CORRESPONDENCE

Mechanism of the erector spinae plane block: insights from a magnetic resonance imaging study

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To the Editor,

The erector spinae plane block (ESPB) has emerged as a valuable regional anesthesia technique for a range of

thoracic, abdominal, and other procedures. Early cadaveric injection and computerized tomographic scan imaging studies^{1,2} have suggested that the local anesthetic spreads

Figure Magnetic resonance imaging with gadolinium contrast added to bupivacaine erector spinae plane block (30 mL total volume) injected at the left T10 level. A) Sagittal view at the level of the intervertebral foraminae showing transforaminal spread of the gadolinium from T5 to T12 of the left side (yellow arrows). B) Sagittal view of the spinal canal depicting epidural spread (red arrows) of the contrast from T5 to T12. C) Axial view at the T12

level demonstrating the spread of gadolinium from the erector spinae plane through paravertebral space (dashed white arrow) transiting the intervertebral foramina (yellow arrow) to spread circumferentially (red arrows) within the epidural space. Some venous uptake of gadolinium is also noted. Modified, with permission, from the original unpublished image in the Philip Peng Educational Series collection (Toronto, ON, Canada)

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in a cephalocaudal direction within the fascial plane, deep to the erector spinae muscle in the paraspinal region and potentially spreads towards the paravertebral space through the inter-transverse soft tissue.³ How the anesthetic spreads to achieve somatic and visceral blockade is largely unclear.

We present magnetic resonance imaging (MRI) that provides additional anatomical information on the potential mechanism of the ESPB. A 38-yr-old female (who consented to this report) with post-surgical chronic visceral abdominal pain received an ultrasound-guided ESPB, which rendered her pain free. Four months later, the patient was still pain free but gave written consent to have an investigative contrast MRI following a repeat ESPB to allow the extent of local anesthetic spread to be evaluated.

For the ESPB, the needle was inserted at the left T10 level and 29.7 mL of 0.25% bupivacaine with 0.3 mL gadolinium ($1 \text{ mmol} \cdot \text{mL}^{-1}$) was injected. The MRI images were taken 45 and 90 min after injection to evaluate potential further spread over time. Diminished pinprick and cold sensation from T6 to T12 over the anterolateral aspect of left thoracoabdominal wall were documented after the ESPB. In addition to the spread of contrast deep to the erector spinae muscle (consistent with the ESPB's interfascial nature), the images showed paravertebral and circumferential epidural spread from T5 to T12 through the left T5 to T12 intervertebral foraminae (Figure). Some intercostal spread was also noted from T6 to T12 on the left side.

These images demonstrate that the visceral and somatic analgesic effects provided by the ESPB likely result from both transforaminal and epidural spread. This explains the visceral pathway blockade (at the foramen where the thoracolumbar splanchnic nerves enter) and the multiple spinal segmental blockade (occasionally bilateral) through the circumferential epidural spread. Although we only observed superficial intercostal muscle spread over several spinal levels, subsequent deep penetration to reach spinal nerves cannot be ruled out.

The ESPB is an interfascial plane block. These MRI images suggest that its mechanism of action is likely linked to the transforaminal and epidural spread, which

may be a potential advantage over other thoracic interfascial plane blocks such as pectoralis nerve (PECS) or serratus anterior plane block (where their analgesic effect is through the blockade of the intercostal nerves).^{4,5} When performed in the lower thoracic level, ESPB might also provide abdominal visceral analgesia as demonstrated in this case, which is an advantage over the transversus abdominis plane block. Although we did not find any discernable contralateral sensory blockade, this may be related to the waning dose of local anesthetic further away from the injection site. Further MRI studies with a larger sample size and a systematic approach to correlate clinical presentation and spread of contrast are required to better elucidate the more detailed anatomical mechanisms of the ESPB.

Conflicts of interest None declared.

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