Original Article

Access this article online

Quick Response Code:

Website: www.herniasurgeryjournal.org

DOI: 10.4103/ijawhs.ijawhs_75_24

E-TEP surgery for ventral hernias: A novel and effective approach to postoperative analgesia

Daniel Mariano de Andrade[1], Fernando Ponce Leon[2], Nathalia Barros Oliveira Santos[2], Jessica Pereira Manso[3], Luisa Delegave Penedo[1], Matheus Wanderley Cunha Fernandes Costa[1], Arnaldo Couto[4,5], Fernando Athayde Veloso Madureira[1,6]

[1]Department of General Surgery, Gaffrée and Guinle University Hospital, Federal University of the State of Rio de Janeiro, Rio de Janeiro, Brazil, [2]Department of General Surgery, Clementino Fraga Filho University Hospital, Federal University of Rio de Janeiro, Rio de Janeiro, Brazil, [3]Department of Oncology Surgery, National Institute of Cancer, Rio de Janeiro, Brazil, [4]Department of Pharmacy, State University of Rio de Janeiro, Rio de Janeiro, Brazil, [5]Research Division, National Institute of Traumatology and Orthopedics, Rio de Janeiro, Brazil, [6]IDOMED Surgery PostGraduate Program Coordinator

Address for correspondence:
Dr. Daniel Mariano de Andrade, Department of General Surgery, Gaffrée and Guinle University Hospital, Federal University of the State of Rio de Janeiro, Rio de Janeiro 20270-004, Brazil.
E-mail: danielmarianodeandrade@gmail.com

Submitted: 12-Oct-2024
Revised: 25-Jan-2025
Accepted: 03-Feb-2025
Published: 26-Mar-2025

Abstract

INTRODUCTION: Ventral hernia (VH), associated with diastasis rectus abdominis, is a relatively common pathology in general surgery. Extended-view Totally Extraperitoneal Technique (e-TEP) is a promising surgical technique for its correction. However, it requires extensive dissection and, therefore, can cause postoperative pain. The aim of this study is to propose a new technique for analgesia and to compare it to existing techniques.

MATERIALS AND METHODS: Thirty patients were submitted to VH and diastasis correction surgery applying e-TEP technique and randomly divided into three groups, according to the type of analgesia administered: general anesthesia (GA) alone; GA and TA plane block guided by ultrasound (US-TAPB); GA and TAPB by direct laparoscopic view (DV-TAPB). Pain scores using the Numeric Rating Scale were collected at 2, 6, and 24 h postop. The time to administer local anesthetic (LA) was also measured.

RESULTS: No significant differences for gender, age, or body mass index (BMI) were observed, nor for the mean defect area and diastasis length, mesh size, and operation time between groups. The DV-TAPB group presented the lowest pain scores at 2 h ($P = 0.001$), 6 h ($P = 0.02$), and 24 h ($P = 0.01$) postoperatively. Additionally, the mean time required to administer the LA was significantly lower in the DV-TAPB group (1.9 min) compared to the US-TAPB group (11.8 min).

CONCLUSION: E-TEP is a relatively new and promising technique to treat VH and diastasis. Additional analgesia by DV-TAPB is faster and offers better pain relief in the first 24h postop period.

TRIAL REGISTRATION: http://isrctn.org/ (identifier: ISRCTN11379598).

Keywords:

Analgesia, diastasis rectus abdominis, e-TEP, TAP block, ventral hernia

Introduction

Ventral hernia (VH) associated with diastasis rectus abdominis (DRA) is one of the most common pathologies in general surgery. DRA is defined by the European Hernia Society (EHS)[1] as an abnormal separation (>2 cm, when located above the umbilicus) of the two rectus abdominis muscles caused by a thinning and widening of the linea alba. Its prevalence is unknown,[2] but its risk factors are clearer, with parity number, high BMI, older age, and diabetes being the most plausible ones.[2,3]

The association between VH and DRA can reach up to 45% in some series[4] and the incidence of ventral incisional hernia is up to 28%.[5] Patients can present asymptomatically or report pain in the hernia site, lower back pain, abdominal wall dysfunctions, and aesthetic dissatisfaction,[6-8] requiring surgical resolution.

How to cite this article: de Andrade DM, Leon FP, Santos NBO, Manso JS, Penedo LD, Costa MWCF, *et al*. E-TEP surgery for ventral hernias: A novel and effective approach to postoperative analgesia. Int J Abdom Wall Hernia Surg 2025;8:21-8.

E-TEP (Extended-view Totally Extraperitoneal) was first described by Daes in 2012 for the repair of inguinal hernias[9] and later applied to correct VHs by Belyansky *et al*. allowing faster recovery and restoration of the anatomy and physiology of the abdominal wall.[10] Unfortunately, this technique has only been taken up by a small number of surgeons,[5,11] since it is more complex to execute, requiring specialized surgical skills[12] and longer surgical time.[5]

Currently, laparoscopic e-TEP arises as a promising technique for VH-associated DRA correction, when compared to usual surgical techniques. It allows closure of the hernia defect and the placement of lower cost and less complex meshes in the retromuscular space, avoiding direct contact with the bowel[13,14] and presenting low recurrence rates (0.02%).[15-17] Laparoscopic e-TEP also reduced pain scores up to the 7th postoperative day,[5] an advantage that can be increased when employing additional analgesia methods.

