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Original Article

Laparoscopic Management of Ventral Hernias by Totally Extraperitoneal (eTEP) Approach: Initial Experience and Short-Term Results

Manejo laparoscópico de las hernias ventrales mediante abordaje totalmente extraperitoneal (eTEP): experiencia inicial y resultados a corto plazo

Manejo laparoscópico de hérnias ventrais usando uma abordagem totalmente extraperitoneal (eTEP): experiência inicial e resultados em curto prazo

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ABSTRACT

Introduction. Managing ventral hernia remains a challenge for surgeons. Repairing it using minimally invasive techniques, such as laparoscopic totally extraperitoneal (eTEP), which allows for a wide dissection of the space to be repaired, faster postoperative recovery, less postoperative pain and shorter hospital stay. The eTEP approach is a novel technique that focus on the uses of the retromuscular space to place prosthetic material and strengthen the abdominal wall. The objective is to describe the short-term results of our initial experience with the eTEP technique in the management of ventral hernias. **Methodology.** Observational, descriptive, retrospective, study, which included patients with a diagnosis of ventral hernia, undergoing laparoscopic eTEP surgery, between July-2021 and June-2022. **Results.** Of a total of 21 patients, 61.9% were men. 47.6% were overweight and 52.4% were obese. Average hospital stay: 1.6 days. 66.7% were incisional hernias. The surgical techniques performed were: Rives-Stoppa (71.4%) with associated transversus abdominis muscle release in 28.6%. 19% of the patients presented global complications and only one was severe, requiring surgical reintervention. The presence of clinical seroma was observed in 9.5% and ultrasound in 57.1%. There was no evidence of hematomas, surgical wound infection or cases of hernia recurrence. **Discussion and conclusions.** The laparoscopic-eTEP Rives-Stoppa approach, associated or not with posterior separation of components, in the management of ventral hernias offers good results with a low incidence of postoperative complications, short hospital stay, low incidence of hernia recurrences, so it could be considered a safe and effective technique in the treatment of ventral hernias.

Keywords:
Hernia, Ventral; Incisional Hernia; Hernia, Abdominal; Laparoscopy; Hernia.

RESUMEN

Introducción. El manejo de la hernia ventral sigue siendo un desafío para los cirujanos. Su reparación mediante técnicas mínimamente invasivas, como la totalmente extraperitoneal (eTEP) laparoscópica, permite una amplia disección del espacio a reparar, una recuperación postoperatoria más rápida, menor dolor postoperatorio y estancia hospitalaria. El abordaje eTEP es un enfoque novedoso que utiliza el espacio retromuscular para colocar material protésico y fortalecer la pared abdominal. El objetivo es describir los resultados a corto plazo de nuestra experiencia inicial con la técnica eTEP en el manejo de las hernias ventrales. **Metodología.** Estudio observacional, descriptivo, retrospectivo, donde se incluyen pacientes con el diagnóstico de hernia ventral, sometidos a cirugía laparoscópica-eTEP, entre julio-2021 y junio-2022. **Resultados.** De un total de 21 pacientes, el 61.9% fueron hombres. El 47.6% tenían sobrepeso y el 52.4% obesidad. Estancia hospitalaria media: 1.6 días. El 66.7% fueron hernias incisionales. Las técnicas quirúrgicas realizadas fueron: Rives-Stoppa (71.4%) asociándose liberación del músculo transverso en el 28.6%. El 19% de los pacientes presentaron complicaciones globales y solo uno fue grave, requiriendo reintervención quirúrgica. Se observó la presencia de seroma clínico en el 9.5% y ecográfico en 57.1%. No se evidenciaron hematomas, infección de herida quirúrgica ni casos de recidiva herniaria. **Discusión y conclusiones.** El abordaje laparoscópico eTEP Rives-Stoppa, asociado o no a separación posterior de componentes, en el manejo de las hernias ventrales ofrece buenos resultados asociando una baja incidencia de complicaciones postoperatorias, corta estancia hospitalaria, baja incidencia de recidivas herniarias, por lo que podría considerarse una técnica segura y efectiva en el tratamiento de las hernias ventrales.

Palabras clave:
Hernia Ventral; Hernia Incisional; Hernia Abdominal; Laparoscopia; Hernia.

RESUMO

Introdução. O manejo da hérnia ventral continua sendo um desafio para os cirurgiões. Seu reparo por meio de técnicas minimamente invasivas, como a totalmente extraperitoneal (eTEP) laparoscópica, permite ampla dissecção do espaço a ser reparado, recuperação pós-operatória mais rápida, menor dor pós-operatória e menor tempo de internação. A abordagem eTEP é uma nova abordagem que usa o

espaço retromuscular para colocar material protético e fortalecer a parede abdominal. O objetivo é descrever os resultados de curto prazo de nossa experiência inicial com a técnica eTEP no manejo de hérnias ventrais. **Metodologia.** Estudo observacional, descritivo, retrospectivo, longitudinal, que inclui pacientes com diagnóstico de hérnia ventral, submetidos a cirurgia laparoscópica-eTEP, entre julho-2021 e junho-2022. **Resultados.** De um total de 21 pacientes, 61.9% eram homens; 47.6% estavam com sobrepeso e 52.4% obesos. Tempo médio de internação: 1.6 dias; 66.7% eram hérnias incisionais. As técnicas cirúrgicas realizadas foram: Rives-Stoppa (71.4%) associada à liberação do músculo transverso em 28.6%. 19% dos pacientes apresentaram complicações globais e apenas um foi grave, necessitando de reintervenção cirúrgica. A presença de seroma clínico foi observada em 9.5% e ultrassonográfica em 57.1%. Não houve evidência de hematoma, infecção de ferida cirúrgica ou casos de recidiva de hérnia. **Discussão e conclusões.** A abordagem laparoscópica eTEP Rives-Stoppa, associada ou não à separação posterior dos componentes, no manejo das hérnias ventrais oferece bons resultados associando baixa incidência de complicações pós-operatórias, curto tempo de internação, baixa incidência de recidivas de hérnias, pelo que pode ser considerada uma técnica segura e eficaz no tratamento das hérnias ventrais.

