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ORIGINAL ARTICLE

Comparing perichondrial M-TAPA and subcostal OSTAP blocks in laparoscopic hernia repair: A randomized, non-inferiority trial

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SUMMARY

Objectives: The modified thoracoabdominal nerves block through the perichondrial approach (M-TAPA) and the oblique subcostal transversus abdominis plane block (OSTAP) provide effective analgesia management after abdominal surgeries. There are limited studies comparing these two blocks in the literature. We aimed to compare M-TAPA and OSTAP in patients who underwent laparoscopic inguinal hernia repair.

Methods: Patients with ASA status I–II, aged between 18 and 65 years, scheduled for elective TAPP under general anesthesia were included in the study. The patients were randomized into two groups: Group M-TAPA (n=30) and Group OSTAP (n=30). Blocks were performed using a total of 60 ml of 0.25% bupivacaine (30 ml per side). Postoperatively, all patients were routinely prescribed intravenous ibuprofen 400 mg three times a day. If a patient's NRS score was ≥4 at any time, a dose of 100 mg intravenous tramadol was administered for rescue analgesia.

Results: The duration of the block procedure was significantly longer in the OSTAP group. The need for rescue analgesia and opioid consumption were similar between the groups. In the first two postoperative hours, static and dynamic NRS scores were lower in the M-TAPA group than in the OSTAP group. There were no differences between the groups in terms of the rate of adverse events. Patient satisfaction (Likert scale) was higher in the M-TAPA group.

Conclusion: The M-TAPA block is not inferior to the OSTAP block following laparoscopic inguinal hernia repair surgery. Moreover, the M-TAPA block may be an alternative option to the OSTAP block, as it is easy to apply.

Keywords: Laparoscopic inguinal hernia; M-TAPA block; OSTAP block; postoperative analgesia.

Introduction

Laparoscopic inguinal hernia repair is a common surgical procedure worldwide, known for its advantages of reduced recovery time and lower postoperative complication rates compared to open surgery.[1] The transabdominal preperitoneal (TAPP) inguinal hernia repair method is a surgical technique used to repair inguinal hernias.[2] The TAPP procedure is a type of laparoscopic and minimally invasive surgery in which small incisions are made in the abdomen to allow the insertion of laparoscopic instruments and a camera. Carbon dioxide is used to inflate the abdomen for the operation. Smaller incisions cause less pain and result in quicker recovery compared to open surgery.[1,2] However, managing postoperative pain remains a significant challenge impacting patient recovery and satisfaction.[3] Inadequately managed pain leads to prolonged hospital stays, delayed return to normal daily activities, and increased healthcare costs.[4] Pain management strategies have evolved, with a growing emphasis on multimodal analgesia to minimize opioid use and its associated side effects.[4,5] In this context, regional anesthesia

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techniques, particularly nerve blocks and interfascial plane blocks, have become increasingly popular due to their efficacy in providing targeted pain relief.

The modified thoracoabdominal nerves block through the perichondrial approach (M-TAPA) and the oblique subcostal transversus abdominis plane block (OSTAP) are two techniques that have shown promise in managing postoperative pain after abdominal surgeries. M-TAPA is a novel technique based on a perichondrial approach that targets the medial and lateral branches of the thoracoabdominal nerves.[6] OSTAP is a modification of the classical TAP block. It is performed using a subcostal approach from the costal margin to the iliac crest along the transversus abdominis plane, targeting the medial branches of the thoracoabdominal nerves.[7] The effectiveness of these two interfascial plane block techniques in reducing postoperative pain while minimizing opioid consumption after surgery has been explored in various surgical contexts.

Despite their growing popularity, there is a paucity of literature directly comparing the efficacy of M-TAPA and OSTAP blocks, particularly in the context of laparoscopic inguinal hernia repair. This study aims to fill this gap by conducting a randomized controlled trial to compare these two techniques in terms of postoperative analgesia management, opioid consumption, patient satisfaction (Likert scale), and potential side effects of opioid analgesics. The primary outcome of the study was a comparison of the groups' postoperative second-hour Numeric Rating Scale (NRS) scores at rest. The secondary outcomes were comparisons of the groups' Likert scale scores, all NRS scores other than the second hour, the need for rescue analgesics, opioid consumption, duration of block procedures, and incidence of side effects recorded 24 hours postoperatively. The hypothesis was that M-TAPA and OSTAP blocks would have similar analgesic efficacy levels following laparoscopic inguinal hernia repair surgery.

