

Global Infections 2019: Influence of injectate volume on paravertebral spread in erector spinae plane block: An endoscopic and anatomical evaluation - You-Jin Choi - Yonsei University College of Medicine

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The paravertebral spread that happens after erector spinae plane block may be volume-dependent. This cadaveric study was undertaken to compare the extent of paravertebral spread in erector spinae plane block using different types of dye volumes. After randomization, fourteen erector spinae plane blocks were performed bilaterally with either 10 ml or 30 ml dye at the level of T5 in seven un-embalmed cadavers. Direct visualization of paravertebral space by endoscopy was done immediately after injections. The back regions were also dissected and dye spread and nerve involvements were investigated. A total of five 10 ml injections and seven 30 ml injections were completed for both endoscopic and anatomical analysis. No paravertebral spread was observed by endoscopy after any of the 10 ml injections. Dye spread to spinal nerves at intervertebral foramen was identified by endoscopy at adjacent levels of T5 (median: three levels) in all 30 ml injections. Upon anatomical dissection, all blocks were consistently joined with posterior and lateral spread to back muscles and fascial layers, especially in 30 ml injections, which showed greater dye expansion. In one 30 ml injection, sympathetic nerve involvement and epidural spread was observed at injection site level. Although paravertebral spread following erector spinae plane block increased in a volume-dependent manner, this increase was variable and not pronounced. As injectate volume increased for erector spinae plane block, injectate spread to the back muscles and fascial layers seemed to be more predominantly increased, rather than the extent of paravertebral spread.

Conventional thoracic paravertebral block is a well-developed technique for analgesia of the thoracic wall in various clinical settings, including thoracic surgery, breast surgery, rib fractures, and chronic neuropathic pain. However, there is a potential risk of pneumothorax or unintentional neuraxial injection. Recently, an erector spinae plane (ESP) block with the use of a more superficial needle placement than that used in the conventional method was introduced and is gaining popularity. The ESP block targets the fascial plane deep to the erector spinae muscles at the tip of the transverse processes. Therefore, this technique is less probable to approach the pleura and incur attendant risks than the conventional method.

The Institutional Review Board approved the study for exemption from formal review. All cadavers used in the present study were legally donated to the Surgical Anatomy Education Centre at our institution. Twelve ESP blocks were arranged on the right and left sides of the posterior thoracic region in seven

unembalmed cadavers except for two cases of unexpected pleural puncture using the 10 ml injection. Each cadaver underwent one ESP block with 10 ml of dye and one with 30 ml of dye, and the choice of which side was used for which volume was made randomly.

The anatomical dissection, most of the dye was located in the fascial layer of the erector spinae muscle group and external intercostal muscles in both ESP blocks (10 ml and 30 ml). In the 30 ml ESP blocks, we observed dye spread to posterior fascial layers of the erector spinae muscles in the craniocaudal direction, but dye spread was barely observed in the retro laminar plane medially and vertically. Above all, lateral spread to the posterior layer of the thoracolumbar fascia and external intercostal muscles was predominantly observed when a larger extent of dye spread occurred using 30 ml of dye (Fig 3A). No dye penetrated the external intercostal muscles; therefore, no dye was noticed in the space between the internal and innermost intercostal muscles, and no intercostal nerve involvement was observed regardless of the volume of dye used. The number of stained thoracic spinal nerves in the intervertebral foramen was exactly the same with the endoscopic evaluation and the anatomical dissection. There was no clear intersegmental dye spread between corresponding vertebral levels within the paravertebral space in all blocks. In one 30 ml ESP block, sympathetic nerve involvement and epidural spread was observed, but they were limited to the T5 injection site level.

In conclusion, ESP blocks with a low volume of injectate, such as 10 ml, do not result in paravertebral spread. Although paravertebral spread following ESP block volume-dependently increased in this study, injectate spread to the back muscles and fascial layers seemed to be more predominantly increased compared with the extent of paravertebral spread. These findings should be verified by calculating the extent of sensory blocks and the actual analgesic effects following ESP blocks with different injectate volumes in living subjects.