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CASE REPORT Open Access

Is lumbar erector spinae plane block (L-ESPB) a lumbar plexus block?: a case report of three cases

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Abstract

Background: Lumbar erector spinae plane block (L-ESPB) is being used in fractured hip patients for the postoperative pain relief and as a sole anesthetic technique. Various clinical and cadaveric studies have differences of opinion about its mechanism of action and pathways of local anesthetic spread; however, the role of lumbar plexus (LP) in the mechanism of action is still not considered. In our clinical experience, we observed that the action on LP could be a pathway for the analgesic action of local anesthetic along with paravertebral spread.

Case presentation: We report here three cases of the fractured hip who were given L-ESPB for postoperative pain management. The radiological examination was done after injection of non-ionic contrast to know the spread of local anesthetic. In two cases, the contrast spread was seen towards LP and in one case spread of contrast was observed towards the paravertebral area.

Conclusions: Effect of local anesthetic on the lumbar plexus is one of the plausible pathways in L-ESPB for its analgesic mechanism of action.

Keywords: Lumbar erector spinae plane block (L-ESPB), Lumbar plexus block, Nerve blocks

Key messages

Analgesic effect of lumbar erector spinae plane block (L-ESPB) is also contributed by spread of local anesthetic on the lumbar plexus. This case report presents a clinical effect and correlated radiological evidence for the mechanisms of action of erector spinae plane block to relieve pain in hip surgery.

Background

The lumbar erector spinae plane block (L-ESPB) is increasingly being used in the fractured hip patients for the postoperative pain relief (Tulgar and Senturk 2018; Tulgar et al. 2018) or as a sole anesthetic technique (Ahiskalioglu et al. 2020). The mechanism of pain relief by the erector spinae plane block (ESPB) is yet not fully understood; however, there are many hypotheses. It is believed that, including the effect on the posterior ramus, it also works through blocking the ventral ramus and paravertebral spread (Forero et al. 2016; Chin et al. 2017a, 2017b). Does it also work by involving the lumbar plexus? It is not yet considered. We report here three cases of hip surgery where continuous lumbar ESPB with catheter was used for the postoperative pain relief. Contrast study was done which showed the spread of contrast in the area of lumbar plexus in two patients and in paravertebral area in one patient. We postulated that local anesthetic spread on the lumbar plexus is a major contributor of pain relief during L-ESPB as in our two cases, excellent pain relief was achieved and the contrast spread was observed towards lumbar plexus.

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Case presentation

Case 1

A 54-year-old male patient had fracture of left femur and was scheduled for open reduction and internal fixation under spinal anesthesia. General physical examination, systemic examination, and investigations were within normal limits. After informed consent patient was taken into operation room. Vital monitors were connected and spinal anesthesia was given with 2.5 ml 0.5% heavy bupivacaine at L3/L4 (3rd lumbar or 4th lumbar vertebral level) in sitting position with sterile technique and taking due aseptic precautions. After spinal anesthesia, the L-ESPB was given at L4 level in same sitting position. To perform L-ESPB, a low-frequency ultrasound probe (2–5 MHz, SonoSite-M Turbo) was placed in the left parasagittal plane and transverse process (TP) of L4 was identified. Skin was infiltrated with 2 ml 1% lidocaine at needle entry point and 18 gauze Tuohy needle was inserted in out of the plane (OOP) till it contacted TP of L4. After contacting the TP, 2 ml saline was injected through the needle and correct needle placement was ascertained by lifting of erector spinae muscle (ESM) and linear caudal-cranial spread of saline underneath the ESM (Fig. 1A, B). After injection of 10 ml saline through the needle, a 20-G epidural catheter was inserted in cranial direction leaving 3 cm catheter beyond the needle tip. After completion of surgery 20 ml mixture of 0.25% ropivacaine and 8 mg dexamethasone was injected slowly through catheter with repeated aspiration to avoid accidental intravascular injection and an infusion of 0.1% ropivacaine + fentanyl 1 μg/ml was started @ 6 ml/h. Injection paracetamol 1 G intravenously (IV) was given every 8-hourly. Pain assessment was done with numeric rating sore (NRS) on the scale of 0–10 where 0 = no pain and 10 = worst imaginable pain. Patient had excellent pain relief the numeric score remains 0–1 on rest and 1–3 on movement during 48 h and did not require any rescue analgesics.

