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Modified thoracoabdominal nerves block through perichondrial approach for surgical patients: a scoping review

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Abstract

Background Modified thoracoabdominal nerves block through perichondrial approach (M-TAPA) is a trunk block that has been gaining attention for managing postoperative pain following abdominal surgeries since its first report in 2019. We conducted a scoping review on M-TAPA, aiming to comprehensively evaluate existing research, identify the gaps in knowledge, and understand the implications of M-TAPA.

Methods This scoping review was conducted using databases including PubMed, Embase, Cochrane, and CINAHL to evaluate the clinical efficacy of M-TAPA on April 19, 2024. Background and outcomes including anesthetized dermatomes, postoperative pain, opioid consumption, quality of recovery, duration to perform, and plasma local anesthetic concentrations were assessed. All reports involving patients, including randomized controlled trials, observational studies, case series, and case reports regarding M-TAPA, were included without language or age restrictions. The included studies were analyzed based on their methodology and clinical relevance.

Results Anesthetized dermatomes were mainly observed in anterior cutaneous branch T7–11. Lateral cutaneous branch T8–10 also anesthetized; however, the probability was lower than anterior cutaneous branch area. M-TAPA has been investigated mostly in laparoscopic cholecystectomy; although its potential to outperform non-block and wound infiltration has been suggested, it did not clearly outperform the transversus abdominis plane block.

Conclusions M-TAPA may be considered a promising technique for postoperative pain management in upper abdominal laparoscopic surgeries. Further studies are warranted to elucidate the precise mechanisms and broader surgical applications.

Keywords Analgesia, Anesthesia, Nerve block

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Background

Several regional anesthesia methods are available for managing postoperative pain following abdominal surgery. Recently, Tulgar et al. defined the technique of administering local anesthetics on both the upper and lower aspects of the 9–10th costal cartilage as "thoracoabdominal nerves block through perichondrial approach" (TAPA) [1]. Thereafter, they modified the TAPA and termed the approach as the modified-TAPA (M-TAPA), which is performed only on the lower aspect of the chondrium [2] (Fig. 1). TAPA and M-TAPA have a wide analgesic range, T5–12 and T7–12, respectively. In particular, upon accumulation of knowledge regarding M-TAPA, M-TAPA is thought to provide good analgesia with a single puncture per side.

The need for comprehensive understanding of M-TAPA is driven by several factors. First, there is significant variability in the reported outcomes, including the analgesic range, across different studies. Second, the applicability of M-TAPA across various surgical procedures is not well-defined, leaving clinicians with uncertainty about its optimal use. These gaps in the current literature suggest the need for a detailed mapping of the existing evidence, which can guide future research and clinical practice.

We aimed to comprehensively investigate the existing research in clinical settings, identify the gaps in knowledge, and understand their implications by conducting a scoping review of M-TAPA. These insights will be valuable in shaping future research on the clinical indications of M-TAPA.

Methods

This scoping review was conducted according to Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation [3]. Studies involving individuals undergoing M-TAPA in surgical settings were included in this review. There were no limitations regarding the language and patient's age and all clinical studies, including randomized controlled trials, observational studies, case series, and case reports regardless of date, setting, or duration were included. Eligible studies were systematically searched using databases, such as PubMed/MEDLINE, Embase, Cochrane Central Register of Controlled Trials, and CINAHL, on April 19, 2024. The full search strategy is presented in Additional file 1. A total of 124 studies were identified during the first search, and 25 studies were included after reviewing the references. To select the studies for final review, the following methods were used. First, the manuscript titles and abstracts were screened independently by two authors (TS and MI), with inconsistencies resolved by discussion; then, the details of the remaining studies were summarized. All extracted data were verified by another reviewer (NT). Studies including patients undergoing M-TAPA were reviewed to assess the following outcomes: (1) postsurgical pain, (2) postoperative opioid consumption, (3) postoperative recovery, (4) the time required to complete M-TAPA, (5) anesthetized dermatomes and duration, (6) blood concentration (maximum drug concentration [C_{max}] and time to reach peak drug concentration [T_{max}]), and (7) complications. The collected data included study and participant characteristics and the details of M-TAPA. Study characteristics included author(s), publication year, type of study, and country. Participant characteristics included age and number. The details of M-TAPA included types and amount of local anesthetic, presence or absence of any adjuvants, and catheter insertion for continuous administration.