In this scenario, the TA Plane Block (TAPB) has been widely performed for postoperative analgesia in abdominal surgeries. Initially described by Rafi in 2001,[18] and later modified, ultrasound-guided TAPB (US-TAPB) can reduce postoperative opioid use and pain scores at rest and during movement, in the first 24 h after hernia surgery, with rare complications.[19-21]

At the end of dissection through the extraperitoneal approach to VHs, there is direct visualization (DV) of the cutaneous branches of the intercostal nerves that innervate the anterior abdominal wall, allowing local anesthetic (LA) injection directly onto these nerves. The present article seeks to compare the effectiveness of DV-TAPB to existing analgesia techniques for pain control after VH and DRA correction surgery using laparoscopic e-TEP, as well as their administration times.

Materials and Methods

Patient groups

A total of 30 patients, aged between 18 and 65 years, were selected to undergo surgery to correct DRA-associated VH, using the laparoscopic e-TEP technique. Exclusion criteria were age < 18 or > 65 years; allergy to LA; history of chronic pain; continuous use of analgesics and corticosteroids; presence of sensory peripheral neuropathies; glycated hemoglobin > 6.5%; body mass index (BMI), > 40 kg/m^2; hernia and/or diastasis > 8 cm; surgical risk ASA > II. Patients who required TA Release during surgery were also excluded.

All patients were submitted to preoperative ultrasound to measure the size of the hernia defects and diastasis diameters. Baseline patient characteristics were also collected.

Patients presenting DRA-associated VH, primary or incisional, that did not meet the exclusion criteria were included in the analysis. Different types of VHs are presented, since the selection of patients was based on those who were candidates for the e-TEP technique as described, using the whole retromuscular space, not varying accordingly to the hernia size defect itself.

The patients were randomly divided into three groups, according to the analgesia protocols described below. The randomization technique used was alternate allocation, in which each patient was sequentially allocated to a group at the time of entry into the study, maintaining the same number of patients in each group.

General Anesthesia (*GA*) *group* (*n = 10*): Patients submitted to surgery under general anesthesia, associated with perioperative analgesia with dipyrone 2 g, magnesium sulfate 2 g, Toradol^R 30 mg administered intravenously and Nubain^R 10 mg administered subcutaneously, for an estimated 2 h surgery time.

US-TAPB group (*n = 10*): General anesthesia and perioperative analgesia as described for the GA group; associated with US-TAPB performed by the anesthetist at the end of the operation. Using a nerve block needle (50–100 mm needle and 0.8 mm gauge) and the lateral approach technique, a 20 mL injection of 0.5% ropivacaine[22] was made on each side of the abdominal wall (in a total volume of 40 mL), in the plane between the TA and internal oblique muscles.

DV-TAPB group (*n = 10*): General anesthesia and perioperative analgesia as described for the GA group; associated with intraoperatively DV-TAPB, performed by the surgeon. After dissection of the retromuscular plane, a 40 mL injection of 0.5% ropivacaine, using a laparoscopic aspirator and a 20 mL syringe, was made over the eight nerve plexuses of the anterior abdominal wall (T7–T10), under DV, distributing the same amount of LA to each side of the abdominal wall (20 mL). The injection of the LA was made close to the nerve plexuses, but without actually touching the nerves to avoid injury.

In this study, we describe the technique of injecting LA directly into the nerves of the anterior abdominal wall guided by laparoscopy. We found no mention in the literature of this type of analgesia, so we refer to it as DV TA Plane Block (DV-TAPB), given its similarity to traditional US-TAPB, since the LA injection is performed just above the TA muscle plane, and lateral to the injection site in the rectus sheath block analgesia [Figure 1].

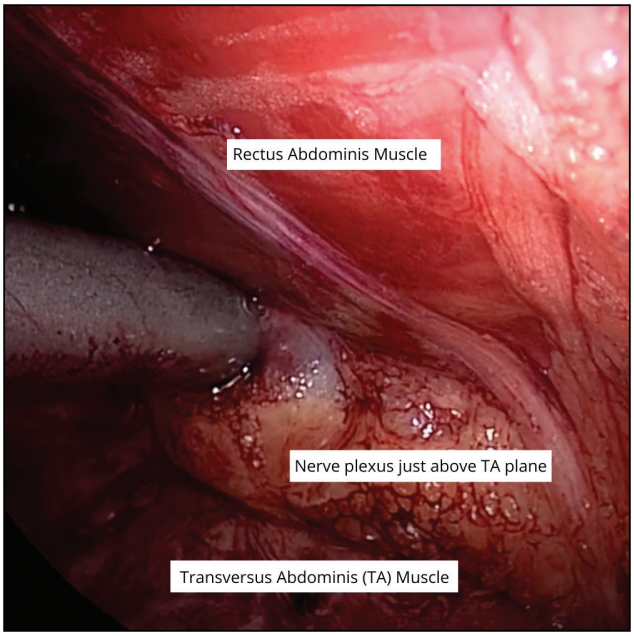

Figure 1: Site of LA injection: directly on the surface of the nerve plexuses, just above the TA muscle plane

The surgeries were performed by Daniel Mariano de Andrade M.D. and Fernando Athayde Veloso Madureira M.D. Each surgeon performed half of the surgeries for each group.

