provide permanent relief.[11]

Although the typical signs of "lumbar dorsal ramus syndrome" as described by Bodguk,[12] such as pain worsened by spinal motion, local paravertebral tenderness, were present in both of

our patients, as patients with stenosis, herniated disc, chronic postoperative pain have also presented with similar signs,[11] we did not describe our patient as having "lumbar dorsal ramus syndrome."

As blocking lumbar dorsal ramus at each level is a lengthy and technically challenging task and as ESPB offer the multilevel coverage of the lumbar dorsal ramus and nearby vertebral structures with a single injection,[3,13] so ESPB was used in this study as a technically easy and safe alternative for treating LBP in routine OPD setting.

In ESPB, injectate spread within the musculo-fascial plane between erector spinae muscle and the tip of the transverse process, deep to the erector spinae muscle.[3] Ivanusic has described the mechanism of action of ESPB using ten unembalmed human cadavers. The authors found extensive craniocaudal and mediolateral spread of dye, both deep and superficial, to erector spinae muscle. Dorsal rami were seen to be stained, but ventral rami and dorsal root ganglia were not stained.[13]

Erector spinae muscle extends along the length of the thoracolumbar spine, so its plane permits the extensive craniocaudal spread of the drug, covering multiple spinal levels. As the tip of the transverse process is directly or indirectly related to the two layers of thoracolumbar fascia, so in ESPB, the drug may spread directly or indirectly into the fascial plane of the thoracic-lumbar fascia. This may be the reason behind the extensive lateral spread of drugs in ESPB.[14]

The first description of this novel analgesic technique was given by Forero *et al*. in 2016 in two patients with severe thoracic neuropathic pain. In both cases, the ESPB produced extensive multilevel pain relief. A cadaveric study was also done, which showed that the most likely site of action is the dorsal and ventral rami of spinal nerves. Dye was injected at the level of T5 transverse process in cadavers. Multidetector computed tomography scan showed craniocaudal spread of injectate from C7 to T8. The authors proposed that ESPB is a simple and safe technique for thoracic analgesia.[3]

Afterward, many researches replicated similar results.[4,5] Low thoracic level ESPB was also successfully implemented for abdominal and lumbosacral spine surgeries.[6,7]

Takahashi and Suzuki performed the first lumbar ESPB in failed back surgery syndrome (posterior lumbar interbody fusion at L4–5 plus spinal stabilization at L3). Bilateral ESPB was performed at L2 transverse process with 20 ml of 0.1875% ropivacaine at each site. The patient reported marked pain relief after three blocks and was satisfied with the extent of pain control. The author concluded that ESPB at the lumbar vertebral level is as effective as that at the thoracic vertebral level.[8]

With extensive literature review and to the best of our knowledge, this is the first description of ultrasound-guided ESPB for nonsurgically treated LBP. In contrary to the

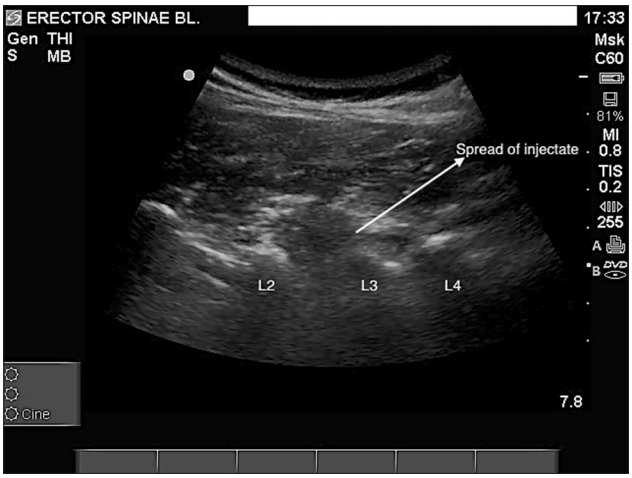

Figure 1: Ultrasound-guided lumbar erector spinae plane block

literature, (3.8) lesser volume of local anesthetic (10 ml at each site) was used in this study, as the area of pain was confined to the lumbar region, and we did not want to block thoracic or lower sacral rami, considering the extensive craniocaudal spread of injectate with using larger volume. Although there is no study on the appropriate dose of local anesthetic, the dose used in this study was probably sufficient because adequate pain relief was obtained without adverse events.

The drug was injected at L3, which was the site of maximum pain and tenderness. So depositing drugs as near as the site of maximum pain may be the explanation of marked pain relief in patient's symptoms. Besides this, 4 mg dexamethasone was added with 0.2% ropivacaine, as literature review indicates that dexamethasone added to perineurial local anesthetic injection may prolong the duration of peripheral nerve block analgesia.[15] Moreover, it may also therapeutically act on the irritated dorsal ramus of lumbar spinal nerves.[16]

In contrary to previous studies,[3,8] any post block sensory loss was not found in any patient, as low concentration of local anesthetic applied at target nerve have been shown to preferentially inhibit pain generation and transmission compared to the motor and sensory functions.[17]

Nowadays, the role of ultrasound in interventional pain management has been explored markedly. Ultrasound is relatively inexpensive and has a lack of radiation hazards to both patients and clinicians. It offers real-time needle guidance, soft-tissue visibility, visibility of vessels (using Doppler), and nerves that can be difficult to identify with using other imaging modalities. Recently, low-cost portable ultrasound machines allowed various procedures to be conducted in routine OPD or patient's bedside settings. Ultrasound allows both diagnostic and therapeutic procedures to be conducted in a single sitting.

Ultrasound-guided ESPB offers several advantages. It is a safe and easy procedure as the target is the tip of the transverse process, which is located far lateral to neuroaxial structures. The transverse process gives a strong echo on ultrasound images so that it can be easily identified. It offers a wide area of drug spread,

both laterally and cranio-caudally, so offers an advantage over trigger point injection or medial branch of dorsal ramus block.

Ethical clearance from the institutional review board was not taken for this study, as ultrasound-guided ESPB is a well-documented modality for pain management at thoracic and lumbosacral levels, but its use to treat chronic LBP was not done in any previous study.

Conclusion

Ultrasound-guided lumbar ESPB may prove to be as effective as when performed at the thoracic level and may offer a simple and safe alternative to more invasive interventions for the treatment of LBP. Injecting drugs as near as the site of maximum pain may reduce the need for the large volume of local anesthetic agents. Relieving patients from debilitating pain may offer early engagement in rehabilitation measures and exercise programs. Further research is needed to reproduce its long-term therapeutic effectiveness to treat LBP.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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