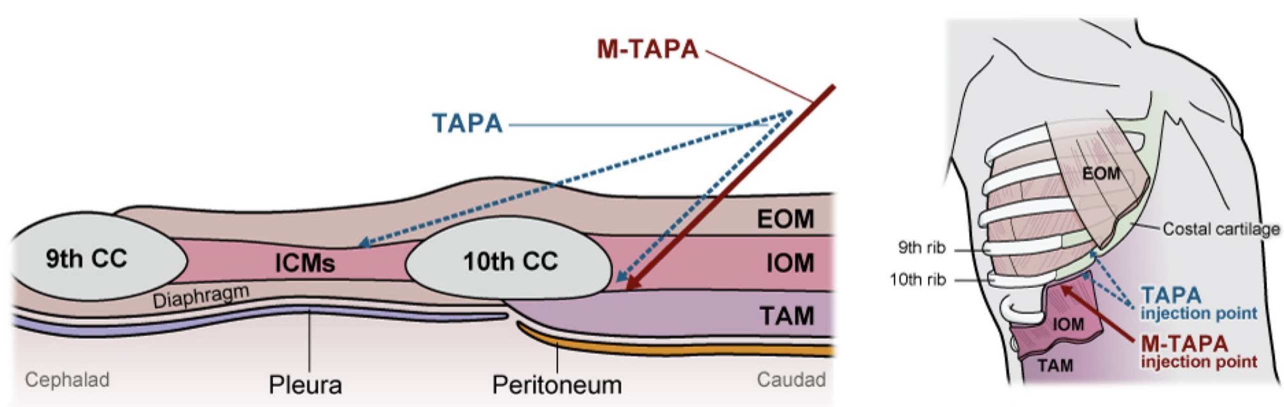

Fig. 1 Schematic diagrams of the puncture sites and dissection for TAPA and M-TAPA. In TAPA, local anesthetic is administered to the caudad side (under the external oblique muscle) and the caudal side (between the internal oblique muscle and the transversus abdominis muscle) of the costal cartilage. In M-TAPA, local anesthetic is administered only to the caudal side of the costal cartilage. CC, costal cartilage; EOM, external oblique muscle; ICMs, intercostal muscles; IOM, internal oblique muscle; TAM, transversus abdominis muscle; TAPA, thoracoabdominal nerves block through perichondrial approach; M-TAPA, modified thoracoabdominal nerves block through perichondrial approach

Outcomes

The time required to complete the M-TAPA was defined as that from the start of the puncture to the end of local anesthetic infusion. Postsurgical pain was assessed using a numerical rating scale (NRS) or visual analog scale. Postoperative opioid consumption was recorded as morphine equivalents when the opioids used postoperatively varied between the studies. The quality of recovery assessed using a validated index, such as quality of recovery, was considered postoperative evaluation [4]. The anesthetized dermatomes and duration of analgesia were assessed. The anterior cutaneous branch area was defined as that from the midline to the anterior axillary line, and the lateral cutaneous branch area as that near the midaxillary line from which information on the anesthetized dermatomes was extracted. Blood samples were collected over time following local anesthetic administration.

Results

Figure 2 shows the flow diagram of the article selection process used in this scoping review; 25 studies were retrieved for inclusion [2, 5–28] (Table 1).

Type of local anesthetics, concentration, and dosage

Adult patients were administered 0.2–0.375% ropivacaine, 0.25–0.5% bupivacaine, and 0.25% levobupivacaine. The volumes used varied from 15 to 30 mL per

