

## In Response

### DEAR EDITOR:

We thank Dr. Nielsen and colleagues for their interest and acknowledge their valuable contribution to our article (1). The paravertebral block (PVB) by proxy has been the hot topic since the erector spinae plane block (ESPB) was reported (2). Many investigators have been enthused about the mechanism of action of the ESPB and have developed novel techniques as paravertebral block by proxy (1,3-5). In fact, the costotransverse foramen block (CTFB) has been discovered by our group since the end of 2016 and presented at the international cadaveric workup in Thailand in February 2018. Unfortunately, the submission process was initiated in early 2019 and we were not aware of the multiple-injection costotransverse block (MICB) (4) or the subtransverse process interligamentary (STIL) plane block (5), which were introduced during similar time frames. Therefore, we would like to express our sincere apology and clarify some issues that Dr. Nielsen et al. concerned regarding our study.

Although contrary to the findings in cadavers studies, cutaneous sensory loss of the anterior chest wall was demonstrated in the clinical cases in our study (1), which may support the possible mechanism of the ESPB in which the spread may involve the lateral cutaneous branches of the intercostal nerves. However, we believed further clinical studies with more patients are still required since our study involved only 2 clinical cases and there might have been an additional analgesic effect of intraoperative opioid administration contributing to low rest pain scores on the ESPB side.

Dr. Nielsen concerned that the neurovascular injury of the CTFB seems to be high. However, we argued that the risk should be minimized, as demonstrated in the 2 clinical cases, with the caudad to cranial needle trajectory, although clinical studies with larger sample size are required to confirm its safety. On the other hand, in our opinion, the needle trajectory from cranial to caudad should increase the neurovascular injury more.

Regarding some unclear anatomical terms in our article (1), in the method section, we first explored the boundary of the CTF on the one side of the back of a cadaver and then performed an ultrasound-guided needle injection to the CTF on "another side" of the back to assure the needle pathway. The back muscle

refers to the deep muscle groups on the back that are involved in the needle passage that include the external intercostal muscle, levatores costarum, and transversospinalis group.

We were very surprised that Dr. Nielsen and colleagues found that the ultrasound images in the Fig. 3D and 3F contain obscured anatomical landmarks. On the contrary, the target of the CTFB is clearly shown to be located at the inferior aspect of the base of the transverse process (TP) and the neck of rib, that is not articulated with the TP, can be seen as a step-down of hyperechoic line anterosuperiorly to the base of TP in the ultrasound image. Moreover, the superior part of the ribs, or the tubercle of the rib, is visualized as a step-down continuous hyperechoic line anterosuperiorly to the level of the tip of the TP. We believed that with accompanied illustrations of the thoracic spines (Fig. 3A-C) and a description of the CTFB as a detailed, step-by-step guide, would allow anesthesiologists to perform the CTFB with ease.

Anatomical localization of the paravertebral structures is sometimes difficult due to their great complexity and diversity as well as different dissection techniques. The view of the superior costotransverse ligament (SCTL) shown in the Fig. 1A-C is partially obstructed since it was retracted and overlapped by the lavatory costarum muscle. The image of the lateral or oblique view with greater magnification is required for better visualization of the SCTL. However, the posterior view images were instead presented because it represents better anatomical relationship with regard to the boundary of the CTF. We depicted the intervertebral foramen in the Fig. 5C, although it is not visible in the posterior view, for better understanding of anatomical relationship with other landmarks, all of which are invisible when the intervertebral foramen is seen from the lateral.

Dr. Nielsen and colleagues has proposed the term of intertransverse tissue complex (ITTC) (6) and observed a similarity and redundancy of various techniques targeting the ITTC (3,5). We respectfully disagree with Dr. Nielsen since the ITTC is a space comprising of many anatomical structures rather than a single exact anatomical location. Using a loose anatomical term to describe the target block site may cause fallacies and even more confusions among anesthesiologist to replicate

the blocks (6). Since each individual block targeting the ITTC has its own unique landmark and needle approach, we believe the CTFB should also be considered a new or alternative technique of paravertebral blocks (7). In addition, although the spread may occur through the CTF with the MTP block or MICB, the CTFB may have more advantages since the needle tip is located closer to the CTF and the paravertebral spread can be observed in real time on ultrasound image, which may result in less local anesthetic requirement and toxicity (if present).

Finally, we agree with Dr. Nielsen and colleagues that not only accurate understanding of the anatomy and appraisal of previous peer-reviewed literatures, but agreement on standardized anatomical nomenclature, decreasing the knowledge gap between the sono-

anatomy and real anatomy, as well as comparing clinical studies with conventional technique are also critical to determine the value and effectiveness of “novel” ultrasound-guided anesthetic techniques.

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