Material and Methods

Study Design and Participants

This study was a randomized, prospective analysis involving 60 patients aged between 18 and 65 years, classified as ASA I–II, and scheduled for elective laparoscopic inguinal hernia repair surgery. After receiving ethical approval from our university's Ethics Board (06.07.2022, no. 610), the study registration was recorded on ClinicalTrials.gov (NCT05476510). This study was conducted in accordance with the principles of the Declaration of Helsinki.

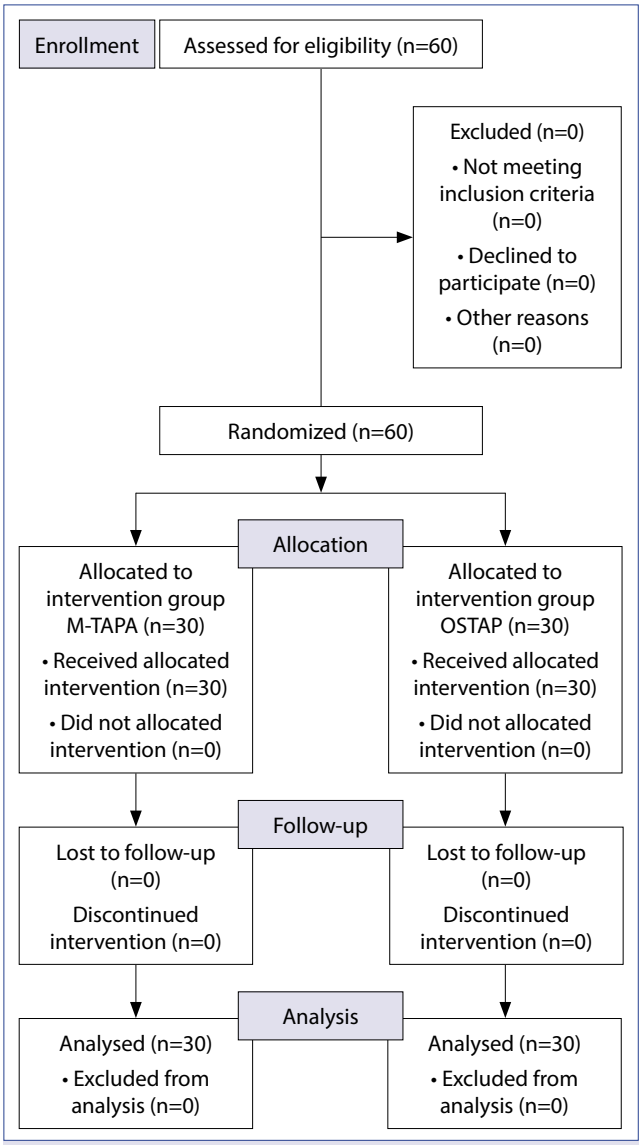

Figure 1. Consort flow diagram of the study.

Written informed consent was obtained from all participants. The CONSORT flow diagram was used for patient enrollment (Fig. 1). The study was conducted between August 2022 and July 2023 at Medipol Mega University Hospital. Patients with a history of bleeding diathesis, allergy or sensitivity to local anesthetics and opioids, infection at the block site, alcohol or drug dependency, allergy to the study drugs, pregnancy or lactation, anticoagulant therapy, or those who did not consent to participate in the study were excluded.

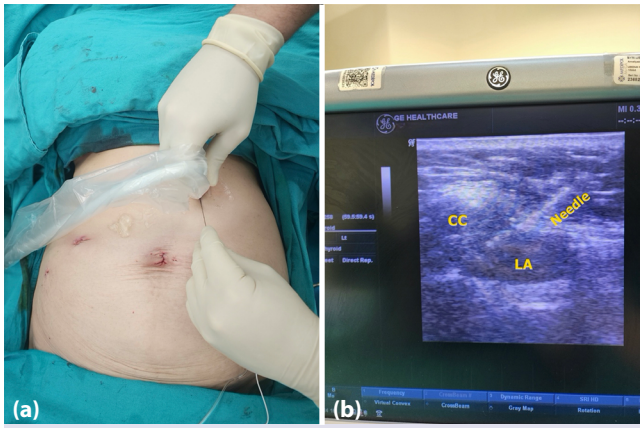

Figure 2. (a) Patient and probe position during M-TAPA. **(b)** Sonographic visualization of M-TAPA. Chondrium and LA spread are seen.