Surgical technique

The e-TEP technique was performed via the left lateral approach using three laparoscopic portals.

The dissection of the retromuscular plane was performed with hook forceps and monopolar energy, in order to separate the rectus abdominis muscle (anteriorly) from its posterior sheath (posteriorly). A superior "crossover" was completed and the dissection continued caudally, up to 7 cm from the lower limit of the hernia defect. The hernia sac was completely reduced. Laterally, the dissection progressed until the visualization of the four visceral afferent vascular-nervous bundles, located bilaterally just above the TA muscle plane [Figure 1].

Correction of accidental perforations of the posterior preperitoneal fascia was performed using absorbable Vicryl® 3.0 sutures. The hernia defect and supra-umbilical diastasis were repaired with continuous overlock suturing using V-loc™180®.

The dissected space was measured using a sterile plastic ruler and a polypropylene mesh was positioned completely open, across it. The mesh was not fixed.

Under DV and using a 20 mL syringe coupled to a laparoscopic aspirator, LA was injected as specified above [Figure 1].

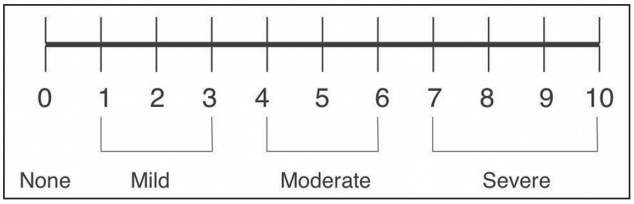

Figure 2: Numeric Rating Scale (NRS): 0 = no pain; 1–3 = mild pain; 4–6 = moderate pain; 7–10 = severe pain

Analgesia and postoperative care

During the first 24 h postoperative period, all patients received dipyrone 2 g intravenously every 4 h regularly, and tramadol 50 mg intravenously every 8 h on an SOS basis. All patients were instructed to use a surgical abdominal belt immediately after leaving the operating room. A bland oral diet was allowed two hours after surgery, and then patients were encouraged to sit and walk with assistance.

Pain measurement and LA administration time

Before surgery, all patients were trained to use the Numeric Rating Scale, where 0 indicates no pain and 10 represents the worst imaginable pain[23] [Figure 2].

Postoperative pain was assessed at 2 h, 6 h, and 24 h post-surgery, by direct verbal questioning.

LA administration time was also ascertained, comparing the GA, US-TAPB, and DV-TAPB groups.

Data tabulation and statistical analysis

Data were collected and tabulated in Excel® software (Microsoft). The study variables were categorized and analyzed in order to identify statistical differences between groups. For data analysis, central tendency (means) and variability (standard deviation) measures were calculated, being compared using the student *t* test for two independent samples and one-way ANOVA for three independent samples and for intragroup comparison of repeated measures. Comparison of differences between the proportions (relative frequencies) of categorical variables was performed using the chi-square test (χ^2) or Fisher's exact test (if applicable). Additionally, graphs were created to better visualize the results, such as box-plot graphs. All data analysis was performed using the statistical software SPSS 26.0 (Statistical Package for Science—Chicago, IL, 2019) with $P < 0.05$ differences being considered statistically significant.

Results

Thirty patients undergoing DRA-associated VH repair using laparoscopic e-TEP technique were included in the analysis.

Table 1: Baseline characteristics

Variable	GA (*n* = 10)	US-TAPB (*n* = 10)	DV-TAPB (*n* = 10)	*P* value
n (%)*				
Sex				
Female	6 (60%)	4 (40%)	5 (50%)	0.67
Male	4 (40%)	6 (60%)	5 (50%)	
(Mean/SD)**				
Age (years)	43.4 (9.5)	47.5 (12.7)	46.7 (12.9)	0.71
BMI (kg/m^2)	29.1 (4.3)	27.7 (3.9)	30.1 (5.0)	0.49

* Chi-Square test (Fisher's exact test, if necessary).
** One-way ANOVA test

Table 2: Classification of ventral hernia and diastasis according to the EHS (European Hernia Society)[1,32]

Classification of Ventral Hernia (EHS)[18]		GA	US-TAPB	DV-TAPB
Primary (*n* = 23)	*Location:*			
	Epigastric	0	2	2
	Umbilical	8	7	2
	Epigastric + Umbilical	0	0	2
	Size:			
	<2 cm	6	5	3
	2–4 cm	2	3	1
	>4 cm	0	1	2
Incisional (*n* = 7)	M2	0	0	2
	M3	2	1	2
	W1	1	1	4
	W2	1	0	0
	R	2	1	4
Classification of Diastasis (EHS)[1]				
D1		4	2	0
D2		6	8	10
H0		0	0	0
H1		10	10	10

No statistically significant differences in sex, age, or BMI were observed between groups [Table 1].

Preoperatively, five (50%) patients in the GA group, five (50%) in the US-TAPB group, and seven (70%) in the DV-TAPB group had abdominal pain. All patients reported aesthetic dissatisfaction due to midline bulging.

The proportion of incisional hernias in relation to primary hernias was higher in the DV-TAPB group: 4/10; 1/10 in the US-TAPB group; and 2/10 in the GA group [Table 2].