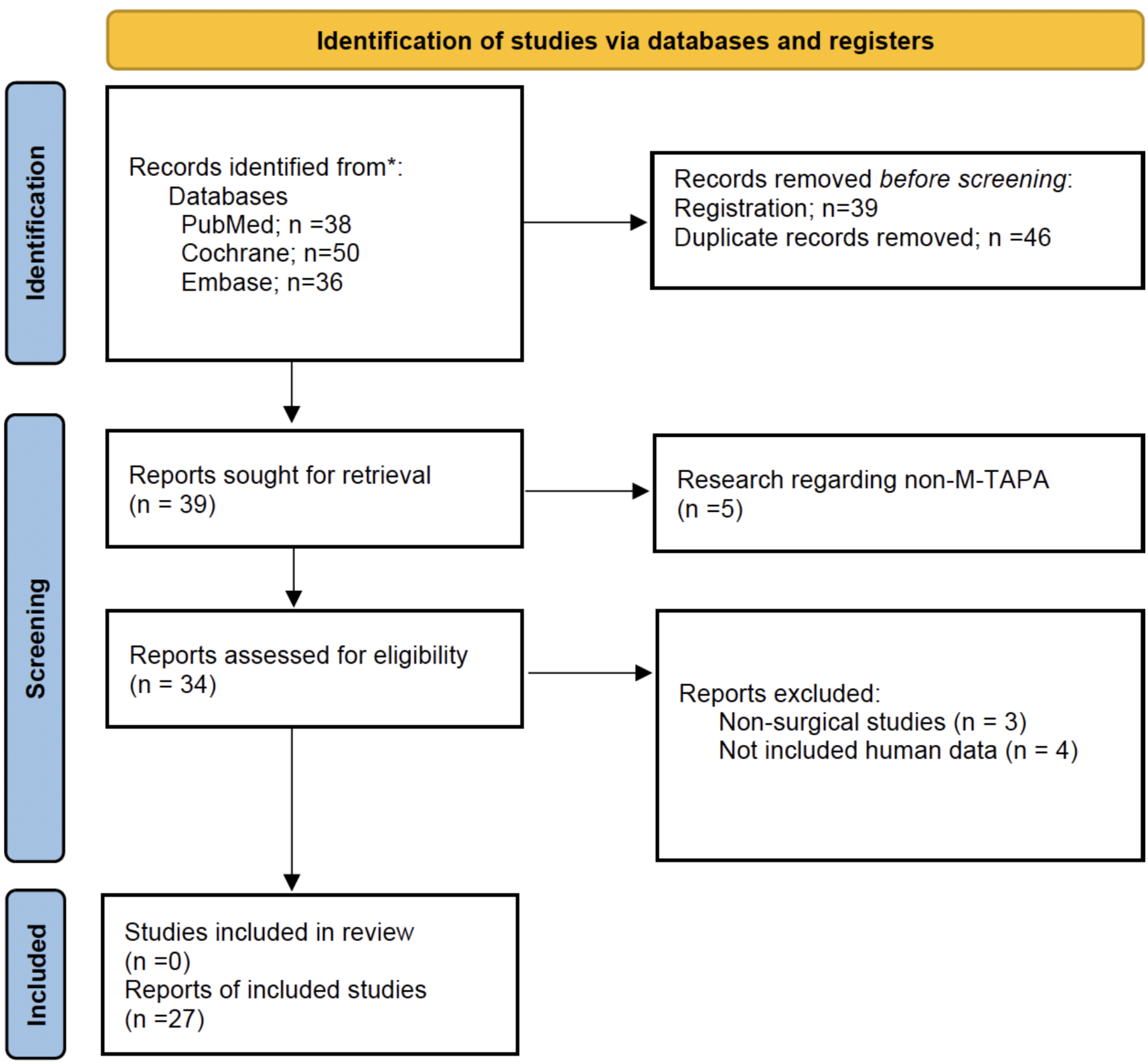

Fig. 2 Flow diagram of the studies selection and identification process

Table 1 Overview of clinical reports regarding M-TAPA

First Author	Year	Country	Study design	Number of patients performed M-TAPA	Comparison methods	Age (years)	ASA-PS	Types of surgery	Time required to complete M-TAPA (min)	Needle tip positions	Types and amount of local anesthetic (per side)	Adjuvants	Catheter insertion
Suzuka T [5]	2024	Japan	RCT	18	OSTAPB; $n=20$	20–75	1–2	Total laparoscopic hysterectomy	4.7 (median)	below the costal cartilage	0.25% levobupivacaine 25 mL	None	None
Avci O [6]	2024	Turkey	RCT	21	Non-block; $n=21$	> 18	1–3	Laparoscopic cholecystectomy	NA	the 9 th and 10 th costal cartilage	0.25% bupivacaine 20 mL	None	None
Singh S [7]	2023	India	Case reports	5	NA	10–12	NA	Thoracotomy	NA	NA	0.25% levobupivacaine 7.5 mL	None	None
Ciftci B [8]	2023	Turkey	Case reports	5	NA	25–65	1–2	Laparoscopic inguinal hernia ($n=2$), Laparoscopic cholecystectomy ($n=3$)	NA	NA	0.25% levobupivacaine 15–20 mL	None	None
Atsumi C [9]	2023	Japan	Retrospective study	40	WIA; $n=50$	20–70	NA	Gynecological laparoscopic surgery (Total laparoscopic hysterectomy 6, Myomectomy 4, Cauterization of endometriosis 13, and Ovarian 17)	NA	Posterior aspect of the costal cartilage and the transversus abdominis muscle	0.25% levobupivacaine 25 mL	None	None