Palavras-chave:
Hérnia Ventral; Hérnia Incisional; Hérnia Abdominal; Laparoscopia; Hérnia.

Introduction

Repair of ventral hernias is one of the most frequently performed procedures in general surgery. The incidence of incisional hernias after laparotomies varies from 9% to 22%, depending on the type of laparotomy, the type of surgery, and the patient's condition, among others. The risk of recurrence increases with each failed repair, also increasing the complexity of the next surgery (1,2). Currently, there are several options available for the management of this pathology, ranging from various techniques using open surgery to minimally invasive techniques. This diversity of techniques makes decision making even more difficult (3).

The main concern of the open approach to ventral hernias remains those related to the surgical wound (infections, hematomas, seromas, infections of the prosthetic material). The open approach is associated with surgical complication rates of up to 25% caused by surgical site infections, six-month recurrence rates of up to 13%, longer hospital stay and increased postoperative pain (4,5).

The use of minimally invasive techniques (both laparoscopic and robotic) in the treatment of ventral hernias (primary or secondary) is currently at its peak. These techniques allow a wide dissection of the space to be repaired, faster postoperative recovery, less postoperative pain, shorter hospital stay and better aesthetic results (6-8).

Minimally invasive ventral hernia repair has its beginnings in 1993 with LeBlanc et al. (9), who described the laparoscopic intraperitoneal onlay mesh repair (IPOM) technique, which has an exponential growth because it offered a faster postoperative recovery and less severe surgical wound complications compared to open surgery (9).

Subsequently, Agarwal et al. (10) presented a modification of the IPOM technique by adding the closure of the hernia defect (IPOM plus), which improved the results in terms of reduction of postoperative seromas, recurrence rate and bulging (10-12).

However, there are complications related to intraperitoneal onlay mesh placement (IPOM or IPOM-plus), such as adhesions of intestinal loops to the mesh and fistulas (13,14). Moreover, mesh fixation during IPOM or IPOM plus repair using tackers is known to produce high levels of postoperative pain and sometimes chronic pain requiring additional surgery to remove the tackers (15).

It is due to this type of short and long term complications that innovations continue to be made with the intention of improving the surgical technique and achieving better results for the patients, which is how the laparoscopic exploration of the retromuscular-preperitoneal space for the management of complex ventral or inguinal hernias arises. In 2012, Dr. J. Daes described a novel minimally invasive technique of enhanced-vision retromuscular-extraperitoneal space exploration (eTEP), which expands the surgical field compared to the conventional totally extraperitoneal (TEP) approach procedure, allowing entry into the preperitoneal or retromuscular (retrorectal) space from any part of the anterior abdominal wall, as well as allowing additional space for dissection of more complex hernias (16).

Subsequently, Belyansky et al. (17) recommended the eTEP approach in the management of ventral hernias in order to achieve an anatomical repair with a mesh in a retromuscular position (sublay), which can be extended from the epigastrium to the pubis (Retzius space), and laterally between both semilunar lines, being able to extend

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laterally in cases in which it is necessary by performing a transversus abdominis muscle release (TAR). In addition, the eTEP approach allows the use of polypropylene meshes, which are less expensive than composite meshes and are placed in a position that avoids contact with the intestinal loops, thus minimizing complications such as adhesions and fistulas. It also allows the restoration or plication of the linea alba, in those cases associated with diastasis of the rectus abdominis. However, it requires the surgeon to be very well trained in advanced laparoscopy, with experience in intracorporeal suturing and with a thorough knowledge of the anatomy of the abdominal wall (6,17).

The aim of this study is to describe our initial experience with the minimally invasive technique of enhanced-vision retromuscular-extraperitoneal space exploration in the management of ventral hernias, both primary and incisional, outlining the modifications we have made to the classic technique and to describe our short-term results.

What is known on the topic?

- The incidence of incisional hernias after laparotomies varies from 9 to 22%, depending on the type of laparotomy.
- There are several surgical options for the management of ventral hernias, from the classic open technique to the new minimally invasive techniques.
- The open approach is associated with a high incidence of postoperative complications, most of them related to the surgical site, in addition to increased postoperative pain and hospital stay.
- Minimally invasive techniques such as eTEP are currently becoming popular; however, they are technically more difficult with a long learning curve that can lead to a higher incidence of postoperative complications.

Methodology

Observational, descriptive, retrospective, longitudinal study, including adult patients treated in the General Surgery Department of the Hospital Medina del Campo, Valladolid, Spain, during the period between July-2021 and June-2022, who met the following inclusion criteria:

- Eighteen years of age or older.
- Patients diagnosed with ventral hernia: primary or incisional.
- Patients undergoing surgical treatment by laparoscopic eTEP approach.