The mean hernia defect size was 1.52 cm in the GA group, 1.8 cm in the US-TAPB group, and 2.5 cm in the DV-TAPB group; the mean diastasis diameters were 3.3 cm, 3.8 cm, and 3.6 cm, respectively. Both measures showed no significant difference between groups [Table 3]. The mean incisional hernia defect size was 2.65 cm in the GA group, 2 cm in the US-TAPB group, and 1.95 cm in the DV-TAPB group.

Table 3: Operative and perioperative data

Variable	GA (*n* = 10)	US-TAPB (*n* = 10)	DV-TAPB (*n* = 10)	*P* value
*(Mean/SD)**				
Hernia defect size (width in cm)	1.5 (1.2)	1.8 (1.4)	2.5 (1.4)	0.25
Diastasis diameter (width in cm)	3.3 (1.5)	3.8 (0.9)	3.6 (0.5)	0.60
Operation time (min)	154.0 (40.9)	145.5 (51.2)	116.2 (69.8)	0.29
Mesh area (cm^2)	433.5 (110.6)	490.8 (160.2)	548.2 (185.0)	0.27

* One-way ANOVA test

Table 4: Postoperative pain assessment

Variables	GA (*n* = 10)	US-TAPB (*n* = 10)	DV-TAPB (*n* = 10))	*P* value*
(Mean/SD)				
NRS 2 h	5.3 (1.9)	4.7 (2.2)	1.0 (1.6)	0.001
NRS 6 h	3.6 (1.9)	4.1 (2.7)	1.4 (2.0)	0.02
NRS 24 h	3.6 (2.2)	1.2 (1.3)	1.1 (1.6)	0.01
P value**	0.01	0.19	0.11	

* One-way ANOVA test.
** One-way ANOVA test for repeated measures.
NRS 2 h: GA and US-TAPB groups: *P* value 0.52; GA and DV-TAPB groups: *P* value 0.0001; US-TAPB and DV-TAPB groups = *P* value 0.001.
NRS 6 h: GA and US-TAPB groups: *P* value 0.64; GA and DV-TAPB groups: *P* value 0.03; US-TAPB e DV-TAPB groups: *P* value 0.02.
NRS 24 h: GA and US-TAPB groups: *P* value 0.01; GA and DV-TAPB groups: *P* value 0.01; US-TAPB and DV-TAPB groups: *P* value 0.88

In the intraoperative evaluation, the mean surgical times for the three groups presented no statistical difference ($P = 0.29$). The mean area of the polypropylene mesh used also did not differ significantly between groups ($P = 0.27$), being 433.5 cm^2, 490.8 cm^2, and 548.2 cm^2 in the GA, US-TAPB and DV-TAPB groups, respectively [Table 3].

In the first 24 h postoperatively, there was a statistically significant difference in pain rating scores (PRS) between the three groups. At 2 h after surgery, the mean PRS were 5.3, 4.7, and 1, in the GA, US-TAPB, and DV-TAPB groups, respectively [Table 4], being significantly lower in the DV-TAPB group when compared to the other two groups ($P = 0.001$).

At 6 h postoperatively, the mean PRS reported by patients were 3.6, 4.1, and 1.4, in the GA, US-TAPB, and DV-TAPB groups, respectively, remaining significantly lower ($P = 0.02$) in the DV-TAPB group.

At 24 h postop, the mean PRS were 3.6, 1.2, and 1.1 in the GA, US-TAPB, and DV-TAPB groups, respectively. As such, the DV-TAPB group once again maintained the lowest mean PRS [Table 4], a statistically relevant result when the three groups were compared ($P = 0.01$).

In the paired statistical analysis of the three groups, different results were observed, depending on the postoperative period analyzed [Table 4].

At 2 h postop, no statistically significant difference was observed between the mean in the GA and US-TAPB groups ($P = 0.52$). However, when comparing the GA and DV-TAPB groups, a statistically significant lower PRS was observed in the DV-TAPB group ($P = 0.0001$). The same was observed when comparing the US-TAPB and DV-TAPB groups ($P = 0.001$), with greater pain relief observed in the DV-TAPB group.

At 6 h postop, there was still no statistically significant difference between the mean PRS for the GA and US-TAPB groups ($P = 0.64$). Consistently, a statistically significant difference was observed when comparing the DV-TAPB and GA group ($P = 0.03$) and the US-TAPB group ($P = 0.02$). These findings corroborate the better analgesic control provided by DV-TAPB at 6 h postoperatively.

At 24 h postop, however, a statistically significant difference was observed between the mean PRS reported by patients in the GA and US-TAPB ($P = 0.01$) and the DV-TAPB ($P = 0.01$) groups, being lower in the last two. The performance of the analgesia conferred by the US-TAPB was able to statistically match the result presented by the DV-TAPB ($P = 0.88$), despite the latter group still showing a tendency toward lower PRS at 24 h postop.

During the analysis of the medians and percentiles (P25 and P75) of the PRS reported at 2 h, 6 h, and 24 h postop, lower values were observed in the DV-TAPB group during the three postoperative moments analyzed [Figure 3]. Interestingly, analysis of medians also showed that at least 50% of patients in the DV-TAPB group reported a PRS equal to 0 at 2 h and 24 h postoperatively.