Cho HY [10]	2023	Korea	RCT	28	Subcostal TAPB; $n=28$	18–70	1–2	Laparoscopic cholecystectomy	NA	A cephalad direction	0.375% ropivacaine 15 mL	None	None
Ozen V [11]	2023	Turkey	Case report	1	NA	8	1	Laparoscopic cholecystectomy	7	NA	0.125% bupivacaine 18.2 mL	None	None
Aikawa K [12]	2023	Japan	Case reports	10	NA	> 19	1–2	Colectomy ($n=6$), Gynecological ($n=4$)	NA	NA	0.25% levobupivacaine 25 mL	1:200000 epinephrine	None
Hirai N [13]	2023	Japan	Case report	1	NA	1	NA	Laparotomy for splenic torsion	NA	A cephalad direction	0.15% ropivacaine 10 mL	None	None
Alver S [14]	2023	Turkey	RCT	30	WIA; $n=30$	18–65	1–2	Laparoscopic inguinal hernia repair	NA	Under chondrium	0.25% bupivacaine 20 mL	None	None
Bilge A [15]	2023	Turkey	RCT	38	OSTAPB; $n=38$	18–70	1–2	Laparoscopic cholecystectomy	NA	Posterior aspect of the 10 th costal cartilage	0.25% bupivacaine 25 mL	None	None
Matsuura H [16]	2023	Japan	Retrospective study	30	WIA; $n=30$	> 18	NA	Laparoscopic cholecystectomy	NA	NA	0.2% ropivacaine 30 mL	None	None
Gungor H [17]	2023	Turkey	RCT	30	WIA; $n=30$	18–65	1–2	Laparoscopic cholecystectomy	NA	Below the chondrium	0.25% bupivacaine 20 mL	None	None
Kumar A [18]	2022	India	Case report	1	NA	10	1	Splenectomy	NA	the 9 th costal cartilage	0.25% bupivacaine 20 mL	None	None

Table 1 (continued)

