Practical tips for placement of transversus abdominis plane catheter using oblique subcostal approach

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Distribution of the sensory block produced by a lateral transversus abdominis plane (TAP) block is narrow and scattered, and not consistent with a dermatomal pattern. Shortcomings of the procedure prevent a widespread sensory block provided by the TAP blocks. The anterior branches of the spinal nerves run immediately superficial to the transversus abdominis muscle, forming a plexus. Hence, if local anesthetics are not delivered under the fascia between either the internal oblique or the rectus abdominis muscles and the transversus abdominis muscle, they may only affect the nerves penetrating the fascial layer, resulting in a scattered distribution of blockade. A plexus of nerves with extensive communication within the TAP may also explain the non-dermatomal sensory block spread by the TAP blocks. Furthermore, Børglum et al. hypothesized that local anesthetics infused into the TAP, medial and lateral to the linea semilunaris, did not communicate with each other. Moreover, with the injection of local anesthetics into the TAP beneath the aponeurosis of the linea semilunaris, we sensed a higher opening pressure compared with hydrodissection of the other parts of the TAP. We believe that an oblique subcostal approach originally reported by Hebbard et al. can address these issues. With the oblique subcostal approach, local anesthetics are first injected into the TAP near the xiphoid process, where the TAP is determined between the rectus abdominis and transversus abdominis muscles. Further, the needle is advanced along the line connecting the xiphoid process and the anterior border of the iliac crest (i.e., the oblique subcostal line), beyond the aponeurosis of the linea semilunaris, while hyrdodissecting the TAP with incremental injections of local anesthetics. The oblique subcostal line crosses the tracks of the spinal nerves derived from T7 to L1 roots. Using a 15–20 cm long needle and 30–50 ml of the local anesthetics enables hydrodissecting the unilateral TAP along the entire oblique subcostal line, avoiding re-insertion of the needle.

We have introduced several tips to improve the procedure for placing of TAP catheters using the oblique subcostal approach for providing analgesia after a laparotomy. First, we aim to provide the widest possible spread of sensory block by single-injection oblique subcostal TAP blocks, using a 15-cm-long Tuohy needle (Disposable Epidural Needle 17 gauge 150 mm; Hakko, Nagano, Japan), before catheter placement because the sensory block spread produced by continuous TAP blocks is essentially narrow. The possible mis-puncture of the superior epigastric artery, situated between the rectus abdominis muscle and the posterior layer of the rectus...
sheath, should be avoided during passage of the needle through the rectus abdominis muscle into the TAP. Second, we use the oblique subcostal approach to facilitate inserting a catheter within the TAP, in a straight-line, crossing the spinal nerves (Fig. 1). If a catheter is threaded into the hydrodissected TAP beyond the needle tip over a long distance, there would be a risk of catheter kinking and knotting within the TAP, which might induce difficulty of the catheter removal. Therefore, after the tip of the Tuohy needle reaches the TAP near the iliac crest while hydrodissecting the TAP, a catheter is threaded into the TAP through the needle, placing the catheter tip ~1 cm beyond the needle tip. Then, the needle is removed, leaving the catheter in situ (Video 1). We have used a point-source epidural catheter, which has a closed tip and three lateral holes located within 1.7 cm from the tip (Perifix Softtip Catheter; B. Braun AG, Melsungen, Germany), for a continuous TAP block. We speculate that the hydrodissection of the TAP before catheter placement and the catheter passage across the spinal nerves may contribute to a wider spread of sensory block, by providing a track for the local anesthetics along the catheter, even with a point-source catheter, although this hypothesis should be validated in future. Recently, we attempted the placement of a multi-hole catheter with a closed tip and eight lateral holes (2-cm apart) within 15 cm from the tip (Pain Clinic Set 17HR95-08h150, Hakko; Fig. 2A), within the TAP using the above-mentioned technique in a cadaver. We observed the distribution of 25-ml of water soluble dye injected through this catheter within the TAP along the entire oblique subcostal line (Fig. 2B, This figure is reprinted from “3D Anatomy project in Okayama 2017” with the permission of 3D Anatomy project of Okayama University). This result warrants future studies to assess the clinical effectiveness of an intermittent bolus TAP block using a catheter with more extensive holes to achieve a wider spread of sensory block.

Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.aja.2017.06.003.

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References