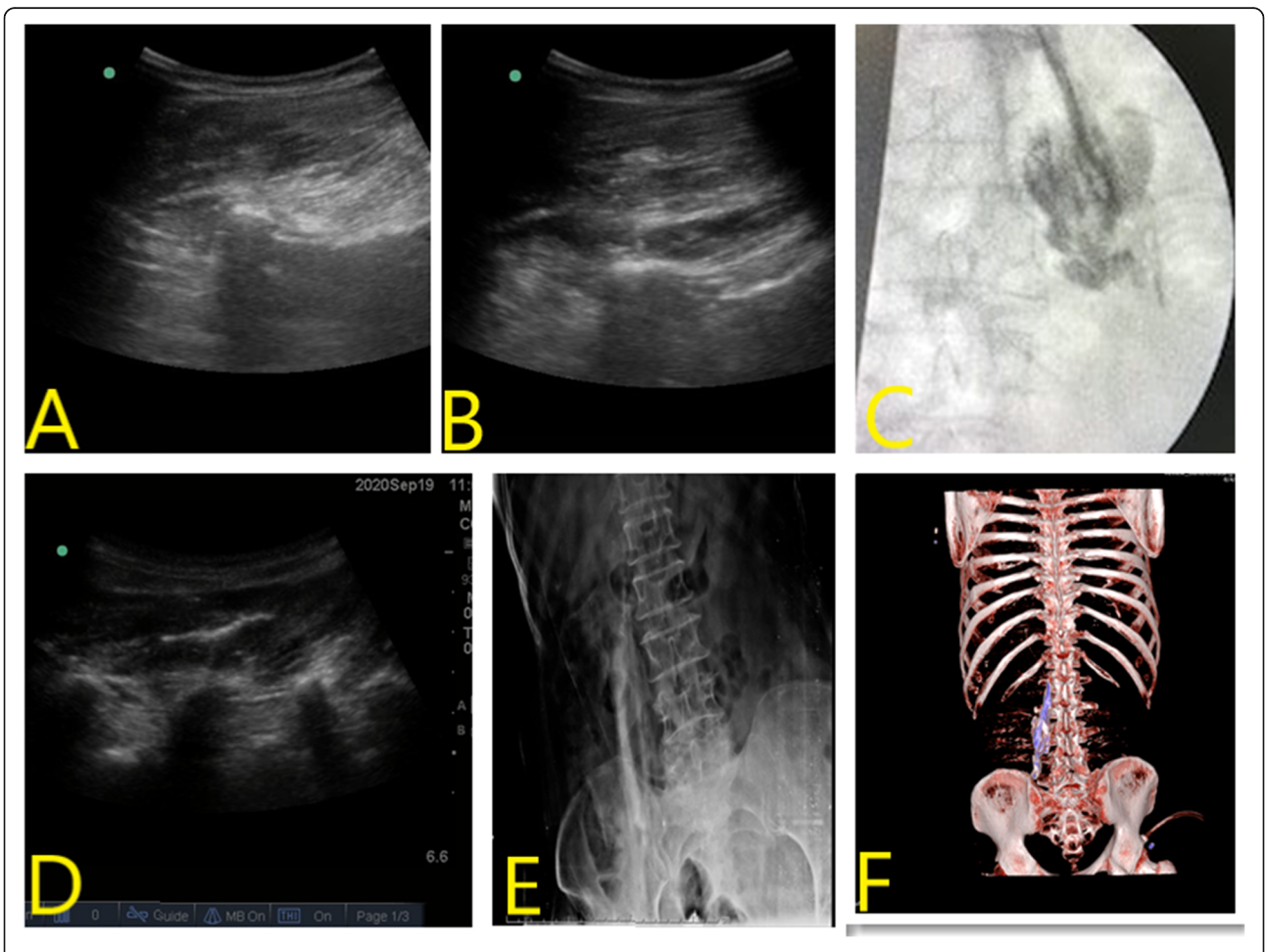

Fig. 1 **A** Sonoanatomy of the first case, showing the transverse process of L4 vertebra. **B** Local anesthetic spread (star marks). **C** X-ray of the first case showing the contrast spread towards lumbar plexus. **D** Local anaesthetic spread in case 2. **E** Contrast spread towards lumbar plexus in case 2. **F** CT of case 3 spread of contrast close to paravertebral spaces. TP—transverse process, ESM—erector spinae muscle

On the 3rd postoperative day, patient was scheduled for ambulation although patient was able to walk; however, he noticed the decreased sensation on anterior side of the thigh and some weakness. An X-ray was done after injection of 2 ml contrast (Omnipaque™-300) mixed with 3 ml saline which showed the spread along the psoas muscles towards paravertebral area corresponds with the site of lumbar plexus (Fig. 1C). Catheter was removed and patient regained full sensation and strength in next 6 h. Patient was discharged on 5th day and his pain was managed with intravenous paracetamol and injection tramadol 50 mg on demand on day 3 and, afterwards with oral paracetamol 325 mg + tramadol 32.5 mg 8 hourly.