First Author	Year	Country	Study design	Number of patients performed M-TAPA	Comparison methods	Age (years)	ASA-PS	Types of surgery	Time required to complete M-TAPA (min)	Needle tip positions	Types and amount of local anesthetic (per side)	Adjuvants	Catheter insertion
Bilge A [19]	2022	Turkey	RCT	34	Non-block; $n=34$	18–70	1–2	Laparoscopic cholecystectomy	NA	the 10 th costal cartilage	0.25% bupivacaine 25 mL	None	None
Tanaka N [20]	2022	Japan	Prospective observational study	10	NA	18–75	1–3	Open radical hysterectomy	NA	the 10 th costal cartilage	0.25% ropivacaine 30 mL	None	None
de Oliveira EJSG [21]	2022	Brazil	Case reports	12	NA	NA	NA	Laparoscopic sleeve gastroplasty	NA	the midclavicular line and the costal cartilage,	0.2% ropivacaine 20–30 mL	None	None
Aikawa K [22]	2022	Japan	Prospective observational study	30	NA	20–70	1–2	Gynecological laparoscopic surgery	NA	the 10 th costal cartilage	0.25% ropivacaine 25 mL	None	None
ERTURK T [23]	2022	Turkey	RCT	28	TAPA; $n=28$	18–90	1–3	Laparoscopic cholecystectomy	2.9 (median)	NA	0.25% bupivacaine 20 mL	None	None
Chen J [24]	2021	China	Case reports	2	NA	45 and 48	NA	Laparoscopic cholecystectomy and subtotal gastrectomy	NA	the 9the and 10 th costal cartilage	0.33% ropivacaine 20 mL and 0.25% ropivacaine 15 mL	None	None
Aikawa K [25]	2020	Japan	Case report	1	NA	46	NA	Laparoscopic sleeve gastrectomy	NA	NA	0.25% ropivacaine 30 mL	None	None
Ohgoshi Y [26]	2019	Japan	Case reports	2	NA	63 and 91	NA	Adhesion release	NA	the 9the and 10 th costal cartilage	0.375% ropivacaine 20 mL	None	Presence
Altiparmak B [27]	2019	Turkey	Case report	1	NA	64	2	Laparoscopic ventral hernia repatr	NA	NA	0.25% bupivacaine 20 mL	None	None
Tulgar A [2]	2019	Turkey	Case report	1	NA	75	NA	Laparotomy due to instinal obstruction	NA	NA	0.25% bupivacaine 25 mL	None	None
Balaban O [28]	2019	Turkey	Case report	1	NA	58	NA	Placement of a pericholecystic drainage catheter	NA	NA	0.5% bupivacaine 20 mL	2% lidocaine 10 mL	None

ASA-PS, American Society of Anesthesiologists physical status; M-TAPA, modified thoracoabdominal nerves block through perichondrial approach; OSTAPB, oblique subcostal transversus abdominins plane block; RCT, randomized controlled trial; TAPA, thoracoabdominal nerves block through perichondrial approach; WIA, wound infiltration analgesia side. Of the included studies, only two reports used 15 mL per side [8, 10], and all others used 20 mL or more. Regarding children, the M-TAPA was adapted for ages 1–12 years. Local anesthetics used included 0.125% bupivacaine 0.7 mL/kg [11], 0.15% ropivacaine 1 mL/kg [13], 0.25% bupivacaine 20 mL (estimated to be approximately 0.6 mL/kg) [18], and 0.25% bupivacaine 7.5 mL (estimated to be around 0.2 mL/kg) [7].

The only reports on additives were the first report on the original TAPA, in which lidocaine was also mixed with 0.5% bupivacaine [28], and a study on plasma concentration levels of levobupivacaine with epinephrine [12], while other reports used local anesthetic alone.

Anesthetized dermatomes in the anterior cutaneous branch area

Anesthetized dermatomes and duration of analgesia were assessed using the pin-prick test in the study included in this scoping review. None of the included studies had used cold sensitivity evaluation. Data were extracted from observational studies or randomized controlled trials (RCTs) that used the pinprick test as an endpoint. Three studies were applicable, all of which were evaluated 2 h postoperatively. The analgesic ranges that showed ≥ 80% probability of efficacy were T6–10 [15], T7–11 [20], and T8–10 [22], respectively. Upon redefining the probability of efficacy as ≥60%, these ranges would be T6-11, T6-12, and T7–11, respectively.

Anesthetized dermatomes in the lateral cutaneous branch area

The same methodology was used in the three studies mentioned above. The analgesic ranges with ≥80% validity were T7–8 [15], T8–11 [20], and none [22], respectively. Upon redefining the probability of efficacy as ≥60%, these ranges would be T6–9, T8–11, and T9–11, respectively.

The time required to complete M-TAPA

The block performance time is defined as the period from the insertion of the needle to the point when the entire local anesthetic has already been injected. Two studies were applicable; each reported a median of 2.9–4.7 min [5, 23]. Of these, one RCT reported a performance time reduction of approximately 4 min over oblique subcostal transversus abdominis plane (TAP) block [5].

Postoperative pain after M-TAPA

Postoperative pain was assessed using the NRS in most studies. Postoperative pain was most often assessed at 2, 12, or 24 h postoperatively, and the NRS scores were below the cut-off value for therapeutic intervention in most studies (NRS scores = 4) [29]. The studies with NRS scores > 4 included radical hysterectomy, sleeve gastrectomy, and laparoscopic cholecystectomy [10, 20, 21]; however, the endpoint of the study regarding laparoscopic cholecystectomy was the worst pain within 24 h.