Exclusion criteria:

- Patients with contraindication for general anesthesia, since without this type of anesthesia it is impossible to perform laparoscopic eTEP eventroplasty.

The following variables were analyzed: sex, age, body mass index (BMI), ASA classification, pathological history, type of ventral hernia (primary or incisional), presence of diastasis of the rectus abdominis, presence of another type of associated hernia, previous surgeries, size of the hernia defects according to computed tomography (CT), location of the defects according to the European Hernia Society (EHS) classification, type of surgical technique performed, surgical times, postoperative hospital stay, complications (according to Clavien-Dindo classification) and follow-up.

The statistical program SPSS version 26 (IBM, Chicago, IL, USA) was used. Qualitative variables were expressed using a frequency distribution. Continuous quantitative variables were expressed as mean and standard deviation, and discrete variables as median and range, as measures of central trend and dispersion, respectively.

Below, we describe the technical steps used by our group in the performance of laparoscopic eTEP repair of ventral hernias:

1. The patient is submitted to general anesthesia and then placed in the supine decubitus position with arms close to the body and legs closed. Bladder catheterization is performed in all cases.
2. Preoperative ultrasound of the abdominal wall is performed to delimit the hernia defect and mark the anatomical references, mainly the lateral borders of the rectus abdominis, which will be the references for the position of the working ports. (Figure 1).
3. Depending on the size of the hernia defect and whether or not it is associated with other lateral or inguinal defects, 3 to 5 working ports are used. The first incision is made in the left hypochondrium (under the costal ridge) on the lateral border of the left rectum, opening the anterior lamina and introducing the dissecting balloon through the retromuscular space to the pubis, under direct vision and taking care not to injure the epigastric vessels or the vascular-nerve bundles laterally. Subsequently, another similar incision is made in the right hypochondrium and the same maneuver previously described is performed (modification to the classic technique: balloon dissection of the right retromuscular space). (Figure 1)

4. Next, 2 more trocars are placed in the left lateral abdominal wall (1×12 mm in the left flank and 1×5 mm in the left iliac fossa), just at the lateral border of the left rectus, taking care not to injure the vascular-nerve bundles. (Figure 1)

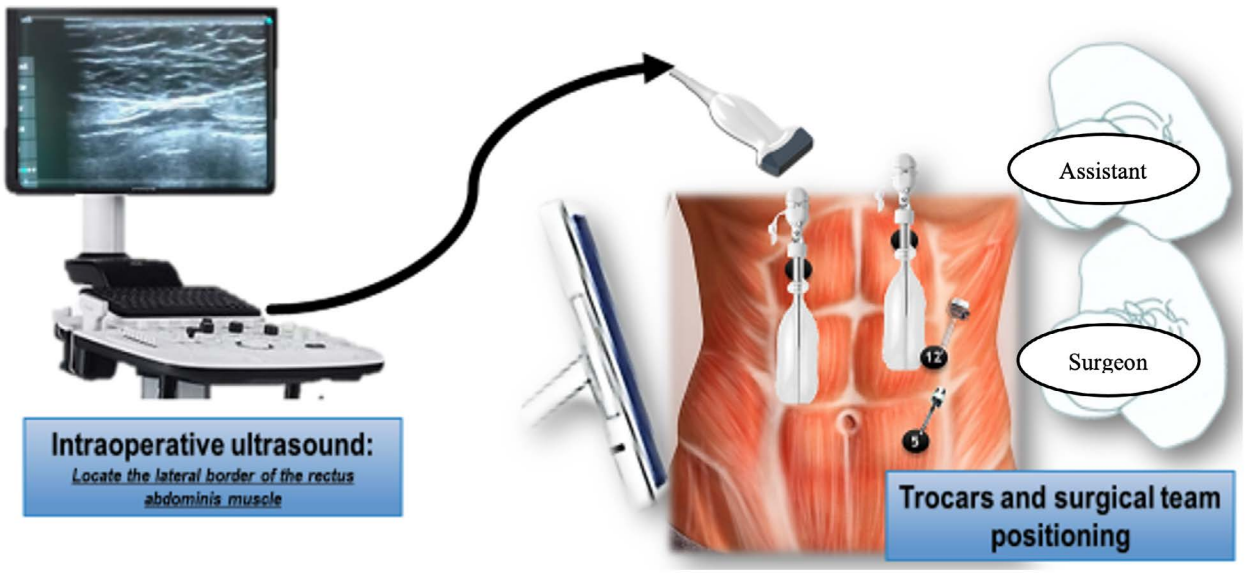

Figure 1. Preoperative ultrasound and positioning of the surgical team and working ports.
Source: elaborated by the authors.

5. Supraumbilical cross-over: it starts with the section of the medial part of the posterior lamina of the left rectum, more or less 1 cm from the linea alba, then dissecting over the preperitoneal fat of the falciform ligament until the visualization and opening of the contralateral posterior lamina to complete the dissection of the contralateral retromuscular space. (Figure 2)