CC: Costochondrium; LA: Local anesthetic.

Figure 3. (a) Patient and probe position during OSTAP. **(b)** Sonographic visualization of OSTAP in the subcostal area at the initial level of the block. Local anesthetic is seen in the transversus abdominis plane.

RAM: Rectus abdominis muscle; LA; Local anesthetic; TAP: Transversus abdominis plane.

General Anesthesia

Patients received premedication with 2 mg midazolam intravenously before entering the operating room. Monitoring included electrocardiography, noninvasive arterial blood pressure, and peripheral oxygen saturation (SpO_2). General anesthesia was performed using the same protocol in all groups: an intravenous dose of 2–2.5 mg/kg propofol, 1.5 µg/kg fentanyl, and 0.6 mg/kg rocuronium. After intubation, mechanical ventilation settings were adjusted to maintain EtCO2 levels between 30 and 35 mmHg. Anesthesia maintenance was achieved with 1–2% sevoflurane in an O_2/fresh air mixture and a remifentanil infusion of 50 µg/h. Postoperative nausea and vomiting prophylaxis was provided with 4 mg ondansetron administered intravenously. All patients received 400 mg ibuprofen and 100 mg tramadol as a single IV bolus dose for postoperative multimodal analgesia management 20 minutes before the end of surgery. All patients underwent laparoscopic inguinal hernia repair with the same TAPP procedure performed by the same surgical team.

Randomization and Outcomes

Participants were randomly assigned into two groups of 30 patients each using computer-generated randomization: Group M-TAPA and Group OSTAP. The need for rescue analgesia and side effects (nausea/vomiting/itching) were evaluated as "yes" or "no."

Regional Anesthesia Technique

Under general anesthesia and before extubation, all blocks were performed in the supine position under ultrasound guidance. A high-frequency linear ultrasound probe (11–12 MHz), covered with a sterile sheath, was used with an 80-mm block needle (Braun 360°).

M-TAPA Procedure

The probe was placed on the chondrium corresponding to the midclavicular line at the level of the ninth–tenth ribs. Using the in-plane technique, the transducer was slightly tilted and the costochondral angle was visualized. An 80-mm block needle was inserted and advanced to a position just below the chondrium between the transversus abdominis muscle and the oblique muscle (Fig. 2a). Five ml of saline was administered to confirm the correct site. Then, 30 ml of 0.25% bupivacaine was injected (Fig. 2b). The same procedure was performed on the contralateral side (total 60 ml).

OSTAP Procedure

For the OSTAP block, the transducer was placed in an oblique plane in the subcostal region from the xiphoid to the iliac crest while the patient was in the supine position. A 150-mm block needle was first inserted between the transversus abdominis and rectus abdominis muscles, advancing in the interfascial plane toward the iliac crest (Fig. 3a). Five ml of isotonic saline was administered for confirmation. Subsequently, 30 ml of 0.25% bupivacaine was administered throughout the oblique subcostal line on each side (60 ml in total) (Fig. 3b).

Postoperative Pain Assessment and Analgesia Management Protocol

Pain intensity was evaluated using the NRS, where 0 indicates no pain and 10 represents the most severe pain. The NRS scores were recorded at rest and during mobilization at 1, 2, 4, 8, 16, and 24 hours postoperatively. The use of analgesic drugs, their quantities, postoperative opioid requirements, side effects (nausea, vomiting, itching), duration of block procedures, and patient satisfaction were all measured using a seven-point Likert scale. The duration of the block procedure was defined as the time from visualization of anatomical structures with ultrasound until administration of the local anesthetic. The duration of surgery referred to the time from the first incision to complete suturing and skin closure.

Postoperatively, all patients in both groups were routinely administered 400 mg ibuprofen intravenously three times a day. If a patient's NRS score was ≥4 at any time, an intravenous dose of 100 mg tramadol was administered as rescue analgesia. The postoperative patient assessment was conducted by a pain nurse anesthetist who was blinded to the study. The participants and the surgical team were aware of group allocation.

Sample Size and Statistical Analysis

The sample size of the study was calculated using the G*Power program (v.3.1.9). The primary aim of this study was to compare postoperative 2nd-hour NRS scores at rest. In the preliminary study, which included eight patients in each group, the 2nd-hour NRS score was 2.50 in the OSTAP group and 1.40 in the M-TAPA group. Standard deviations were 1.85 and 0.8, respectively. Considering α error 0.05 and β error 0.05, the number of patients to be included in each group was determined as 25 with 95% power. Taking into account a potential dropout rate of 10%, 60 subjects were planned for the study.

