This article has been accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination, and proofreading processes, which may lead to differences between this version and the version of record.

Please cite this article as https://doi.org/10.4097/kja.21457
The novel continuous bilateral Parascapular Sub-Ilicostalis Plane (PSIP) block for thoracic spine surgery

Carlos Rodrigues Almeida¹, Lígia D. G. D. S. Vieira²*, Emília M. Francisco³, Pedro M. F. Antunes⁴

¹, ², ³, ⁴ - Department of Anesthesiology, Tondela – Viseu Hospital Centre, Portugal

Running head: The bilateral Parascapular Sub-Ilicostalis Plane block

*Address correspondence to:
Lígia Denise Gonçalves de Sá Vieira; Address: Centro Hospitalar Tondela Viseu; Serviço Anestesiologia; Avenida Rei D. Duarte; Portugal
Telephone: +351925472061; Email: ligiadenise@hotmail.com

The authors declare no conflict of interest.
There is no funding.
The novel continuous bilateral parascapular sub-iliocostalis plane (PSIP) block for thoracic spine surgery

In major thoracic spine surgery available regional anesthetic techniques may impinge with the surgical site [1,2] and interfere with post-operative neurological evaluation [1,2]. With this case report we aim to propose the use of the continuous bilateral Parascapular Sub-iliocostalis Plane (PSIP) block - that has been recently described for posterior rib fractures [3] - for thoracic spine surgery, due to its safer profile [4]. The patient authorized the publication of this case report with anonymized details. The procedure was conducted in accordance with the Helsinki Declaration-2013.

A 25 year-old man, without past medical history, presented thoracic vertebrae fractures (spinous processes and laminae of T5 and T6) caused by a motorcycle crash. He was 179 cm tall and his weight was 73 kg. He was proposed for a percutaneous transpedicular fixation of the thoracic spine (from T4 to T7) in prone position, under general anesthesia. The intraoperative period went uneventfully. To control his expected postoperative pain, it was administered multimodal intravenous analgesia (paracetamol 1000 mg, metamizole 1000 mg, parecoxib 40 mg, tramadol 150 mg and morphine 6 mg were given intravenously [IV]) 30 to 45 min before emergence. Nevertheless, in the post-anesthetic care unit (PACU) his pain was severe (9/10 on the Numeric Pain Rating Scale [NPRS]) despite the administration of rescue analgesia (boluses of morphine IV in the PACU: total 10 mg). In this context, PSIP blocks were performed in contralateral decubitus. A high frequency linear ultrasound probe (Acuson P300; Siemens, Germany) was placed in a parasagittal plane orientation to 2 cm from the medial scapular border at the level of the edge of the scapular spine (fourth rib level) under sterile conditions. From the superficial to deep muscular layers the trapezius, rhomboid major, iliocostalis, and intercostal muscles were visualized (Fig. 1). A sonovisible
100 mm 18 G needle (SonoLong Echo NanoLine®; Pajunk®, Geisingen, Germany) was inserted with a caudal to cranial orientation using an in-plane technique and advanced in the iliocostal-intercostal plane in the vicinity of the fourth rib. The needle location was confirmed with a 2 ml saline solution, after which 25 ml of 0.375% ropivacaine (Kabi-Fresenius, Santiago de Besteiros, Portugal) were administered. A catheter was then inserted 6 cm beyond the needle tip and tunneled under the skin. Fifteen minutes after local anesthetic (LA) administration, pain was 2/10 on the NPRS. The techniques were performed laterally to surgical dressing/drapes. After the blocks, the patient did not mention any sensory or motor changes. The analgesic protocol consisted of 0.2% ropivacaine (20 ml boluses) given through each PSIP catheter every 6 hours; and paracetamol 1 g every 8 hours, metamizole 1 g every 12 hours and parecoxib 40 mg every 12 hours, tramadol 100mg IV every 8 hours and morphine 3 mg every 6 hours in rescue (all drugs were prescribed IV). The patient was discharged to an intermediate care unit. During his stay, the patient maintained significant pain control (NPRS was between 1 and 2 at rest and 1 and 3 at motion) without needing rescue analgesia. He did not report thermal changes or any other sensitive alterations. The patient did not require supplemental analgesia. Patient managed to start ambulation in the next day. During this period, no complications related to the PSIP block were reported. After three days, the patient was transferred to the ward and systemic analgesia was maintained. The PSIP catheters were then removed leading to an increase in the NPRS to 4/10 at motion and 3/10 at rest in the following days.