The mean time spent to induce general anesthesia did not vary significantly between the groups ($P = 0.89$). However, the mean time to perform US-TAPB postoperatively was 11.8 min (11 min and 45 s) while the meantime for DV-TAPB was 1.9 min (1 min and 53 s), approximately six times quicker, presenting a statistically significant difference ($P = 0.001$) between the two groups [Table 5].

The mean hospital discharge time after surgery was 19.6 h, 19.3 h, and 18.4 h for the GA, US-TAPB, and DV-TAPB groups, respectively, with no statistically significant difference observed ($P = 0.85$).

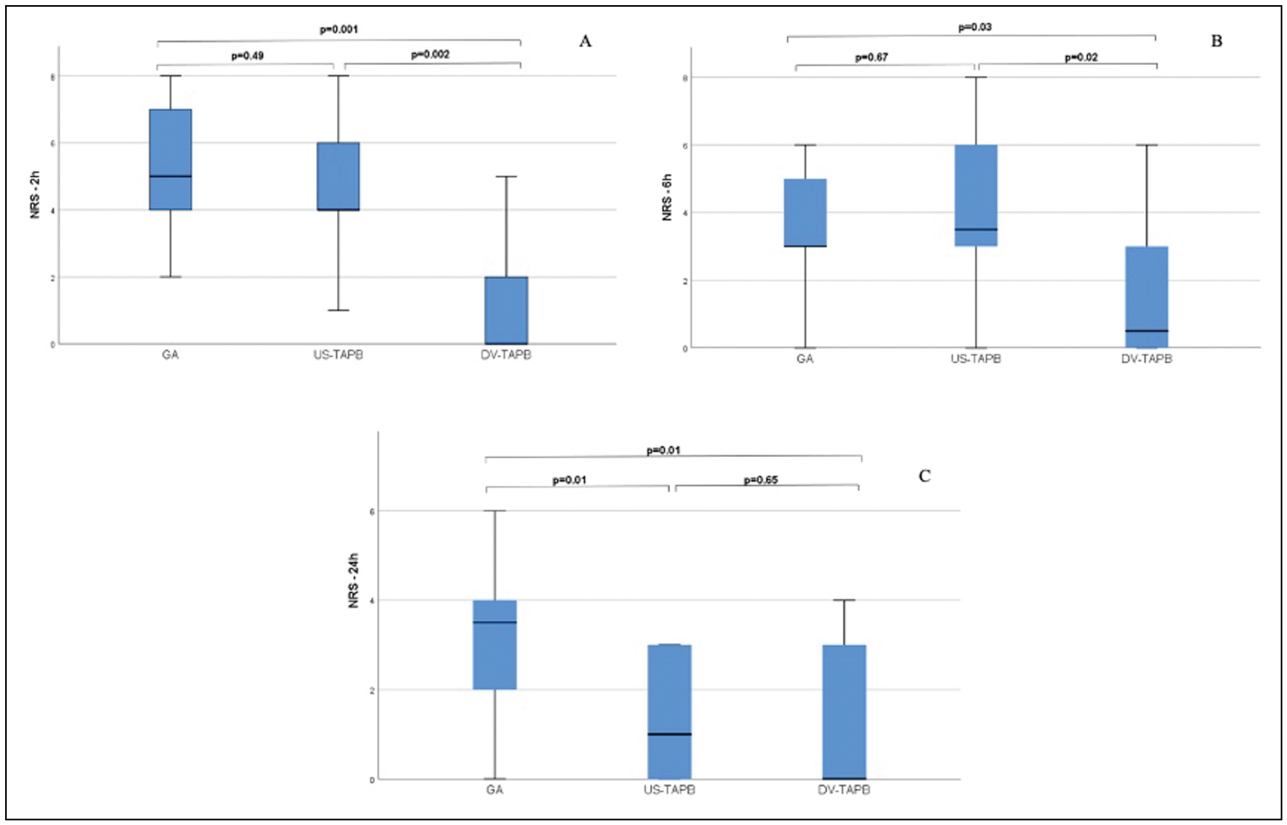

Figure 3: Pain score medians and percentiles. Graph A: GA group: (median: 5//P_{25}–P_{75}: 4–7); US-TAPB group: (median: 4//P_{25}–P_{75}: 4–6); DV-TAPB group: (median: 0//P_{25}–P_{75}: 0–2). Graph B: GA group: (median: 3// P_{25}–P_{75}: 3–5); US-TAPB group: (median: 3.5// P_{25}–P_{75}: 3–6); DV-TAPB group: (median: 0.5//P_{25}-P_{75}: 0–3). Graph C: GA group: (median: 3.5// P_{25}–P_{75}: 2–4); US-TAPB group: (median: 1//P_{25}–P_{75}: 0–3); DV-TAPB group: (median: 0//P_{25}–P_{75}: 0–3)

Only one patient in the GA group presented an estimated intraoperative bleeding > 100 mL, requiring the placement of a drain in the retromuscular space. The drain showed low output and was removed within 24 h. Only one patient in the US-TAPB group spent more than 24 h in the hospital after surgery, due to an anxiety crisis. One patient in the GA group, 2 patients in the US-TAPB group, and 0 patients in the DV-TAPB group had difficulty walking during the first 24 h after surgery. One patient in the GA group, two in the US-TAPB group, and one in the DV-TAPB group requested additional pain control medication, with tramadol 50 mg or morphine 8 mg being administered intravenously, in a single dose, followed by complete symptom relief [Figure 4].