Statistical analyses were performed using IBM SPSS Statistics for Windows (Version 22.0; IBM Corp., Armonk, NY, USA) and the R statistical software package (v.4.0.2; R Foundation for Statistical Computing, Vienna, Austria). We calculated the 95% CI of the median differences in NRS scores using the Hodges–Lehmann estimator. As our hypothesis was a non-inferior NRS score in patients receiving M-TAPA block 2 hours after surgery compared with those receiving OSTAP, a non-inferiority study design was used, and an acceptable non-inferiority margin was defined as 1.0 according to a previous study.[8] The Shapiro–Wilk test was used to analyze data distribution. Continuous variables were expressed as mean±standard deviation and median (25th–75th percentiles). The Pearson chi-square test was used to compare categorical data between groups. Student's t-test was used for normally distributed continuous variables. In our study, the statistical significance threshold value was $p<0.05$.

Results

The study included 60 patients, who were equally divided into the M-TAPA (n=30) and OSTAP (n=30) groups. The patients' demographic data and surgical details are presented in Table 1. There were no significant differences between the two groups in terms of age, sex, ASA classification, height, weight, or type of surgery (unilateral/bilateral). The duration of surgery was not significantly different between the groups (M-TAPA: 64.9±8.6 min; OSTAP: 68.6±7.9 min; p=0.090). However, the duration of anesthesia was significantly longer in the OSTAP group (M-TAPA: 81.8±9.8 min; OSTAP: 89.8±4.9 min; p=0.001). Similarly, the duration of the block procedure was significantly longer in the OSTAP group (M-TAPA: 9.3±1.3 min; OSTAP: 15±2.8 min; p=0.001). The longer anesthesia duration in the OSTAP group was related to the longer block procedure time.

Table 2 summarizes the patients' postoperative opioid consumption and use of rescue analgesia. No significant differences were observed in tramadol doses between the two groups (p=0.725). Similarly, the requirement for rescue analgesia was comparable between the groups (M-TAPA: 7/23; OSTAP: 8/22; p=0.766).

The comparison of static and dynamic NRS assessments between the groups is detailed in Table 3. The M-TAPA and OSTAP groups were not superior to each other in terms of overall NRS scores. In the first postoperative hour at rest, patients in the M-TAPA group had significantly lower NRS scores compared to those in the OSTAP group (M-TAPA: 1[1–2]; OSTAP: 2[1–2]; p=0.008). Similar patterns were observed in the second (p=0.009) and sixteenth hours (p=0.032). However, no significant differences were noted at other time points. Regarding pain during movement,

Table 1. Comparison of demographic data, duration times of surgery and anesthesia, and duration of block procedure between groups

	Group M-TAPA (n=30)	Group OSTAP (n=30)	p
Age	44.6±8.1	47.9±9.1	*0.136*
Gender (M/F)	19/11	17/13	*0.791†*
ASA (I/II)	18/12	19/11	*0.791†*
Height (cm)	167.5±6.6	170.1±9.8	*0.248*
Weight (kg)	78.8±11.2	77.1±10.7	*0.551*
Type of surgery (unilaterally/bilaterally)	12/18	13/17	*0.598†*
Duration of surgery (min)	64.9±8.6	68.6±7.9	*0.090*
Duration of anesthesia (min)	81.8±9.8	89.8±4.9	***0.001***
Duration of block procedure (min)	9.3±1.3	15±2.8	***0.001***

Values are expressed mean±standard deviation or number; P value is obtained with t-test (mean±SD); †: P value is obtained with Pearson's χ^2 test (n); p values were italicized and values that are written in bold represent statistical significance. ASA: American Society of Anesthesiologist; M: Male; F: Female; cm: Centimeter; kg: Kilogram; min: Minutes; M-TAPA: Modified Thoracoabdominal Nerves Block Through the Perichondrial Approach; OSTAP: Oblique Subcostal Transversus Abdominis Plane Block.