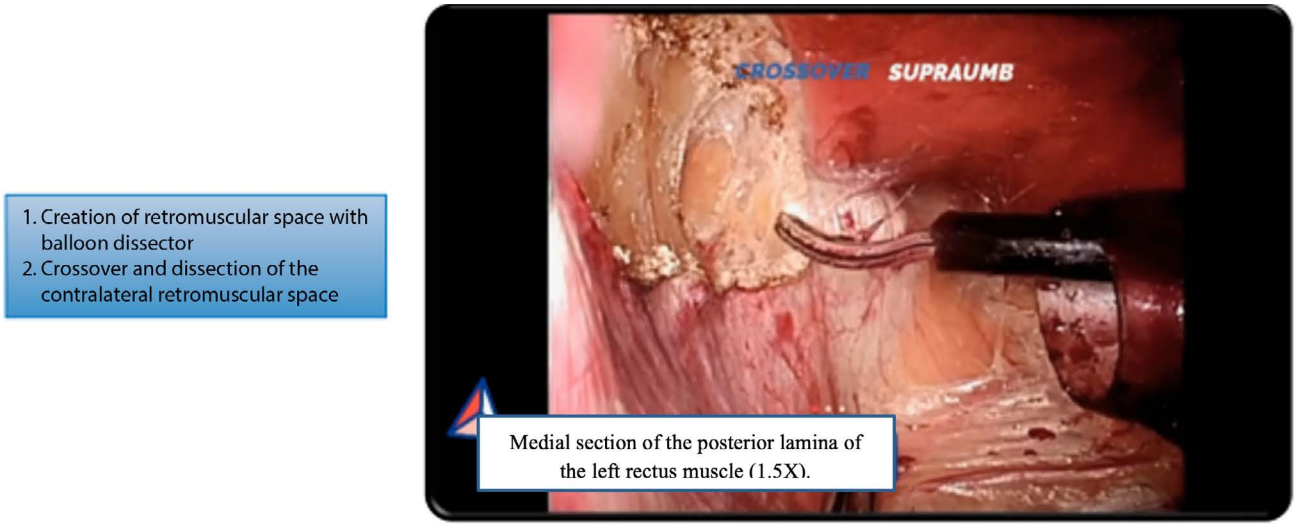

Figure 2. Steps to perform supraumbilical crossover.
Source: elaborated by the authors.

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6. Dissection of the hernial sac and opening of the hernial sac is continued in some cases to release adhesions to the hernia defect. The dissection continues towards the pubis dissecting the Retzius space. (Figure 3)

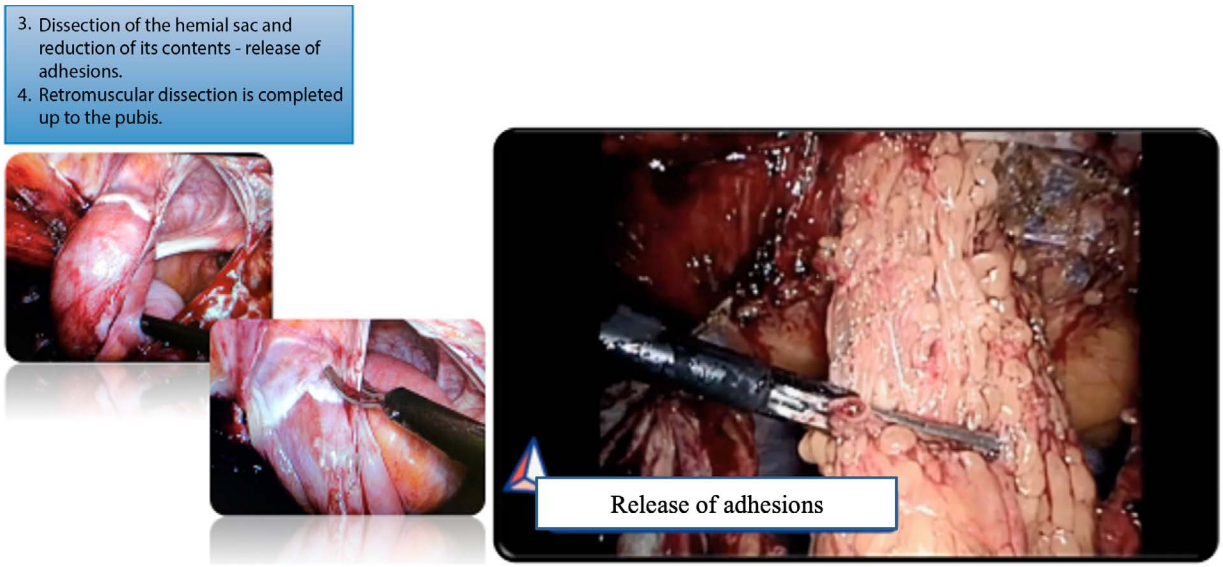

Figure 3. Dissection of the hernia sac, release of adhesions and dissection up to the pubic region. **a.** Release of intestinal loop adhered to the hernial sac. **b.** Complete release of hernial sac and adherent intestinal loops.
Source: elaborated by the authors.

7. Transversus abdominis muscle release (TAR): In cases with large hernia defects (>8 cm) and/or associated with lateral defects, transversus abdominis muscle release (uni or bilateral) is performed. The right hemiTAR is performed in an up-to-down approach because of its greater ergonomics due to the position of the trocars. This procedure begins with the section of the posterior lamina of the right rectum at its lateral border just before the vascular-nerve bundles, followed by section of the transverse muscle and completion of the dissection of the preperitoneal space.