Indication of M-TAPA

Studies on laparoscopic cholecystectomy were the most popular, with nine studies in total. Two RCTs compared M-TAPA with non-block and concluded that M-TAPA significantly reduced the pain scores at rest and on movement in the first 24 h postoperatively [6, 19]. Compared to wound infiltration, a retrospective study suggested that the number of analgesic requests within 24 h postoperatively was lower [16]. Subsequently, Güngör reported that M-TAPA reduced the NRS scores at rest up to 4 h postoperatively in their RCT [17]. Two RCTs compared the M-TAPA with existing trunk blocks: subcostal TAP block or oblique subcostal TAP block. Bilge reported that tramadol consumption within 24 h postoperatively was significantly lower than that in the oblique subcostal TAP block group [15], while Cho observed no significant difference in the NRS pain scores and other outcomes when compared with the subcostal TAP group [10]. The second most commonly studied surgical procedure was laparoscopic gynecological surgery. However, in a retrospective observational study, M-TAPA was not significantly different from wound infiltration under mixed surgical technique conditions [9]. We also concluded that Quality of Recovery-15 questionnaire was not likely to outperform the oblique subcostal TAP block in total laparoscopic hysterectomy [5]. Another RCT that included laparoscopic inguinal hernia repair found that M-TAPA was superior to wound infiltration in terms of the quality of recovery [14]. Thus, all target surgical techniques in the RCTs included laparoscopic surgery. Upon expanding the search for prospective observational studies and case reports, we identified reports of open radical hysterectomy in adults and laparotomy or thoracotomy in pediatric patients.

Plasma concentration level of local anesthetic

There were no reports on the plasma concentration level of ropivacaine or bupivacaine. Two studies used 25 mL of 0.25% levobupivacaine per side: one with epinephrine and the other without. Without epinephrine, the mean C_{max} was 1.17 (95% confidence interval [CI]: 1.03 to 1.32) μg/mL and T_{max} 25.0 (95% CI: 17.8 to 32.2) min; with 1:200,000 epinephrine, the mean C_{max} was 0.73 (95% CI: 0. 60 to 0.85) and T_{max} 85.5 min (95% CI: 59.2 to 111.8) [5, 12]. In several cases, the peak was not captured at 120 min when epinephrine was added. However, the peak was not close to the toxic level of 2.62 μg/mL [30]; thus, M-TAPA is likely to be a safe nerve block with an adequate observation period.

Table 2 Findings of volunteer and cadaveric studies regarding M-TAPA

First author	Subject of study	Main Results
Sawada [31]	Cadaver	The highly probable staining range was T8–10. The dye did not diffuse into the intercostal space.
Ohgoshi [32]	Volunteer	The effective duration was 870 min (median). Cephalad administration of original TAPA had no effect.
Ciftci [33]	Cadaver	The dye was found to have spread between T4 and T11–12.
Ohgoshi [34]	Volunteer	SEDIC is the key structure involved in the effect on the lateral cutaneous branch T8–12.
Aikawa [35]	Cadaver	The dye spread was observed in the space between the diaphragm and the parietal peritoneum. M-TAPA may result in suboptional diffusion patterns in some cases, leading to a limited sensory area.

M-TAPA, thoracoabdominal nerves block through perichondrial approach; SEDIC, space between the endothoracic fascia, diaphragm, and costodiaphragmatic recess; TAPA, thoracoabdominal nerves block through perichondrial approach

Complications

The occurrence of complications, such as local anesthetic systemic toxicity, infection, accidental vascular puncture and hematoma formation was not found in this review.