Case 2

An elderly female aged 82 years was scheduled for right hip surgery under spinal Anesthesia. Pre-anesthetic work-up was done and an informed consent was taken. She had hypertension, hypothyroidism and ischemic heart disease however, well-controlled with medicines. She had history of L5 partial laminectomy for radicular pain right limb. She was unable to sit due to severe pain therefore L-ESPB was given in right lateral position before spinal anesthesia in the procedure room with due aseptic precaution and monitoring. Once correct needle position was confirmed (Fig. 1D) 20 ml 0.25% ropivacaine mixed with 8 mg dexamethasone was given through Tuohy needle and a 20-G epidural catheter was inserted tunneled and fixed. After 30 min patient was shifted to the operation room and spinal anesthesia was given in sitting position without any pain or discomfort during positioning. Sensory mapping showed decreased sensation to cold and pin-prick with blunt metal pointer in the distribution of femoral nerve however, patient was able to move the right limb side-wise with mild pain (NRS = 3). After completion of surgery an infusion of 0.1% ropivacaine + fentanyl 1 μg/ml was started @ 6 ml/h. Injection IV paracetamol 1 G, every 8 h was given and tramadol 50 mg IV was advised as rescue analgesia if NRS was ≥ 4. Patient did not require rescue analgesia and maintained NRS 1–3 during rest and on movement. Infusion was continued for 48 h and before removal of catheter, 10 ml mixture of (5 ml 0.125% ropivacaine and 3 ml contrast (Omnipaque™-300) was injected which showed the contrast spread along the psoas muscle towards paravertebral space near L2 vertebral level (anatomic area of lumbar plexus injection) and down towards insertion point of iliopsoas tendon (Fig. 1E).

Case 3

A 52-year-old male patient admitted with left fracture hip due to road traffic accident. He had a history of chronic abdominal pain. He was a chronic alcoholic with alcoholic liver disease. Investigations showed mildly deranged liver functions and, coagulation profile (bilirubin

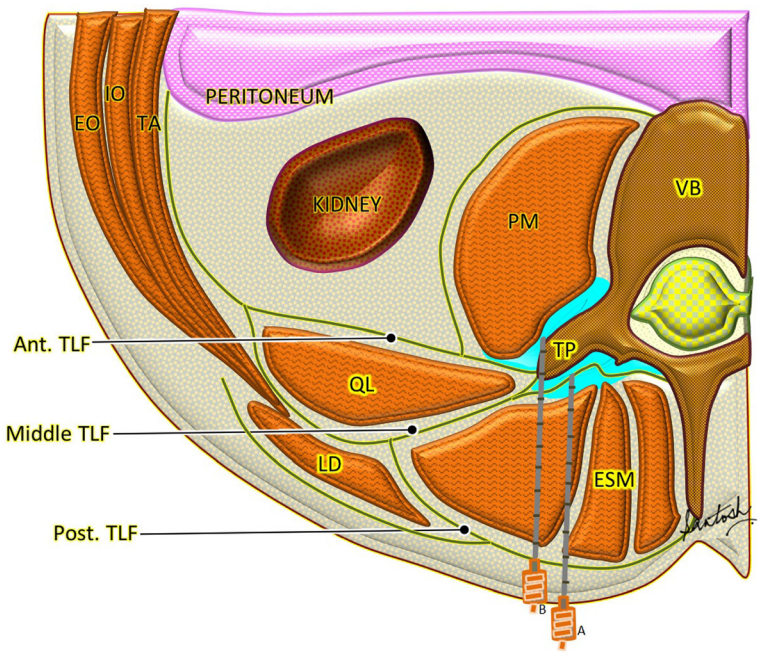

Fig. 2 Schematic diagram showing the variable catheter tip/needle position. **A** Needle on the transverse process. **B** Needle on the lower border of transverse process which may lead to the LA spread along the psoas muscle towards LP. EO—external oblique, ESM—erector spinae muscle, IO—internal oblique, LD—latissimus dorsi, PM—psoas muscle, QL—quadratus lumborum, TA—transversus abdominis. TLF—thoraco lumbar fascia, TP—transverse process, VB—vertebral body

