Evaluation of Sensory Loss Obtained by Modified-Thoracoabdominal Nerves Block Through Perichondrial Approach in Patients Undergoing Gynecological Laparoscopic Surgery: A Prospective Observational Study

Katsuhiro Aikawa, MD, PhD,† Isao Yokota, PhD, MPH.,‡ Yosuke Maeda, MD,† and Yuji Morimoto, MD, PhD†

From the

†Department of Anesthesiology and Critical Care Medicine, Faculty of Medicine and Graduate School of Medicine, Sapporo, Japan

‡Department of Biostatistics, Faculty of Medicine and Graduate School of Medicine, Sapporo, Japan

Address correspondence to:

Katsuhiro Aikawa, MD, PhD**,** Department of Anesthesiology and Critical Care Medicine, Faculty of Medicine and Graduate School of Medicine, Hokkaido University, Kita-15, Nishi-7, Kita-ku, Sapporo 060-8638, Japan

Phone/Fax: +81-11-706-7861 (Email: katsuhiro.aikawa@med.hokudai.ac.jp)

ORCID iD

Katsuhiro Aikawa http://orcid.org/0000-0003-0871-3956

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Abbreviations

M-TAPA: modified-thoracoabdominal nerves block through perichondrial approach

ASA: American Society of Anesthesiologists

IQR: interquartile range

LA: local anesthetic

TAP: transversus abdominis plane

TAPB: transversus abdominis plane block

INTRODUCTION

Recently, Tulgar et al. reported modified-thoracoabdominal nerves block through perichondrial approach (M-TAPA).[1] However, studies showing the area blocked by M-TAPA are lacking.

METHODS

In this prospective observational study, 30 patients undergoing gynecological laparoscopic surgery were recruited after obtaining ethical approval and written informed consent. Exclusion criteria were: ASA ≥3, age <20 or >70 years, pregnancy, local anesthetics allergy, weight <45 kg, body mass index >35 kg/m^2, history of thoracotomy or laparotomy except for lower abdominal laparoscopic surgery, communication disorders, neuropathy, or operation time of >6 hours.

M-TAPA technique

M-TAPA was performed bilaterally by a single anesthesiologist (KA) after general anesthesia induction (see Figure 1A–D). The needle tip was repositioned if intramuscular spread was observed.

Sensory level assessment

An investigator (KA or YM) assessed sensory levels T4–L1 using a pinprick test 2 hours postoperatively. The anterior and lateral cutaneous branches were evaluated at a vertical line 3–5 cm from the midline and midaxillary lines, respectively. A vertical force (1 newton) was visualized using a tension gauge. A 3-point numerical scale (0 = no pain, 1 = decreased pain, 2 = normal pain) was used: values of 0 or 1 were defined as effective. Normal sensation on the

shoulder was used for comparison.

RESULTS

The median (IQR) highest sensory level was T7 (T5–8) in the anterior and T9 (T7–10) in the lateral area. Sensory loss was not observed in the lateral area in five patients. The median (IQR) number of blocked dermatomes was 5 (7–4) in the anterior and 4 (5–2) in the lateral area (Figure 2).

DISCUSSION

This study evaluated the sensory levels of anterolateral thoracoabdominal wall after performing M-TAPA using 25 mL of 0.25% ropivacaine and demonstrated its inconsistency. Because 10th costal cartilage usually contacts the transversus abdominis muscle, the injected local anesthetic (LA) spreads along the transversus abdominis plane (TAP). However, our results indicated that the LA pathway differed between TAP block (TAPB) and M-TAPA. Borglum et al.[2] reported that LA injected to the TAP does not overcome the linea semilunaris. The anterior abdominal wall is innervated by the upper (T6–9) and lower TAP plexus (T10–12) divided by the linea semilunaris; therefore, the hydrodissection technique[3] or dual TAPB[4] is required to simultaneously anesthetize both areas. Considering the LA was injected outside the linea semilunaris, and most patients had some sensory loss in the lateral area, the LA might spread laterocranially, resulting in a sensory block. Zinboonyahgoon et al.[5] reported that a single LA injection to the endothoracic fascial plane, positioned immediately beneath the ribs, could achieve multi-level intercostal nerve block. Thus, that compartment could be the responsible pathway of M-TAPA. LA spread of fascial plane blocks is influenced by multiple factors.[6] Therefore, the features of the individual fascia allowing cranial and lateral spread may affect the sensory area. The lower rate of dermatomal coverage of the T12 and L1 in the anterior area may be because of cranial needle direction.

This study has several limitations. Sensory areas were assessed postoperatively, and a previous

study demonstrated sensory ranges regressing over time.[4] Hence, our results may be less than the maximum height and range. Furthermore, we cannot deny the existence of performance bias and the potential residual effect of opioids. Because of several incisions and dressings, we could not evaluate the blocked area as a plane, but only on the representative longitudinal lines.

CONCLUSION

The area blocked by M-TAPA varies and provides limited dermatomal coverage than previously reported. Anterior sensory coverage was marginally better than lateral coverage. Future studies should investigate the corresponding fascial plane, and perioperative analgesic efficiency of M-TAPA.