Table 2. The comparison of postoperative opioid (tramadol) consumption and the incidence of need for rescue analgesia between groups

	Group M-TAPA (n=30)	Group OSTAP (n=30)	p
Tramadol dose (mg)	0 (0–0)	0 (0–100)	*0.725*
Rescue analgesia (Y/N)	7/23	8/22	*0.766†*

Data are expressed as median; P value is obtained with Mann-Whitney U test median (percentiles 25–75); †: P value is obtained with Pearson's χ^2 test (n); p values were italicized and values that are written in bold represent statistical significance; Y: Yes (indicates the number of the patients that used rescue analgesia); N: No; Mg: Milligram; M-TAPA: Modified Thoracoabdominal Nerves Block Through the Perichondrial Approach; OSTAP: Oblique Subcostal Transversus Abdominis Plane Block.

significant differences were observed between the groups in the first (M-TAPA: 2[1–2]; OSTAP: 2[2–3]; p=0.023) and second hours (p=0.032).

Figure 4 demonstrates the non-inferiority of the M-TAPA group (95% CI of the median differences in postoperative NRS scores).

The rates of adverse events and patient satisfaction are shown in Table 4. There were no significant differences between the groups in terms of adverse event rates. Patient satisfaction, measured using a Likert scale, was slightly higher in the M-TAPA group (M-TAPA: 7[6–7]; OSTAP: 6[6–7]; p=0.183).

Discussion

Our non-inferiority study yielded noteworthy findings regarding the efficacy of M-TAPA in laparoscopic TAPP inguinal hernia repair surgery. The M-TAPA group exhibited superior outcomes in terms of pain management and patient satisfaction, as assessed by NRS scores and the Likert scale. According to our results, NRS scores in the first 2 postoperative hours were lower in the M-TAPA group than in the OSTAP group. Likert scale scores were higher in the M-TAPA group than in the OSTAP group at the 24th postoperative hour.

Pain management after TAPP inguinal hernia repair surgery is an important issue. Although it is a minimally invasive procedure, patients may experience severe postoperative pain.[3–5] Effective analgesia management provides many benefits, including early recovery, early mobilization, and early discharge in the postoperative period.[5] Pain after TAPP surgery may be caused by various factors, such as peritoneal stretching due to intraperitoneal gas insufflation, dissection and mesh placement for hernia repair, and inflammatory mediators.[9] Several regional analgesia techniques are used for postoperative pain management following TAPP inguinal hernia surgery.

Table 3. Comparison of the average Numerical Rating Scale scores between groups

	Group M-TAPA (n=30)	Group OSTAP (n=30)	p	Difference in NRS‡	
				Median	95% CI
Static					
1st hour	1 (1–2)	2 (1–2)	***0.008***	***-1***	***-1 to -1***
2nd hour	1 (1–2)	2 (1–2)	***0.009***	***0***	***-1- 0***
4th hour	1 (1–2)	1 (1–2)	*0.193*	*-1*	*-1- 0*
8th hour	1 (1–2)	1 (1–2)	*0.980*	*0*	*-1- 0*
16th hour	1 (1–1)	1 (1–2)	***0.032***	***0***	***-1- 0***
24th hour	1 (1–2)	1 (1–2)	*0.192*	*0*	*-1 -1*
Dynamic					
1st hour	2 (1–2)	2 (2–3)	***0.023***	***0***	***-1- 0***
2nd hour	2 (1–2)	2 (2–3)	***0.032***	***0***	***-1- 0***
4th hour	1 (1–2)	2 (2–2)	*0.080*	*0*	***-1- 0***
8th hour	2 (1–2)	2 (1–2)	*0.338*	*0*	*-1 -1*
16th hour	1 (1–2)	2 (1–2)	*0.084*	*-1*	***-1- 0***
24th hour	2 (1–2)	2 (1–2)	*0.806*	*0*	*-1 -1*

Data are expressed as median (percentiles 25–75). Difference of NRS=NRS of M-TAPA minus NRS of OSTAP; p values were italicized and values that are written in bold represent statistical significance. Wilcoxon rank-sumtest used to compare medians between the groups. ‡: Hodges–Lehman estimator used to calculate 95% CI of the median differences. NRS: Numerical Rating Scale; M-TAPA: Modified Thoracoabdominal Nerves Block Through the Perichondrial Approach; OSTAP: Oblique Subcostal Transversus Abdominis Plane Block; CI: Confidence interval.