2.5 mg/dl, prothrombin time was prolonged and international normalized ratio was 1.6). He received 3 doses of 10 mg vitamin K before surgery. Internal fixation of left hip was done under spinal anesthesia. The L-ESPB was done in sitting position and catheter was inserted after bolus injection of 0.25% ropivacaine + 8 mg dexamethasone. Postoperative pain management was similar to other two previous patients. He required two doses of tramadol during first 24 h; otherwise, postoperative course was uneventful. Catheter was removed after 3 days. Before removal of the catheter 10 ml mixture of (5 ml 0.125% ropivacaine and 3 ml contrast (Omnipaque™-300) was injected and 3D reconstruction was done after computed tomography (CT) Images showed the contrast spread from L5 to L1 and encroachment of contrast in the paravertebral area at L1–L3 (Fig. 1F).

Discussion

The erector spinae plane block is a multi-utility regional block which has been used in various clinical situations extending from the face to sacral area (Jadon et al. 2019; Kilicaslan et al. 2020). However, the exact mechanism of action is still elusive. The cadaveric studies as well as clinical studies supported with radiological evidence have suggested that, the local anesthetic spreads up-to the paravertebral space and affect the ventral rami, sympathetic fibers along with the involvement of dorsal rami of spinal nerves (Forero et al. 2016; Chin et al. 2017a, 2017b; Vidal et al. 2018; Chin et al. 2017a, 2017b). The contrary results are also being presented by the similar range of studies suggesting that the ESPB only affect the dorsal rami. Ivanusic J et al. noted in their cadaveric study that there was no spread of dye anteriorly to the paravertebral space to involve origins of the ventral and dorsal branches of the thoracic spinal nerves (Ivanusic et al. 2018). The dorsal ramus involvement was posterior to the costotransverse foramen. Till today, we do not know the true reason for this discrepancy in results. In our cases also, we noticed that in two patients contrast spread was seen towards lumbar plexus along the psoas