Discussion

Within this scoping review, we intended to characterize the clinical efficacy of M-TAPA based on the currently available literature. This scoping review revealed that the anterior cutaneous branch area of T7–11 is presumed to be the main analgesic dermatomes on M-TAPA, making it a viable option for somatic pain control in upper abdominal surgeries, particularly in laparoscopic surgery. These findings suggest that M-TAPA may offer comparable analgesic efficacy to other common regional anesthesia techniques, such as TAP block, in terms of postoperative pain relief and opioid-sparing effects; however, M-TAPA did not consistently outperform these techniques across all outcomes. A significant advantage of M-TAPA is its relatively simple and rapid administration, typically requiring less than 5 min to perform, which may offer a practical benefit in operating management. However, while M-TAPA showed promise in reducing the pain scores and opioid consumption in the immediate postoperative period, its effectiveness varied based on the specific surgery and the comparison group used. In particular, M-TAPA demonstrated more consistent benefits in laparoscopic cholecystectomy compared to wound infiltration; however, its advantages over TAP blocks remain less conclusive. These clinical insights underscore the potential of M-TAPA as a supplementary or alternative technique in multimodal analgesia; nevertheless, further randomized controlled trials across broader kinds of surgical procedures are necessary to solidify its place in clinical practice.

Although we focused on the clinical effectiveness of M-TAPA, results of volunteer and cadaveric studies are necessary to discuss the characteristics of M-TAPA. The findings of volunteer and cadaver studies, which were omitted from this exploration, are presented in Table 2.

The original TAPA method involved administering local anesthetics, both cephalad and caudal, to the costal cartilage. The significance of local anesthetic administration on the cephalad side of the costal cartilage is controversial. Ohgoshi et al. claimed that it was completely ineffective [36]. Tulgar pointed out that their claim may be based on misinterpretation and injection of the dye in the wrong location, and makes the opposite claim that it is effective on the lateral cutaneous branch [37]. In either case, it is estimated that opportunities to perform original TAPA are decreasing because M-TAPA also provides a wide effective range, and the amount of local anesthetic required and the effort to perform additional punctures can be reduced.

Considering the uncertainty of efficacy on the lateral cutaneous branch, the main analgesic range is mainly T7–11 in the anterior cutaneous branch. Recently, Ohgoshi et al. reported that local anesthetic administration into the space between the endothoracic fascia, diaphragm, and costodiaphragmatic recess (SEDIC) may influence the presence or absence of effects in the lateral cutaneous branch region [34]. Since the initial reports, needle position and puncture site were not specified in a reproducible manner and owing to the diversity of effect ranges, we planned to investigate the needle position and puncture method in this scoping review. The target for needle insertion was almost always the 9th −10th costal cartilage; however, some reports have mentioned the needle tip being positioned below the costal cartilage. Moreover, there were also reports in which the images in the paper did not show this; thus, there might be no strict uniformity in the puncture method and the needle tip position.

Interestingly, the certainty of the effect at T12 seems to decrease. Analysis of four studies that performed the pinprick test revealed that only 38.1% found efficacy in T12 [15, 20, 22, 32], which suggests that the indications regarding abdominal surgery below the umbilicus confined to the lower abdomen are weak. Most cadaveric studies have demonstrated that the dye extends to the transversus abdominis plane of the costal arch and its caudal side but does not extend to T12. In clinical studies using 30 mL of local anesthetic per side, the effect on T12 was achieved in 60% of the cases [20]. Although the use of 30 mL of local anesthetic per side in adults may be one way to achieve this, a risk of local anesthetic systemic toxicity exists.

Paradoxically, clinical effects higher than T7 and anatomical findings that did not stain higher than T7 were observed. Diffusion into the intercostal space have been proposed as possible causes [22]; however no currently reported studies support this hypothesis [20, 31, 35]. Further research using contrast agent and images on the living body, including volunteers, is warranted.

The effective duration of M-TAPA was initially expected to provide overnight analgesia, with some reports suggesting a residual effect for more than 24 h [20, 25]. However, these reports were based on patients with diabetes or those under the influence of intravenous patient-controlled analgesia [20, 25], and the most reliable duration of the efficacy was 870 (range, 660–1200) min in a volunteer study [32]. The duration of analgesia in clinical practice depends on the type, amount, and concentration of the local anesthetic to be injected, patient factors (e.g. diabetic neuropathy), and surgery-induced tissue inflammation. Thus, the effective duration may not be similar to that of the volunteer study. From a safety point of view, the plasma concentration of the local anesthetic does not reach the toxicity levels, and without the additive, a 30-minute observation period would not cause any major problems. The addition of epinephrine further suppressed the C_{max} and prevented the transition to local anesthetic systemic toxicity. Levobupivacaine, the agent used in this study, has no effect on prolonging the effective duration by the addition of epinephrine [38, 39]; however, one should be aware of these properties before using M-TAPA in clinical practice.