Table 4. Comparison of the incidence of side effects and patient satisfaction (Likert) between groups

	M-TAPA (n=30)	OSTAP (n=30)	p
Nausea (Y/N)	5/25	6/24	*0.739*
Vomiting (Y/N)	3/27	4/26	*1*
Itching (Y/N)	4/26	5/25	*0.718*
Likert Scale	7 (6–7)	6 (6–7)	***0.183†***

P value is obtained with Pearson's χ^2 test (n); †: P value is obtained with Mann-Whitney U test median (percentiles 25–75). P values were italicized and values that are written in bold represent statistical significance; Y: Yes; N: No; M-TAPA: Modified Thoracoabdominal Nerves Block Through the Perichondrial Approach; OSTAP: Oblique Subcostal Transversus Abdominis Plane Block.

The thoracoabdominal nerves (T7–T12 and L1) innervate the abdomen. Cutaneous nerve branches enter the transversus abdominis plane (TAP) after separation from the thoracic nerves.[10,11] Therefore, the anterior and lateral branches may be blocked within the TAP. The TAP is located between the transversus abdominis muscle and the internal oblique muscle.[10] Local anesthetic is administered into this area during the M-TAPA block just below the chondrium at the level of the ninth–tenth rib.[6] This costal margin corresponds to the attachment points of three abdominal muscles and represents the origin of the TAP. The internal oblique muscle attaches to the costal cartilage from below, and the transversus abdominis muscle attaches from the inner aspect.[12,13] Injecting local anesthetic between these two muscles, corresponding to the TAP plane, results in consistent spread of the anesthetic. Thus, M-TAPA provides a sensory blockade from T7 to L1. Injection of local anesthetic just below the tenth rib provides multilevel thoracoabdominal blockade through the endothoracic fascia.[14,15] The extensive dermatomal coverage, including T12 and L1, may be related to the cranial needle direction during the M-TAPA block.[15,16]

Aikawa et al.[16] evaluated the dermatomal coverage of the M-TAPA block in patients undergoing gynecological laparoscopic surgery in their prospective observational study. They reported that the T8–T11 dermatomes were the most commonly covered dermatomes both anteriorly and laterally with M-TAPA. Laparoscopic inguinal hernia repair surgery mainly involves lower dermatomal levels between T10 and

L1, particularly in cases with mesh placement, which may be associated with increased pain. In addition, trocar insertion points are generally between T8 and T10 for this surgery. The more the needle is directed cranially during the M-TAPA block, the greater the dermatomal involvement extending to the lower abdomen. This is because local anesthetic administered just below the costal cartilage causes multilevel sensory blockade via the endothoracic fascia.

Ohgoshi et al.[17] conducted a study on the effectiveness of M-TAPA, including anatomical analysis in cadavers and dermatome analysis in healthy volunteers. They dissected the anatomical areas where M-TAPA spread in cadavers and investigated the clinical correlation of this anatomical spread by performing dermatome analysis in healthy volunteers. They emphasized that the space between the endothoracic fascia, diaphragm, and costodiaphragmatic recess observed in cadaver dissections plays a critical role in the mechanism of M-TAPA. They stated that the greater the spread in this area, that is, the more the block needle advances cranially under the rib, the wider the distal area of effect of M-TAPA. They reported that dermatomal coverage in healthy volunteers extended down to T12. We believe that this spread pattern may further increase the distribution of local anesthetic as far as L1 due to increased intraabdominal pressure during laparoscopic surgery.

Bilge et al.[8] compared M-TAPA and OSTAP in patients who underwent laparoscopic cholecystectomy surgery. They reported that M-TAPA was superior to OSTAP in terms of pain scores, opioid consumption, and sensory blockade levels. According to their results, M-TAPA provided extensive dermatomal involvement from T4 to T12/L1. Furthermore, they reported that dermatomal coverage was wider in the midclavicular region than in the midaxillary area. In our study, pain scores in the first two postoperative hours were lower in the M-TAPA group than in the OSTAP group. Alver et al.[18] performed a study in patients who underwent laparoscopic inguinal hernia surgery, comparing M-TAPA with a control group. They reported that the M-TAPA group was superior to the control group in terms of pain scores, opioid consumption, and Quality of Recovery-40 scores at 24 hours postoperatively. In addition, there are studies indicating that the M-TAPA block is effective in laparoscopic cholecystectomy surgery.[19,20] Tanaka et al.[12] conducted a study in open gynecological surgery and performed a cadaveric evaluation of the efficacy of M-TAPA. They reported low pain scores, and anesthetized dermatome levels in patients ranged between T6 and T12, mainly in the innervated anterior branches. According to the results of their cadaveric study, dye spread between T8 and T11. In a cadaveric evaluation performed by Ciftci et al.,[13] dye spread between T4 and T12. In general, results from cadaveric and clinical studies may differ. Tanaka et al.[12] reported that there might be more cranial spread up to T7 due to pneumoperitoneum during laparoscopic surgeries, intraoperative positioning, and increased intraabdominal pressure.[11] Additionally, studies have indicated that M-TAPA provides abdominal dermatomal coverage in both the anterior and lateral abdominal regions.[16,21]