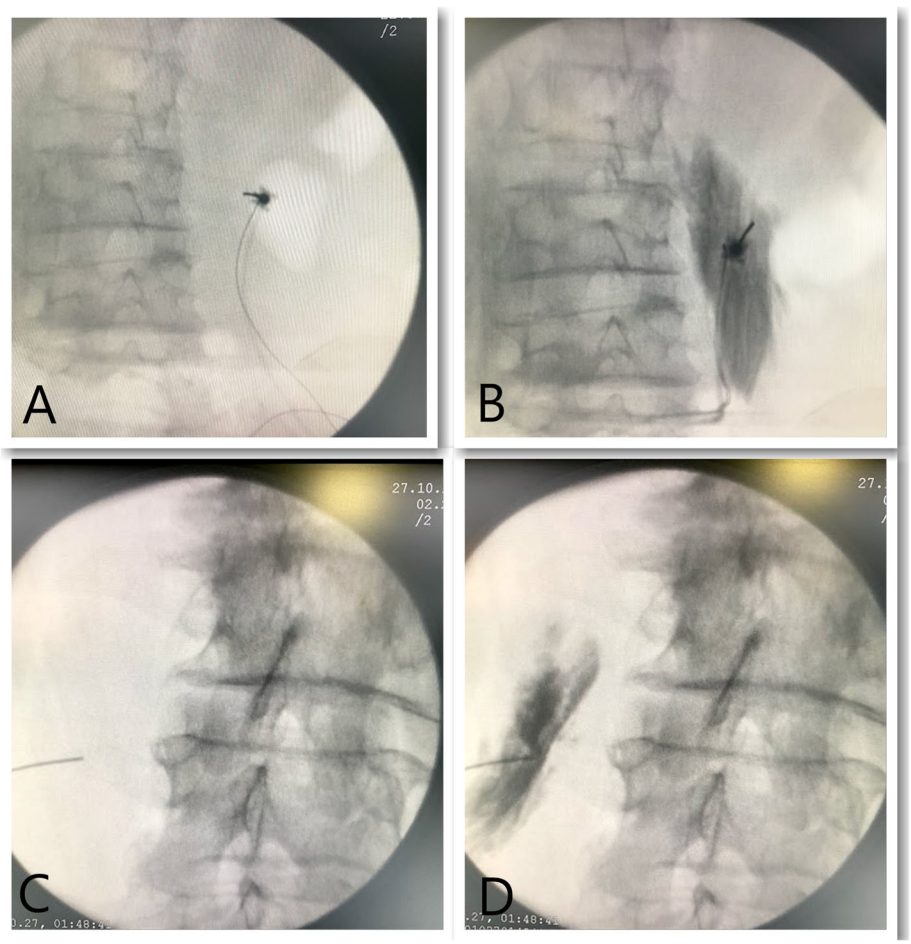

Fig. 3 **A** X-ray showing contact of the needle in the middle of the transverse process. **B** Contrast spread close to paravertebral space. **C** Needle contacting the lower border of the transverse process. **D** Contrast spread along with the psoas muscle towards lumbar plexus. TP—transverse process

muscle however, in 3rd case the contrast was close to the vertebral column (paravertebral area) far-medial from other cases. Although, similar technique was used in all the cases; however, the possibility of variation in catheter tip placement (lateral or medial) in relation to tip of TP cannot be ruled out. We hypothesized that the insertion of catheter plays an important role in spread of local anesthetic towards lumbar plexus. Position of needle/catheter tip plays an important role in spread of local anesthetic as shown in the schematic diagram (Fig. 2). In our pain clinic, we have treated many patients suffering with acute or chronic back pain due to muscle spasm by L-ESPB given under fluoroscopy in the prone position. We have observed that, the contrast spread remains close to paravertebral area whenever injection is given through needle which is in close contact of TP. However, changing the contact of needle (towards the inferior or superior borders of the TP) leads to the contrast spread either along the psoas muscle or laterally towards the lateral fibers of erector spinae muscles (e.g., iliocostalis) (Fig. 3A–D). As we have observed variable distribution of contrast depending upon the needle position, could be one of the reasons of variable results of ESPB observed by other studies (Forero et al. 2016; Chin et al. 2017a, 2017b; Vidal et al. 2018; Chin et al. 2017a, 2017b; Ivanusic et al. 2018).

In all three patients, excellent pain relief was achieved. It simply means that, whatever may be the pathway of local anesthetic to reach the spinal nerves either through paravertebral space or through 'psoas tunnel' up to lumbar plexus it is an effective approach for postoperative pain relief in patients of hip surgery. However, this report suggests that one of the mechanisms of pain relief in ultrasound-guided L-ESPB is the effect of local anesthetic on to the lumbar plexus. Effective analgesia in our cases with variable contrast spread suggests another possibility of mechanism of action that is, co-existing pathways. In a study, Daring et al. reported the success of erector spinae plane block after failed lumbar plexus block in hip joint and proximal femur surgery. This supports the view that, drug must have acted through alternative route other than lumbar plexus plausibly, paravertebral (Darling et al. 2018).

In the situation where research is still on to find out the pathways of local anesthetic spread and correct mechanism of action, this case report presents a clinical effect and correlated radiological evidence for the one of the mechanisms of action of erector spinae plane block to relieve pain in hip surgery. However, before generalizing the results of this case report, more evidence is required by large study and other reliable radiological evidence like CT/MRI (magnetic resonance imaging) and cadaveric dissection.

Conclusions

This case report presents a series of three patients where clinical effect of L-ESPB was correlated with radiological evidence to understand the mechanisms of action of erector spinae plane block to relieve pain in hip surgery. Effect of local anesthetic on the lumbar plexus is one of the plausible pathways in L-ESPB for its analgesic mechanism of action.

Abbreviations

@: At the rate of; CT: Computed tomography; ESM: Erector spinae muscle; ESPB: Erector spinae plane block; IV: Intravenous; L-ESPB: Lumbar erector spinae plane block; MRI: Magnetic resonance imaging; NRS: Numeric rating sore; OOP: Out of the plane; TP: Transverse process

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Authors' contributions

AJ: concept, manuscript writing, review of literature, final draft. RKS: editing, review, intervention observation. SKS: editing, review, intervention, observation. All the authors have read and approved the final manuscript.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval consent to participate

Ethical approval was taken from ethical committee of Tata Motors Hospital, India on 5th of January 2021 (Reference no#: Anesth /03/01-21) and informed written consent to participate from the patients was taken.

Consent for publication

Written informed consent to present, discuss and publish the patients' medical information, management details and pictures was taken.

Competing interests

The authors declare that they have no competing interests.

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