Cadaveric investigation about the spread of thoracoabdominal nerve block through a perichondral approach and modified approach

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DECLARATIONS

Ethics approval and consent to participate

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Competing interests

The authors declare that they have no competing interests.

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- Letter to the Editor -

Interfascial plane blocks and nomenclature about them is very popular issue nowadays. Novel plane blocks have been described and the cadaveric studies about spread of the block is important to determine the difference of the novel applications [1]. Recently, Tulgar et al defined thoracoabdominal nerve block through a perichondral approach (TAPA) block. They reported that local anesthetic (LA) performed upper and lower aspect of 9th-10th costal cartilages would blockage both the anterior and lateral cutaneous branches, thus provide abdominal analgesia [2]. Following the description of TAPA, authors redefined the approach and named the new one as modified TAPA (M-TAPA). They reported that administrating LA only lower surface of the costal cartilage would provide successful analgesia as well as TAPA [3]. In the literature, there are some case reports and observational studies about TAPA and M-TAPA, however, to the best of our knowledge, there is no reliable cadaveric investigation that shows the spread of blocks. Herein, in this cadaveric investigation, we aimed to evaluate dye spread of both TAPA and M-TAPA. This study has been approved by the Istanbul Medipol University Ethics and Research Committee (Decision no. 36, 06.01.2022).

One fresh human male cadaver was obtained by the Istanbul Medipol University. Injections were performed by two investigators experienced in regional anesthesia. In supine position, M-TAPA was performed on the right side, TAPA was performed on the left side. The blocks were performed bilaterally under US-guidance with a linear transducer. The transducer was placed on the costochondral angle in the sagittal view, then moved deeply to see the lower sight of the chondrium. For TAPA block 20 ml of 0.25% methylene blue dye was injected both upper and lower side of the
chondrium (totally 40 ml). For M-TAPA 40 ml of 0.25% methylene blue dye was injected to the lower side of the chondrium.

Anatomic dissections were performed 30 minutes after the procedure. For both TAPA and M-TAPA; there was dye spread over the lower surface of the upper part of the rectus abdominis. There was dye spread over the thoracoabdominal nerve in both TAPA and M-TAPA sides. It was observed that the lower surface of external oblique muscle (OEAM) was stained by dye completely (over the 8, 9, and 10th ribs). Upper and lower surfaces of internal oblique muscle (OIAM) were stained. There was dye spread on the upper surface of the costal margin. There was dye spread from T4 to T11-12 on both sides. Different from TAPA block, there was dye spread over transverse abdominis (TAM) in M-TAPA block area. The dye spread on the TAM was lesser in TAPA block than M-TAPA (limited to the upper part of the muscle) (Figure 1A,1B).

Thoracoabdominal nerves are actually thoracic spinal nerves and have ventral and dorsal branches. The sensorial and muscular innervation of the abdomen is performed by the anterior primary rami of the T7-T12. The anterior primary rami of the T7-T11 exit from intercostal areas and entry into the plane between the OIAM and TAM (transverse abdominis plane-TAP). Intercostal nerves pass just under the costal cartilage and take their place in the TAP in the abdominal region [2-4]. T10-12 enters the TAP at the mid-axillary line; which is why more posterior block applications may fail. The 6th and 9th nerves enter the TAP at the level of the anterior axillary line, which is the reason for failure of the lateral and posterior TAP block in the upper abdomen [4]. The TAM inserts to the inner side of the costal margin, OIAM inserts to lower sides of costal cartilages of lover 4 ribs, and OEAM inserts to the anterior sides of the 5th-12th ribs. Therefore, injecting local anesthetic on the point where these three muscles insert, would provide abdominal analgesia by blocking thoracoabdominal nerves [2-4]. Aikawa et al. performed M-TAPA and evaluated the sensory loss in patients underwent gynecological surgery [5]. In this study, the authors reported that the M-TAPA
provided limited dermatomal coverage and anterior sensorial loss was superior to lateral. In contrast to the clinical results of the study by Aikawa et al, there was dye spread between T4-T11/12 in our cadaveric study. They used 25 ml volume of local anesthetic, we used 40 ml of dye.

As a conclusion, the success of plane blocks may be affected by multiple factors. It may be better to perform high volume M-TAPA because fascial plane blocks are volume related blocks. Based on our results, both TAPA and M-TAPA may provide analgesia after different abdominal procedure. Different from TAPA, M-TAPA may be more effective since its spread over TAM is larger than TAPA. Since the thoracoabdominal nerves enter subcutaneous area in the anterior abdominal wall as anterior and lateral cutaneous branches of the skin, TAPA blocks may be a good alternative for abdominal analgesia due to its spread region. In the literature, we see the successful analgesia by TAPA for several and different surgical procedures [2,3,5]. In this point, there may be limitations related to volume. Therefore, further cadaveric and clinical studies are needed to understand exact effects of M-TAPA block.
References


**Figure 1A.** Dissection of the M-TAPA block. OEAM; external oblique muscle, OIAM; internal oblique muscle, TAM; transverse abdominis muscle. The yellow line shows the thoracoabdominal nerves region between OIAM and TAM.

**Figure 1B.** Dissection of the TAPA block. OEAM; external oblique muscle, OIAM; internal oblique muscle, TAM; transverse abdominis muscle. The yellow line shows the thoracoabdominal nerves region between OIAM and TAM.

**Figure 1C.** The yellow arrows show the thoracoabdominal nerves that spread by dye.