8. The next step is the closure of the hernia defect (anterior sheath) and plication of the diastasis (if required), which is initially performed down-to-up above the umbilical area and then completed up-to-down. A 0 barbed suture (Stratafix®) is used, with ½ needle of 36 mm. (Figure 4)

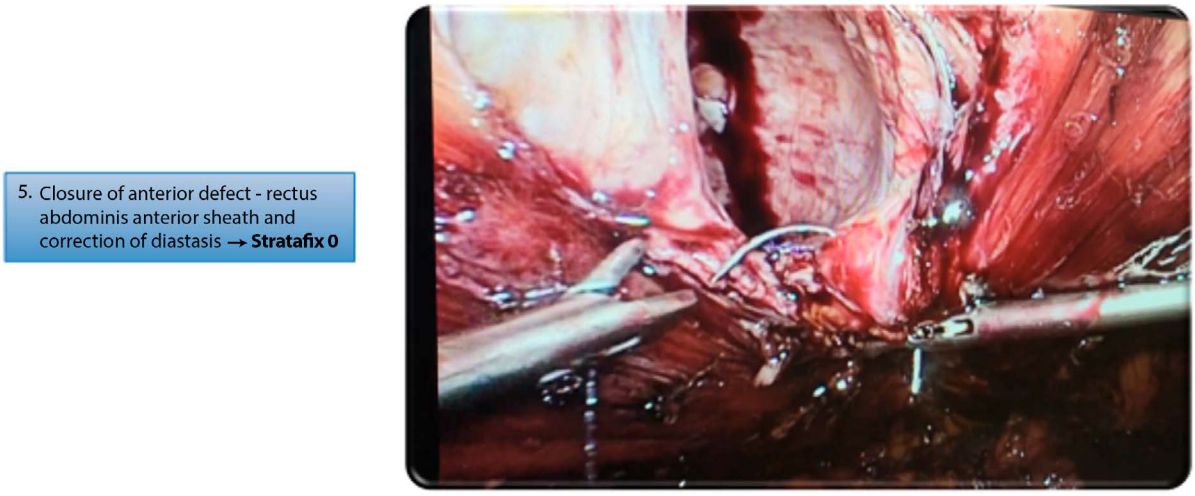

Figure 4. Closure of the anterior abdominal wall (hernia defect) and plication of the linea alba.
Source: elaborated by the authors.

9. Next, tension-free closure of the posterior sheath is performed using 2-0 barbed suture (V-Lock®) with ½ needle of 26 mm. As with the previous sheath, a down-to-up closure is performed initially and then the up-to-down closure is completed. (Figure 5)

10. Measurement of the dissected retromuscular-preperitoneal space: the maximum longitudinal and transverse diameters are measured with the help of a spinner.

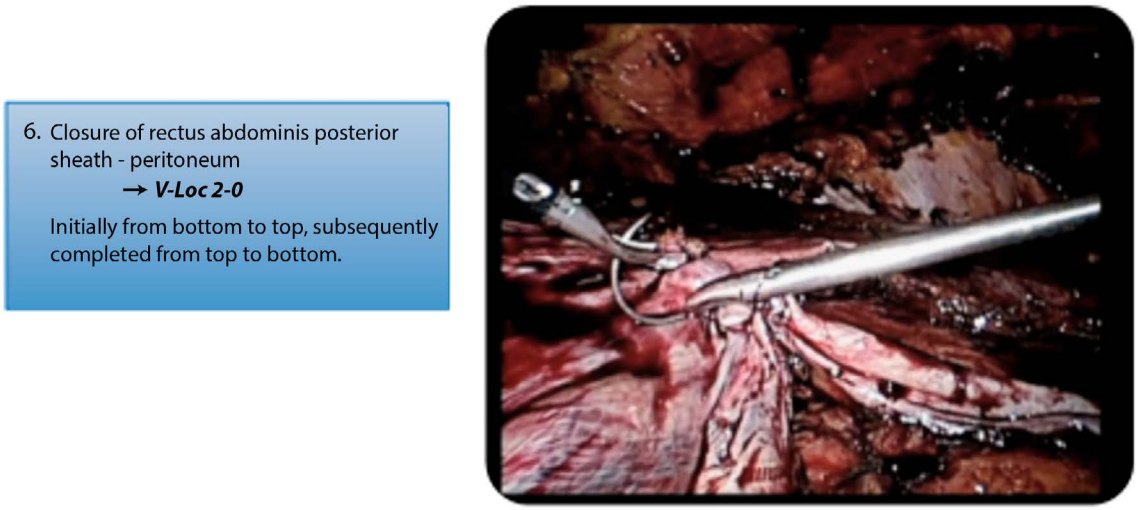

Figure 5. Closure of the posterior abdominal wall (posterior rectus sheath and/or peritoneum)
Source: elaborated by the authors.

11. The mesh is then prepared (usually low density polypropylene) according to the dimensions previously obtained and is introduced through the 12 mm trocar. Atraumatic fixation systems are used: fibrin or cyanoacrylate. The mesh should cover the entire midline and the lateral trocar holes. In some cases, as in bilateral TAR, aspiration drainage is usually left in place. (Figure 6)

12. Finally, a controlled desufflation is performed under vision and the closure of aponeurotic defects of the 12 mm trocars is performed.