No patient required hospital readmission, conversion to open surgery, or presented hernia or diastasis relapse [Figure 4]. During postoperative follow-up, over a period ranging from 3 months to 1 year, all patients reported satisfaction with the result of their surgery and having resumed their usual activities one month after surgery. No patient reported sustained chronic pain. Only one patient in the DV-TAPB group reported mild paresthesia in the anterior abdominal wall. Imaging tests did not reveal any surgical complications and the patient reported complete improvement of symptoms after four months.

Table 5: Time spent in anesthetic procedures

Variables	GA (*n* = 10)	US-TAPB (*n* = 10)	DV-TAPB (*n* = 10)	*P* value
(Mean/SD)				
Time spent in general anesthesia (min)	17 (12.52)	15.7 (15.65)	17.2 (8.73)	0.89*
Time spent in nerve block (min)	–	11.8 (3.15)	1.9 (0.34)	**0.001****

* One-way ANOVA test.
**Student's *t* test

Discussion

Currently, a number of options are available to correct DRA-associated VH, ranging from open to minimally invasive techniques, including robotic assisted.[24] Laparoscopic e-TEP is a promising technique, since it avoids transfacial fixation of the mesh, thus preventing chronic pain[10,25-27]; and allows the synthesis of the hernia defect, reducing complications and restoring the anatomy, function, and aesthetics of the abdominal wall.[28,29] However, it is a complex technique requiring an experienced laparoscopic surgeon, longer execution time[30], and optimal postoperative analgesia.

In this study, 30 patients underwent successful correction of DRA-associated VH employing laparoscopic e-TEP. The number of patients selected to participate in this study was determined by convenience sample since data in the literature are still scarce for this type of approach.

The baseline characteristics of the groups analyzed were homogeneous. The mean size of VH defects ranged from 1.54 cm to 2.7 cm. E-TEP should not be considered an exaggeration even in the repair of small VHs, since the placement of mesh reduces recurrence rates.[9,31]

Operation time varied from 116.2 min to 154 min, being slightly shorter than the reported in the literature (156 min–218 min). The shortest mean operation time was observed in the DV-TAPB group: 116.2 min (SD 69.2), with no statistical significance. Paradoxically, the largest

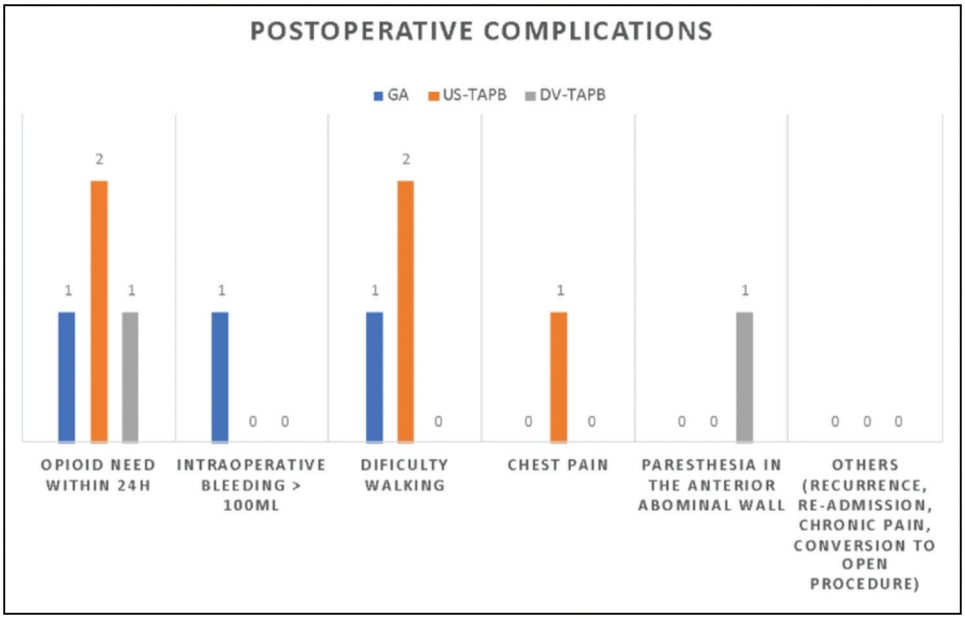

Figure 4: Postoperative complications

median diameter of DRA-associated VH and the largest median area of the meshes were also observed in the DV-TAPB group. Wider dissections, seeking to visualize the four nerve plexuses might explain this slight increase.

In this study, different forms of analgesia were administered. At 2 h postop, patients in the DV-TAPB group reported significantly less pain (1) than those in the GA group (5.3) ($P = 0.0001$). This finding reveals that e-TEP is not a pain-free technique and that this pain can be significantly reduced with DV-TAPB. Compared to GA and US-TAPB, DV-TAPB was able to significantly reduce PRS in 2 h ($P = 0.001$) and 06 h postop ($P = 0.02$).

As the postoperative period progressed, both the PRS and the difference between them decreased across the three groups. This can be explained by the natural improvement in pain control reported by patients as they move away from the surgical trauma. However, even with this trend, in all postoperative phases analyzed, DV-TAPB group reported the lowest PRS throughout the first 24 h postoperatively. Since the virtual retromuscular space created during surgical dissection takes time to completely collapse, LA remains "bathing" the nerves for a longer period of time. This fact can explain the better postoperative analgesia conferred by the DV-TAPB.