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LEGENDS for figures

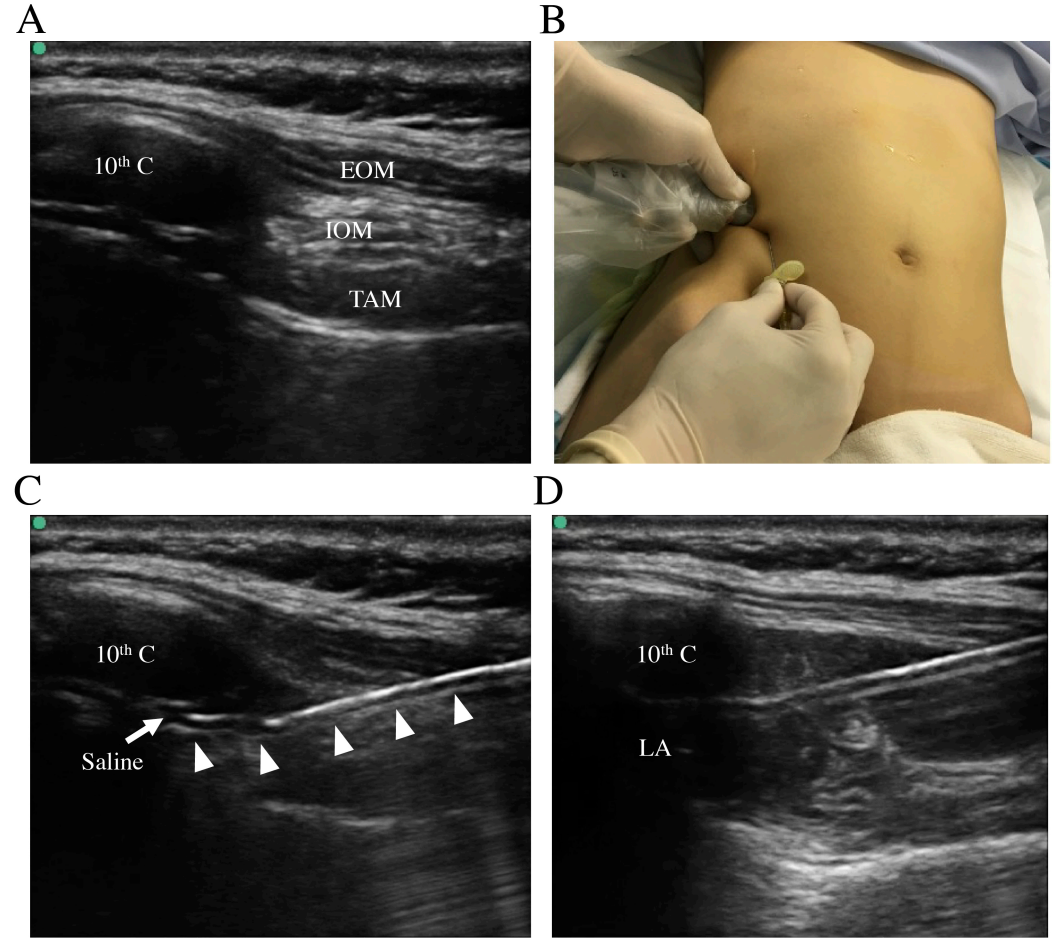
Figure 1: M-TAPA technique

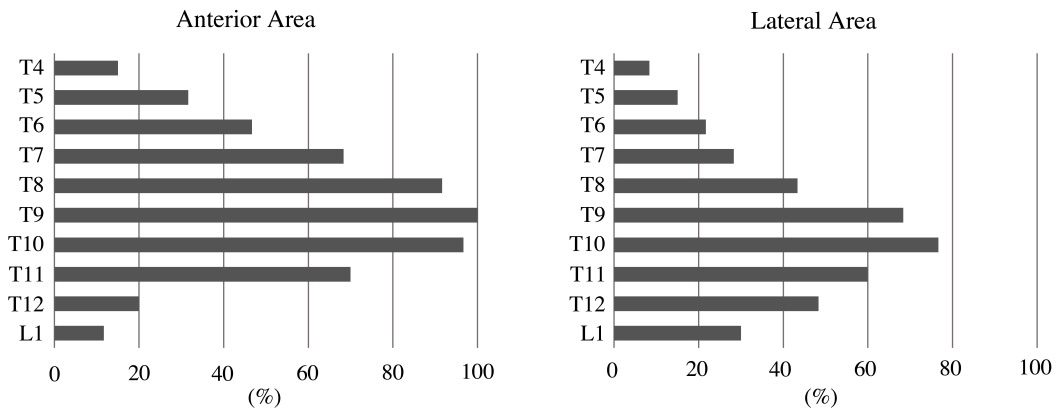
A: A high-frequency linear probe (6–13 MHz) is placed in the sagittal direction at the 10th costal margin, and transversus abdominis, internal oblique, and external oblique muscles are identified. B: An 8-cm 18G Tuohy needle is inserted in the cranial direction using an in-plane technique. C: The needle tip is moved to the posterior aspect of the 10th costal cartilage, following 1 mL of saline injection to confirm the correct spread. D: Subsequently, 25 mL of 0.25% ropivacaine is administered along with an intermittent aspiration test. It should be noted that the needle tip never proceeded over the cranial edge of the 10th costal cartilage.

Abbreviations: C, costal cartilage. EOM, external oblique muscle. IOM, internal oblique muscle. TAM, transversus abdominis muscle. LA: local anesthetics.

The white triangle symbolizes the 18G Touhy needle.

Figure 2: Percentages of successful blocks in each dermatome.


A
10th C
EOM
IOM
TAM
B
C
10th C
Saline
D
10th C
LA


Anterior Area
T4
T5
T6
T7
T8
T9
T10
T11
T12
L1
0
20
40
60
80
100
(%)
Lateral Area
T4
T5
T6
T7
T8
T9
T10
T11
T12
L1
0
20
40
60
80
100
(%)