All the RCTs were performed for laparoscopic surgeries, mostly for laparoscopic cholecystectomy. The main characteristic of M-TAPA is the somatic pain control of T7-11 in the anterior cutaneous branch; based on this characteristic, its use in laparotomy is not problematic. Therefore, M-TAPA may be considered suitable for postoperative analgesia when transitioning from laparoscopic surgery to laparotomy. It may also be useful in cases under the presence of stoma that obstructs the performance of TAP block or rectus sheath block (RSB). The analgesic range of RSB is limited to the anterior cutaneous branch area, the effective duration is reportedly as short as 196 min [40]. Thus, M-TAPA may be superior than RSB; however, no reports have compared M-TAPA with RSB. Although the TAP block, especially oblique subcostal TAP block, is based on anatomical findings and provides perfect analgesia [41], M-TAPA may be superior under the above conditions. Thus, M-TAPA could be a plan B/C/D block, if not a plan A block [42]. Only one RCT each was performed for gynecological laparoscopy and laparoscopic inguinal hernia repair, and no RCTs were performed for laparotomy or laparoscopic sleeve gastrectomy, which were the subject of case reports; thus, potential for further investigation still exists. Case reports on its application in laparotomy and thoracotomy in the field of pediatrics are gradually increasing. We believe that M-TAPA can be applied more rigorously and reasonably in the future following the elucidation of its mechanism of action.

This scoping review has several limitations. First, the quality of studies was not formally assessed using tools such as QUADAS-2 or GRADE. The included studies consisted of few RCTs and many case reports, making it challenging to evaluate the quality of studies. Second, the broad scope may result in the inclusion of heterogeneous studies, making it challenging to draw specific conclusions. Additionally, as M-TAPA is a hot topic in regional anesthesia, and it is important to keep up to date with the accumulating evidence on its applications and outcomes. At the time of writing this manuscript, further findings are being reported [34, 43, 44]; and the limitation in review papers applies to our report as well.

Future insight

Standardized puncture protocols, including discussions regarding the position of the needle tip, the diffusion pathway of local anesthetic, pharmacokinetics of different local anesthetics, the exploration of indications for laparoscopic surgery and laparotomy other than those listed here, comparisons with existing nerve blocks (e.g. oblique subcostal TAP, external oblique intercostal block, or RSB), and the identification of the optimal volume and concentration of local anesthetic should be considered in future research.

Conclusions

M-TAPA mainly provides analgesia of somatic pain in the anterior cutaneous branches T7–11 for approximately 14 h, which is considered effective for laparoscopy of the upper abdomen at this stage. Further clarification of the mechanism of action, route of local anesthetic diffusion, and effect on surgical procedures other than laparoscopic cholecystectomy is warranted.

Abbreviations

C_{max}	Maximum drug concentration
M-TAPA	Modified thoracoabdominal nerves block through perichondrial approach
NRS	Numerical rating scale
PRISMA	Preferred Reporting Items for Systematic reviews and Meta-Analyses
PRISMA-ScR	Preferred Reporting Items for Systematic reviews and Meta-Analyses Extension for Scoping Reviews
RCT	Randomized controlled trial
RSB	Rectus sheath block
SEDIC	Space between the endothoracic fascia, diaphragm, and costodiaphragmatic recess
TAP	Transversus abdominis plane
TAPA	Thoracoabdominal nerves block through perichondrial approach

T_{max} Time to reach peak drug concentration

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12871-024-02878-y.

Additional file 1: The search strategies in PubMed, Embase, and Cochrane

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Author contributions

NT performed a formal analysis and data curation. MI was responsible for study conceptualization, methodology, formal analysis, investigation, project administration, data curation, and resources. NT and MI wrote the original draft. TS was responsible for study visualization. MK was responsible for supervision and funding acquisition. TS and MK were responsible for the review and edit of the manuscript. All authors read and approved the final manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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