OSTAP is a modification of the oblique subcostal TAP block developed by Hebbard et al.[7] Unlike other TAP block methods, a much longer needle (150–200 mm) and a larger volume of local anesthetic are required.[10] The oblique subcostal line runs from the xiphoid to the anterior part of the iliac crest. The OSTAP block potentially covers the T6–L1 nerves and provides both upper and lower abdominal analgesia. However, OSTAP is technically more challenging than other TAP block techniques.[10] Filling a long fascial plane with a larger volume of local anesthetic using a long needle can be difficult. In our study, we compared the duration of the block procedure between the groups. The duration was significantly shorter in the M-TAPA group (9.3±1.3 min) than in the OSTAP group (15±2.8 min). This finding indicates that the M-TAPA block is easier to perform than the OSTAP block. The advantages of the M-TAPA block compared with the OSTAP block are that it requires a lower volume of local anesthetic and is easier to perform. However, there may be inter-practitioner differences, and further studies are needed.

It has been reported that OSTAP provides effective analgesia after several abdominal surgeries.[22–24] In our study, opioid consumption was low and similar in both the M-TAPA and OSTAP groups. Pain scores were also similar, although scores in the first two postoperative hours were lower in the M-TAPA group. In addition, we used 30 ml of local anesthetic for the blocks. While volumes greater than 30 ml are

often required for the OSTAP block, 30 ml may be sufficient for M-TAPA. The difference in pain scores in the first two hours in our study may therefore be related to this volume difference. Additionally, the Likert patient satisfaction score was higher in the M-TAPA group than in the OSTAP group. This difference may be attributable to lower pain scores in the early postoperative period.

In our study, 30 ml of local anesthetic was administered for both the M-TAPA and OSTAP blocks. NRS scores in the first two postoperative hours were lower in the M-TAPA group, whereas opioid consumption was similar between the groups. Notably, the block procedure duration was longer in the OSTAP group. The M-TAPA block may be preferred over the OSTAP block because a lower volume is sufficient and it is easier to apply.

Another important issue in our study is the use of a relatively high volume of local anesthetic (60 ml of 0.25% bupivacaine, totaling 150 mg) and the importance of discussing the risk of local anesthetic systemic toxicity (LAST). While the total dose of 150 mg of bupivacaine is below the commonly cited maximum single dose of 2 mg/kg (or an absolute maximum of 175 mg), the potential for systemic absorption and toxicity remains an important consideration in any regional anesthesia technique. In this study, all blocks were performed under ultrasound guidance to ensure correct needle placement and to minimize the risk of intravascular injection. Furthermore, no clinical signs or symptoms of LAST, such as neurological or cardiovascular disturbances, were observed in any of the patients postoperatively. Nevertheless, the use of large volumes of local anesthetic remains a point of discussion, and future studies could explore the efficacy of these blocks with lower volumes or concentrations of local anesthetics to further enhance the safety profile.

Limitations

Our study has several limitations. We used a volume of 30 ml for each block. Different results may be achieved with different or larger volumes. The number of participants was also limited. Finally, we did not evaluate the sensory blockade. We only used pain scores and opioid consumption to assess the efficacy of the blocks.

Conclusion

In conclusion, the M-TAPA block provided comparable analgesia to the OSTAP block after laparoscopic inguinal hernia repair surgery. The M-TAPA block may be a useful alternative to the OSTAP block, as it is easy to perform.

Ethics Committee Approval: The İstanbul Medipol Non-Interventional Clinical Research Ethics Committee granted approval for this study (date: 06.07.2022, number: 610).

Clinical Trial Registration: This study was registered at ClinicalTrials.gov (Identifier: NCT05476510).

Informed Consent: Written informed consent was obtained from the participants.

Conflict of Interest: The authors declare that there is no conflict of interest.

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Peer-rewiew: Externally peer-reviewed.

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