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High variability of in-depth injective spread in the erector spinae plane block: a cadaveric anatomical insight

Erector spinae plane (ESP) block is an interfascial block consisting of an injection of the local anesthetic in a plane between erector spinae muscles and the tip of the vertebral transverse process.[1] The local anesthetic spreads along the fascial plane diffusing anteriorly and laterally at several levels. The block provides analgesia in a wide range of clinical scenarios, although sometimes resulting in inadequate effect.[2]

The aim of this pilot study was to evaluate the anatomical extent of the ESP block, both in two-dimensional spatial terms and in the symmetry between the sides of the chest. All the procedures performed in this study involved human bodies from the Veneto Region Reference Center for the Preservation and Use of Gifted Bodies (DGR Veneto Region N. 245, March 8, 2019; N. 389897), in accordance with the national laws, and the ethical standards of the regional/national research committees, as well as with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was provided to join the Body Donation Program.

One fresh frozen corpse within the Body Donation Program of the Institute of Anatomy – University of Padua was used.

The bilateral ESP block procedure was performed on the body in a prone position by ultrasound-guidance at the T5 level, according to Forero *et al*.[1] A total of 20 mL of black tissue marking dye solution was injected on both sides while observing for the spread of dye in the anatomical plane between the erector spinae and the transverse processes. The gross anatomical dissection was performed 20 minutes after, by using a midline incision over the spinous processes from above C7 to the lower lumbar vertebrae. The skin, superficial, and underlining erector spinae muscles were removed at their attachments. The deepest muscles of the posterior wall (*i.e.* multifidus thoracis, rotatores thoracis breves and longi, levatores costarum breves and longi, thoracic intertrasversarii) were recognized and detached. At this stage, the extent of dye spread was evaluated both in craniocaudal and in the mediolateral direction. The dye spread ranged from T3 to T11 vertebral level for a maximum of 10 cm (median 7 cm) laterally on the right, and from T2 to T8 vertebral level for a maximum of 13 cm (median 10 cm) laterally on the left (Figure 1). A significant defect of symmetry was noted between the two sides of the chest.

In literature, an extensive craniocaudal spread of dye involving the erector spinae muscles group was reported, sometimes with dye crossed over to the contralateral side of the spine,[3] although a marked asymmetry in the diffusion of the dye between the two sides of the chest has never been underlined.[4, 5] The present paper underscored the high spatial variability of dye distribution (*i.e.* anesthetic solution in clinical practice) over the posterior thoracic wall, which could explain the poor reproducibility of ESP plane block observed into the daily clinical practice, even concerning both sides of the same patient treated by one anesthesiologist.

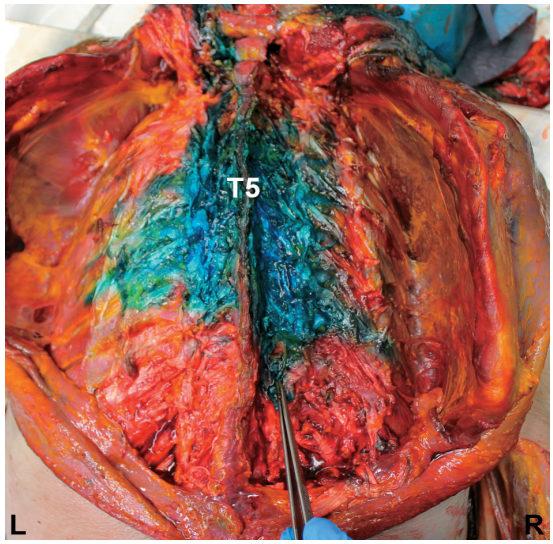

Figure 1.—Gross anatomical dissection.
By gross anatomical dissection, the superficial muscles (*i.e.* trapezius, latissimus dorsi, and rhomboids), the underlying erector spinae muscles enveloped by the thoracolumbar fascia (*i.e.* iliocostalis, longissimus and spinalis) and the deepest muscles of the posterior wall (*i.e.* multifidus thoracis, rotatores thoracis breves and longi, levatores costarum breves and longi, thoracic intertrasversarii) were removed to allow the evaluation of the extent of dye spread both in craniocaudal and in the mediolateral direction.
R: right side; L: left side; T5: T5 vertebral level (corresponding to the level of the ESP block procedure).

However, some limitations are present. Firstly, the current report reflects a single anecdotal trial, although suggestive. Secondly, considering the spread of dye to estimate the local anesthetic diffusion is only an unproven approximation of clinical reality. Thirdly, the black tissue marking dye used for the injection in our cadaveric model may theoretically diffuse differently from the anesthetics.

However, the present findings open up exciting perspectives for explaining the clinical variability of the ESP block.

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References

1. Forero M, Adhikary SD, Lopez H, Tsui C, Chin KJ. The Erector Spinae Plane Block: A Novel Analgesic Technique in Thoracic Neuropathic Pain. Reg Anesth Pain Med 2016;41:621–7.

2. De Cassai A, Bonvicini D, Correale C, Sandei L, Tulgar S, Tonetti T. Erector spinae plane block: a systematic qualitative review. Minerva Anestesiol 2019;85:308–19.

3. Dautzenberg KH, Zegers MJ, Bleeker CP, Tan EC, Vissers KC, van Geffen GJ, *et al.* Unpredictable Injectate Spread of the Erector Spinae Plane Block in Human Cadavers. Anesth Analg 2019;129:e163–6.

4. Aponte A, Sala-Blanch X, Prats-Galino A, Masdeu J, Moreno LA, Sermeus LA. Anatomical evaluation of the extent of spread in the erector spinae plane block: a cadaveric study. Can J Anaesth 2019;66:886–93.

5. Elsharkawy H, Bajracharya GR, El-Boghdadly K, Drake RL, Mariano ER. Comparing two posterior quadratus lumborum block approaches with low thoracic erector spinae plane block: an anatomic study. Reg Anesth Pain Med 2019;44:549–55.

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Above cuff vocalization (ACV): an additional benefit of subglottic suction tracheostomy tubes

I read with interest the report from Terrangni *et al.*[1] describing a significant reduction in the observed ventilator-associated pneumonia rates in a group of ICU patients managed with subglottic suction tracheotomy tubes when compared with propensity-matched controls. Whilst these data support the widespread adoption of tracheostomy tubes with subglottic suction ports, there are additional benefits worthy of discussion.

These tubes are designed primarily for secretion management, but the instructions for use of most major manufacturers' products state that these tubes can be used for above cuff vocalization (or ACV). This technique was first described in the 1970s and involves delivery of a retrograde flow of gas *via* the subglottic suction port which exits above the cuff (Figure 1).[2] This technique can be safely used 72 hours after tracheostomy insertion and provides a method for vocalization and communication in around 80% of patients for whom cuff deflation cannot be achieved.[3, 4] There appear to be additional benefits to restoring laryngeal function, with earlier and more effective coughing and swallowing, which may further reduce the incidence of ventilator-associated pneumonia as part of optimal multidisciplinary care.[5] An example of the technique can be seen at the UK National Tracheostomy Safety Project website.[6] The technique can only be used when the upper airway is patent and is limited by the need for constant attention from a qualified healthcare worker, as the system has no pressure controls or alarms. The delivery of cold, non-humidified gas may affect laryngeal function, but we observed no ill effects when limiting use to 15 minutes at a time.[3, 4]

I congratulate Terrangni *et al.* on clearly demonstrating benefit from the use of subglottic suction tracheos-