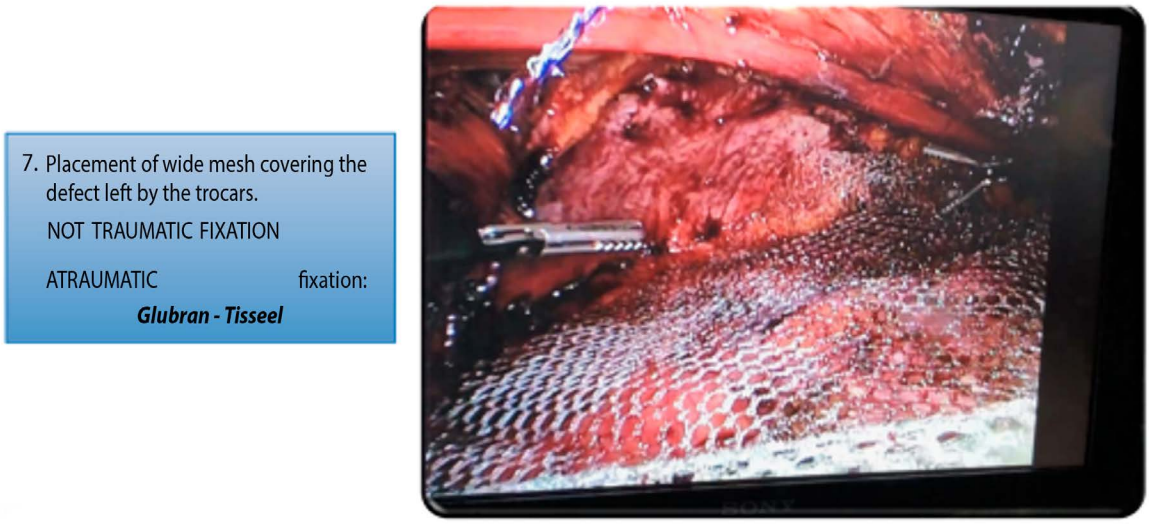

Figure 6. Placement of prosthetic material with/without atraumatic fixation.
Source: elaborated by the authors.

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Results

During the study period described above, a total of 22 patients underwent surgery using the laparoscopic eTEP approach; one patient was excluded because it was not possible to complete the surgery using the eTEP approach. Of these, 13 patients (61.9%) were men and 8 (38.1%) were women. The mean postoperative stay was 1.6 days. A total of 10 patients (47.6%) were overweight and 11 (52.4%) obese; the remaining comorbidities are described in the attached table. (Table 1)

Table 1. Demographic and clinical characteristics.

	N	%
	21	100%
Men / Women	♂ 13 / ♀ 8	♂ 61.9% / ♀38.1%
Age	64 years	IQR: 44 - 74 years
Post-surgical hospital stay	1.6 ± 0.67 days	1 - 3 days
BMI (kg/m^2)	30.6 ± 4.5 kg/m^2	
Monitoring	179 days	IQR: 96 - 254 days
ASA Classification		
I	6	28.6%
II	10	47.6%
III	5	23.8%
Comorbidities		
Overweight	10	47.6%
Obesity	11	52.4%
Prior abdominal surgeries	14	66.7%
Dyslipidemia	12	57.1%
High blood pressure	10	47.6%
Smoking	4	19%
Diabetes mellitus	4	19%
Cardiovascular disease	3	14.3%
Respiratory pathology	3	14.3%
Alcohol consumption	2	9.5%

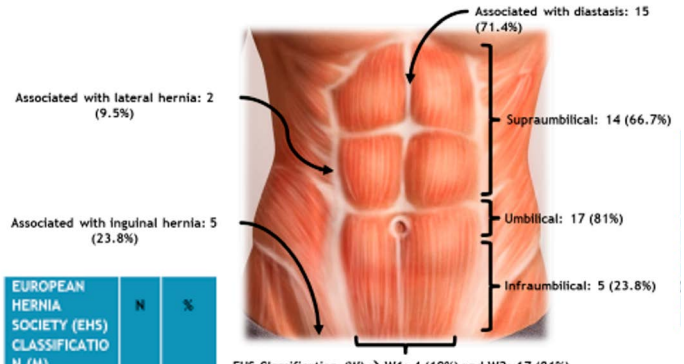
Source: elaborated by the authors.

Of the patients who underwent surgery, a total of 7 patients (33.3%) had primary hernias and 14 (66.7%) had incisional hernias. All hernias were located in the midline, in 5 patients (23.8%) there were also associated inguinal hernias and in 2 (9.5%) lateral hernias. In 6 patients (28.6%) botulinum toxin was used preoperatively (4 weeks before surgery) as an adjuvant to facilitate surgery (Table 2) (Figure 7).

Table 2. Preoperative clinical and radiological characteristics.

	N	%
Type of hernia		
Primary	7	33.3%
Incisional	14	66.7%
Location		
Midline	21	100%
Associated with lateral hernia	2	9.5%
Associated with inguinal hernia	5	23.8%
Size of the hernia defect		
Transverse diameter (maximum)	6 cm	RIQ: 4 – 7.6cm
Longitudinal diameter (∑)	4 cm	RIQ: 3.5 – 9.75cm
Preoperative botulinum toxin	6	(28.6%)
200 UI	1	4.8%
400 UI	5	23.8%
Associated with diastasis	15	71.4%
Distance between rectus abdominis	5.1 ± 1.6 cm	3 – 8 cm
D1 (>2-3cm)	3	14.3%
D2 (>3-5cm)	5	23.8%
D3 (>5cm)	7	33.3%
Type of diastasis		
T1	1	4.8%
T2	14	66.7%

Source: elaborated by the authors.



EUROPEAN HERNIA SOCIETY (EHS) CLASSIFICATION (M)	N	%
M1-M2-M3	1	4.8%
M2	4	19%
M3	4	19%
M2-M3	8	38.1%
M2-M3-M4	2	9.5%
M3-M4	1	4.8%
M3-M4-M5	1	4.8%

Figure 7. Location and type of hernial defects.
Source: elaborated by the authors.