Furthermore, the mean LA administration time in the DV-TAPB group was approximately 6.2 times less compared to the US-TAPB group, suggesting that it is easier and faster to administer LA through DV. Effectively, the laparoscopic dissection of the retromuscular space generates greater technical difficulty for the anesthesiology team in finding the correct LA injection site postoperatively. This may also contribute to its lower accuracy.

Importantly, the better analgesia conferred by DV-TAPB in the first 24 h postop allows for earlier patient mobility and walking, thus preventing deep vein thrombosis, atelectasis and longer hospital stays, as shown by the mean postoperative discharge time of less than 24 h. These are important secondary gains of a more effective postoperative analgesia.

A limitation of this study was the performance of the surgeries by two different surgeons. Although both are experienced, this could generate differences in operation time and extent of the surgical dissection, which can affect postoperative PRS.

However, our study was able to statistically demonstrate the superiority of DV-TAPB when compared to other forms of analgesia, in all postoperative stages, being greater at 2 h. These results can provide evidence for developing postoperative analgesia protocols. Since this is a new form of analgesia proposed, we hope that further studies using a similar methodology will be able to replicate our results. Further research with a larger number of patients and larger VH defect areas and DRA diameters could also be performed to demonstrate this benefit in larger series and more complex cases, as well as going beyond the initial 24 h postoperative period.

Conclusion

The laparoscopic e-TEP technique is a relatively new and promising technique for DRA-associated VH repair. DV-TAPB was more effective for postoperative analgesia, when compared to US-TAPB and GA alone, offering the lowest mean PRS, presenting statistical significance. This benefit was observed both earlier and later on. DV-TAPB was faster and easier to perform than postoperative US-TAPB.

Author contributions

All authors contributed significantly to the research and manuscript. DMA and FAVM performed the surgeries, and all authors participated in the surgeries. AC performed the statistical analysis. All authors read and approved the final manuscript.

Ethical policy and institutional review board statement

The study was approved by The Research Ethics Committee of the Gaffréé e Guinle University Hospital (Version 2; CAAE: 66449322.4.0000.5258; Project Approval Number: 5.915.842, dated on Feb 28th, 2023). The procedures used in this study adhere to the tenets of the Declaration of Helsinki.

Declaration of patient consent

All patients signed an informed consent form agreeing to participate in the study, with its risks and benefits being explained, as well as the future use of health-related data for research.

Data availability statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Financial support and sponsorship

Nil.

Conflict of interest

There is no conflict of interest.

References

1. Hernández-Granados P, Henriksen NA, Berrevoet F, Cuccurullo D, López-Cano M, Nienhuijs S, *et al*. European Hernia Society