The posterior components of the vertebrae, namely laminae, pedicles are, in large extent, innervated by the branches of the posterior rami of the spinal nerves [1,2,5]. A safe regional analgesia depends on the ability to block those branches minimizing the impact on the ventral rami of the spinal nerves [5]. To date, the techniques for thoracic
spine surgery most usually implemented are epidural analgesia or intrathecal morphine but they may be associated to significant adverse effects [1]. In the last decade, retrolaminar, erector spinae plane (ESP) blocks or different types of paraspinal intrafascial blocks have been described for lumbar spine surgery [3]. Theoretically, at thoracic level, ESP block may provide good analgesic quality, but they may also cause several undesirable effects at this level, particularly in bilateral techniques, such as central sympathetic blockade, weakness of the chest wall, and risk of fall during ambulation, because thoracic ESP block may spread easily toward the paravertebral space (PVS), through the costotransverse foramina [5]. Notably, a frequent concern, in laminectomy surgery or trauma patients, is the violation of the epidural space; the potential spread of large volumes of anesthetics into the PVS and epidural space makes that the risk may outweigh the benefit for the ESP block in thoracic spine surgery [2]. The thoracolumbar interfascial plane block, or paraspinal intrafascial plane blocks, have been only described for lumbar spine surgery, to our best knowledge, may be safer than the ESP block as their primary target is specific to the dorsal spinal ramus and its branches but again, are still performed in the close vicinity of the retrolaminar plane adjacent to the surgical site [2].

In the PSIP block, the LA will spread mostly medially because the costal insertions of the ilio-costalis muscle (ILCM) will limit the lateral dispersion of the LA, as they are often a barrier for the dispersion of rhomboid intercostal block [4]. We propose the use of bilateral PSIP block for patients with thoracic vertebrae fractures or thoracic spine surgery because: there is no conflict with the surgical site, the risk of involving the anterior rami of the spinal nerves is lowered dramatically leading to less motor or sensitive block, the risk of masking epidural hematoma symptoms is lowered; it produces less sympathetic block or other epidural-like effects, or thoracic wall weakness than other regional analgesia techniques; and
due to its safer profile it allows rapid ambulation reducing the risk of fall comparing to the thoracic ESP block [3]; however, anatomical studies are needed to prove its applicability and advantages.

References

Figure 1A: Description of the Parascapular Sub-iliocostalis Plane (PSIP) block. With the patient in
a left lateral decubitus, a high-frequency linear ultrasound probe was placed with a parasagittal
orientation, 2 cms from the medial scapular border at the level of the edge of the scapular spine
(fourth rib level). Ultrasound depth was 3 cms. The PSIP block relies on the identification of the
lateral border of the iliocostalis muscle (ILCM), to avoid confusion with other muscles, as
longissimus or rhomboid muscles or posterior-superior serratus muscle, the injection done medial to
this border. The tendinous insertion of the ILCM at the rib is in the superolateral direction (it should
not be confounded with the insertion of the levatitore costarum muscles whose insertion is in the
inferior-lateral direction). We chose to perform the PSIP block at T4 level to benefit from the
gravity effect during the sitting position or ambulation. No significant spread was seen laterally to
the lateral border of the ILCM.
Abbreviations: TM: trapezius muscle; RMM: rhomboid major muscle; ILCM: iliocostalis muscle; LA, local anesthetic.

**Figure 1B:** A schematic representation of the relevant anatomy for the performance of the PSIP block. The injection is done superficially to rib in the sub-iliocostalis plane. At upper levels, the Serratus Posterior-superior muscle may be observed below the Rhomboid Major or Rhomboid Minor muscles. Of note, at thoracic level, the iliocostalis dorsi muscle does not have any insertion at the vertebrae in opposition to the longissimus dorsi or spinalis dorsi muscles.

**Figure 1C:** Post-operative X-ray showing a transpedicular T4 to T7 transpedicular spine fixation.