The laparoscopic eTEP approach was performed in 21 patients (95.5%) and one patient underwent conversion to transabdominal retromuscular laparoscopic surgery (laparoscopic Rives). The surgical techniques performed were: Rives-Stoppa in 15 patients (71.4%), with unilateral TAR in 4 patients (19%) and bilateral TAR in 2 patients (9.5%) (Table 3).

Table 3. Principal surgical characteristics.

	N	%
Surgical technique		
Rives-Stoppa	15	71.4%
Transversus abdominis muscle release (TAR)	6	28.6%
Unilateral TAR	4	19%
Bilateral TAR	2	9.5%
Number of trocars used	4	IQR: 4-5
3 trocars	1	4.8%
4 trocars	15	71.4%
5 trocars	4	19%
6 trocars	1	4.8%
Posterior sheath closure	20	95.2%
Mesh size (Diameter)		
Transversal	19.7 ± 4.3 cm	14 – 30cm
Longitudinal	27.5 ± 5.4 cm	16 – 40cm
Mesh type		
DynaMesh®-CICAT (PVDF)	9	42.9%
DynaMesh®-IPOM (PVDF)	2	9.5%
Optilene® Silvermesh Elastic (PPL)	8	38.1%
BARD® Soft Mesh (PPL)	2	9.5%
Fixation system type		
Fibrin (Tisseel®)	11	52.4%
Cyanoacrylate (Glubran®)	5	23.8%
Non-fixation	5	23.8%
Drainages	3	14.3%
Surgical time	200min	RIQ: 180 – 300min

Source: elaborated by the authors.

A total of 4 patients (19%) presented global complications (two clinical seromas, one acute urinary retention requiring bladder catheterization and one incarcerated hernia). Of the complications described, only one (4.8%) was severe (Clavien-Dindo 3b) and required surgical reintervention due to incarcerated hernia secondary to dehiscence of the posterior rectus sheath and was repaired by an iterative laparoscopic eTEP approach. The presence of clinical seroma was observed in 9.5% of patients, and ultrasound in 57.1% (18).

No hematomas, infection of the surgical wound or prosthetic material were observed, and no cases of hernia recurrence have been reported to date. (Table 4)

Table 4. Description of postoperative complications.

	N	%
Global complications	4	19%
Clinical seroma	2	9.5%
Acute urine retention	1	4.8%
Incarcerated hernia due to posterior sheath dehiscence	1	4.8%
Severe complications (Clavien-Dindo IIIb) *(Dehiscence of posterior sheath of the rectus)*	1	4.8%
Intraoperative complications	0	0
Surgical reintervention *(Dehiscence of posterior sheath of the rectus Laparoscopic Re-eTEP)*	1	4.8%
Cierre de vaina posterior	20	95.2%
Seromas (according to S. Morales-Conde classification)		
Type 0b (non-clinical, ultrasound only)	12	57.1%
Type I (clinical <1 month)	1	4.8%
Type IIa (clinical 1-3 months)	1	4.8%
Hematoma	0	0
Infection of surgical site	0	0
Infection of the prosthetic material	0	0
Recurrence	0	0
Exitus	0	0

Source: elaborated by the authors.

What new contribution does the article provide?

- The laparoscopic eTEP approach has a low rate of severe complications (4.8%) and clinical seromas (9.5%).
- The modification of the classic technique facilitates the performance of the crossover and shorter surgical times, mainly in the initial stages of the learning curve.
- The laparoscopic eTEP approach offers a short hospital stay.

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Discussion

There is currently evidence that minimally invasive techniques offer the advantage of less postoperative pain, shorter postoperative hospital stay, early return to work and fewer surgical wound complications compared to open techniques (17,19-21).

The results corroborate the current evidence regarding a low complication rate, 19% of global complications, 4.8% of serious complications and 9.5% of clinical seromas, results similar to those obtained by Bellido et al. (21) which showed 2.6% of serious complications and 10.3% of postoperative seroma, also similar to those published by Belyansky et al. (17) who obtained 2.8% of seromas, 2.5% of intraoperative complications and 1.3% of hernia recurrences. In addition, the incidence of seromas is much lower compared to the IPOM technique, according to results published by Bellido et al. (21) which revealed an incidence of 35%.

In addition to the above, this technique has achieved a short hospital stay (1.6 ± 0.67 days), results that are similar to those found in the current literature, as shown by Bellido et al. (21) who found a hospital stay of 1.3 ± 0.7 days and those of Belyansky et al (17) who recorded a hospital stay of 1.8 ± 1.8 days.

The eTEP approach is a novel focus in which the retromuscular (retrorectal) space is used to place the prosthetic material (mesh) to strengthen the abdominal wall. This approach, in accordance with Pascal's law, provides a plane to strengthen the abdominal wall and also at the same time avoid intraperitoneal placement of the mesh (22). It is believed that placement of the mesh in the retromuscular space results in better vascularization of the mesh, less hernia recurrence, fewer fixation problems, and less possibility of intestinal adhesions, in addition to being more economical, since lower cost meshes can be used (23).

The retromuscular space offers advantages in the reconstruction of complex abdominal wall defects, in addition to avoiding intraperitoneal prostheses, thus avoiding adhesions, fistulas and migrations, it provides a large potential space that is easily dissected and a well vascularized compartment for the placement of large meshes. Also, placement of the mesh in the retromuscular space has been associated with a more significant production of types I and III collagen fibers compared to meshes in the supraaponeurotic position (5,24).