guidelines on management of rectus diastasis. Br J Surg 2021;108:1189-91.
2. Cavalli M, Aiolfi A, Bruni PG, Manfredini L, Lombardo F, Bonfanti MT, *et al*. Prevalence and risk factors for diastasis recti abdominis: A review and proposal of a new anatomical variation. Hernia 2021;25:883-90.
3. Kaufmann RL, Reiner CS, Dietz UA, Clavien PA, Vonlanthen R, Käser SA. Normal width of the linea alba, prevalence, and risk factors for diastasis recti abdominis in adults, a cross-sectional study. Hernia 2022;26:609-18.
4. Köhler G, Luketina RR, Emmanuel K. Sutured repair of primary small umbilical and epigastric hernias: concomitant rectus diastasis is a significant risk factor for recurrence. World J Surg 2015;39:121-6; discussion 127.
5. Penchev D, Kotashev G, Mutafchiyski V. Endoscopic enhanced-view totally extraperitoneal retromuscular approach for ventral hernia repair. Surg Endosc 2019;33:3749-56.
6. Benjamin DR, Frawley HC, Shields N, van de Water ATM, Taylor NF. Relationship between diastasis of the rectus abdominis muscle (DRAM) and musculoskeletal dysfunctions, pain and quality of life: A systematic review. Physiotherapy. 2019;105:24-34.
7. Doubkova L, Andel R, Palascakova-Springrova I, Kolar P, Kriz J, Kobesova A. Diastasis of rectus abdominis muscles in low back pain patients. J Back Musculoskelet Rehabil 2018;31:107-12.
8. Joueidi Y, Vieillefosse S, Cardaillac C, Mortier A, Oppenheimer A, Deffieux X, *et al*. Impact du diastasis des muscles droits de l'abdomen sur les symptômes pelvi-périnéaux: revue de la littérature [Impact of the diastasis of the rectus abdominis muscles on the pelvic-perineal symptoms: Review of the literature]. Prog Urol 2019;29:544-59.
9. Daes J. The enhanced view-totally extraperitoneal technique for repair of inguinal hernia. Surg Endosc 2012;26:1187-9.
10. Belyansky I, Daes J, Radu VG, Balasubramanian R, Reza Zahiri H, Weltz AS, *et al*. A novel approach using the enhanced-view totally extraperitoneal (eTEP) technique for laparoscopic retromuscular hernia repair. Surg Endosc 2018;32:1525-32.
11. Prakhar G, Parthasarathi R, Cumar B, Subbaiah R, Nalankilli VP, Praveen Raj P, *et al*. Extended View: Totally Extra Peritoneal (e-TEP) Approach for Ventral and Incisional Hernia-Early results from a single center. Surg Endosc 2021;35:2005-13.
12. Khetan M, Dey A, Bindal V, Suviraj J, Mittal T, Kalhan S, *et al*. e-TEP repair for midline primary and incisional hernia: technical considerations and initial experience. Hernia. 2021;25:1635-46.
13. Kumar N, Palanisamy NV, Parthasarathi R, Sabnis SC, Nayak SK, Palanivelu C. A comparative prospective study of short-term outcomes of extended view totally extraperitoneal (e-TEP) repair versus laparoscopic intraperitoneal on lay mesh (IPOM) plus repair for ventral hernia. Surg Endosc 2021;35:5072-7.
14. Bui NH, Jørgensen LN, Jensen KK. Laparoscopic intraperitoneal versus enhanced-view totally extraperitoneal retromuscular mesh repair for ventral hernia: A retrospective cohort study. Surg Endosc 2022;36:1500-6.
15. Quezada N, Grimoldi M, Besser N, Jacubovsky I, Achurra P, Crovari F. Enhanced-view totally extraperitoneal (eTEP) approach for the treatment of abdominal wall hernias: mid-term results. Surg Endosc 2022;36:632-9.
16. Baig SJ, Priya P. Extended totally extraperitoneal repair (eTEP) for ventral hernias: Short-term results from a single centre. J Minim Access Surg 2019;15:198-203.
17. Holihan JL, Nguyen DH, Nguyen MT, Mo J, Kao LS, Liang MK. Mesh Location in open ventral hernia repair: A systematic review and network meta-analysis. World J Surg 2016;40: 89-99.
18. Rafi AN. Abdominal field block: A new approach via the lumbar triangle. Anaesthesia 2001;56:1024-6.
19. Mavarez AC, Hendrix JM, Ahmed AA. Transabdominal Plane Block. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023.
20. Gao T, Zhang JJ, Xi FC, Shi JL, Lu Y, Tan SJ, *et al*. Evaluation of transversus abdominis plane (TAP) Block in Hernia Surgery: A Meta-analysis. Clin J Pain 2017;33:369-75.
21. Paasch C, Fiebelkorn J, De Santo G, Aljedani N, Ortiz P, Gauger U, *et al*. Ultrasound-versus visual-guided transversus abdominis plane block prior to transabdominal preperitoneal ingunial hernia repair. A retrospective cohort study. Ann Med Surg (Lond) 2020;59:281-5.
22. Liang M, Chen Y, Zhu W, Zhou D. Efficacy and safety of different doses of ropivacaine for laparoscopy-assisted infiltration analgesia in patients undergoing laparoscopic cholecystectomy: A prospective randomized control trial. Medicine (Baltim) 2020;99:e22540.
23. Karcioglu O, Topacoglu H, Dikme O, Dikme O. A systematic review of the pain scales in adults: Which to use? Am J Emerg Med 2018;36:707-14.
24. Morrell ALG, Morrell AC, Cavazzola LT, Pereira GSS, Mendes JM, Abdalla RZ, *et al*. Robotic assisted eTEP ventral hernia repair: Brazilian early experience. Hernia. 2021;25:765-74.
25. Nervil GG, Paulsen JF, Kalstrup J, Deigaard S, Herbst I, Lambaa S, *et al*. Simple plication alleviates physical symptoms in patients with post-gestational rectus diastasis. Hernia. 2023;27:957-68.
26. Vermeulen J, Alwayn I, Stassen LP. Prolonged abdominal wall pain caused by transfascial sutures used in the laparoscopic repair of incisional hernia. Surg Endosc 2003;17:1497.
27. Weltz AS, Sibia US, Zahiri HR, Schoeneborn A, Park A, Belyansky I. Operative Outcomes after open abdominal wall reconstruction with retromuscular mesh fixation using fibrin glue *versus* transfascial sutures. Am Surg 2017;83:937-42.
28. Earle D, Roth JS, Saber A, Haggerty S, Bradley JF, 3rd, Fanelli R, *et al*; SAGES Guidelines Committee. SAGES guidelines for laparoscopic ventral hernia repair. Surg Endosc 2016;30: 3163-83.
29. Tandon A, Pathak S, Lyons NJ, Nunes QM, Daniels IR, Smart NJ. Meta-analysis of closure of the fascial defect during laparoscopic incisional and ventral hernia repair. Br J Surg 2016;103:1598-607.
30. Taşdelen HA. Comparison of outcomes of the extended-view totally extraperitoneal rives-stoppa (eTEP-RS) and the intraperitoneal onlay mesh with defect closure (IPOM-plus) for W1-W2 midline incisional hernia repair-a single-center experience. Surg Endosc 2023;37:3260-71.
31. Mitura K, Skolimowska-Rzewuska M, Rzewuska A, Wyrzykowska D. Is mesh always necessary in every small umbilical hernia repair? Comparison of standardized primary sutured versus patch repair: retrospective cohort study. Hernia. 2021;25: 571-7.
32. Muysoms FE, Miserez M, Berrevoet F, Campanelli G, Champault GG, Chelala E, *et al*. Classification of primary and incisional abdominal wall hernias. Hernia. 2009;13:407-14.