Another advantage of retromuscular space dissection is that in selected cases posterior separation of the components can be performed, which was described in 2012 by Novitsky et al. (25) and basically consists of releasing the transversus abdominis muscle, which is a technique with low perioperative morbidity and recurrence rates. This technique allows us to place wider prostheses, extending approximately 6 to 8 cm from the midline on both sides, with greater medial advancement of the posterior fascia and wider overlap. The goal of performing a TAR is to provide tension-free closure of the posterior sheath, which is sometimes difficult in large hernia defects (5,25). In our series it was necessary to release the transversus abdominis muscle in 28.6% of the cases (in 19% it was unilateral and in 9.6% bilateral), in 2 cases because lateral defects were associated and in the other 4 cases because they were large hernial defects, so it was necessary to perform it in order to achieve a correct closure without tension of the posterior sheath. Our transversus abdominis muscle release performance rate was lower than that published by Belyansky et al. (17), who performed this procedure in 52% of their patients operated on for ventral hernia.

The eTEP approach for the treatment of ventral hernias is associated with certain inherent complications related to the technique, such as opening or dehiscence of the posterior sheath, injury to the linea alba while performing crossover, inadvertent injury to the neurovascular bundle or crescentic line while performing posterior dissection. Understanding the proper endoscopic anatomy of the eTEP approach and careful dissection in the retrorectal space prevents such complications (21,26).

In our series we observed a severe complication that required urgent surgical reintervention. This was one of the first cases performed, the patient was readmitted to the emergency room on the third postoperative day due to sudden onset abdominal pain, so abdominal CT was performed and partial dehiscence of the posterior sheath of the rectum was visualized, causing incarceration of the small bowel loop. It was decided to perform urgent surgery by laparoscopic eTEP iterative approach, an incarcerated small bowel loop was visualized with no signs of intestinal distress and it was easily reduced. Given the excessive tension to close the dehiscence area, a right hemiTAR and subsequent closure of the posterior sheath without tension is performed. This type of complication is rare but has already been described in the literature, and we believe that in our case it was due to the lack of initial experience, since these were our first cases performed and we were in the initial phase of the learning curve, so we believe that this type of complication can be avoided with experience and standardization of the technique.

It is also important that the surgeon can perform his own ultrasound to map the rectus muscles and lateral muscle extension prior to surgery, which is usually performed by our team to have the anatomical references for the placement of the working ports. The CT scan should also

be analyzed together with the radiologist prior to surgery. The diameter of the defect in transverse and longitudinal directions, the content, the size of the rectum and the quality of the oblique muscle, the thickness of the subcutaneous fat over the defect, including changes due to previous surgery, are important (21,25).

The eTEP approach is now an accepted procedure by scientific societies and is increasingly used for ventral hernia repair. However, when performed on irreducible hernias, it may involve difficulty in reduction, especially if there are adhesions of the hernia sac contents. The minimally invasive transabdominal retromuscular (TARM) approach allows reduction of the contents under direct vision and finally dissection and placement of the mesh in the same plane as the eTEP is performed (6,27).

Ventral midline hernias may be associated with rectus abdominis diastasis in some cases. In these circumstances, repair of the ventral hernia defect without adequate treatment of the diastasis may lead to an increased risk of recurrence due to the poor quality of the surrounding tissues (28,29). According to our data, the incidence of diastasis associated with ventral hernias is high (71.4%), so we believe that a complete repair of the entire abdominal wall with an anterior midline closure and plication is more than justified, and in these cases the eTEP technique is one of the best options.

The limitations of the eTEP technique according to the available evidence, are the prolonged surgical time, the long learning curve, the need for advanced laparoscopic skills, the difficulty of performing a correct crossover without entering the abdominal cavity in incisional hernias with large hernia defects and the suturing of the anterior rectus sheath (20,30,31).

Our study has certain limitations, such as being a retrospective study with a small number of patients. Moreover, as this was not a comparative study between different techniques for the repair of ventral hernias, no further analysis was possible. Another limitation of our study is that to date we still have a relatively short follow-up. Likewise, we believe that a longer follow-up period and a larger sample size are required to assess recurrence after ventral hernia repair.

Conclusions

The modification of the classic laparoscopic eTEP technique by dissection of both retromuscular spaces with balloon could demonstrate in this study a simpler crossover, a lower risk of injuring vascular-nerve structures and a reduction in surgical times, mainly in surgical teams that are just learning this technique.

The laparoscopic-eTEP Rives-Stoppa approach associated or not with posterior separation of components (TAR) for the treatment of midline ventral hernias (primary and incisional), seems to have good results, showing a low incidence of global and severe complications, short hospital stay, low incidence of hernia recurrence, so it could be considered a safe and effective technique in the treatment of ventral hernias; however, further prospective analytical studies are needed to continue providing more scientific evidence.

Conflicts of Interest

The authors of this manuscript declare that there are no conflicts of interest in the development of this research.

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Ethical responsibilities

Protection of people and animals: The Institutional Ethics Committee approved the present study.

Data confidentiality: the authors declare that they have followed their center's protocols on the publication of patient data.

Right to privacy and informed consent: the authors have obtained the informed consent of patients and/or subjects mentioned in the article. This document is in the possession of the corresponding author referred to in the article.

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