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“Enhanced” view extraperitoneal (eTEP) approach for repair of ventral hernia: Our initial experience

Sanjay Gupta¹, Talib Khan¹, Aaina Aggarwal¹, A. K. Attri¹, Ravinder Kaur²

Abstract

BACKGROUND: Over the past two decades, minimally invasive techniques for ventral hernia repair have evolved significantly. Among these, the enhanced view totally extraperitoneal approach has gained popularity in recent years. This study presents our early experience with the enhanced-view totally extraperitoneal (eTEP) technique for ventral hernia repairs.

MATERIALS AND METHODS: This prospective observational study was conducted from January 2022 to April 2025. A total of 72 patients who underwent eTEP repair for midline ventral hernias were included. Patient demographics, hernia characteristics, operative details, and postoperative outcomes were also recorded. The early outcomes in terms of complications, postoperative pain, recurrence, and cosmetic satisfaction were analyzed.

RESULTS: eTEP was successfully performed in 68 (94.4%) of 72 patients in whom eTEP was attempted, while in four patients, it was converted to an open or hybrid procedure. Seroma was observed in 5.9% of patients at the first week and month, and in 2.9% of patients at 3 months of follow-up. The mean visual analog scale scores showed progressive improvement, and cosmetic outcomes were excellent at 3 months (mean Likert score: 4.35/5). Two patients had recurrence, while there were no cases of surgical site infection or posterior rectus sheath rupture.

CONCLUSION: The eTEP approach is feasible, safe, and cost-efficient for ventral hernia repair. Careful patient selection and proper surgical techniques are associated with favorable early outcomes, minimal complications, and high patient satisfaction. However, comparative trials and further studies with long-term follow-up are required to confirm its long-term efficacy.

Keywords:

Henia, retro rectus, sublay, ventral

Introduction

Ventral hernias are the second-most common type of abdominal wall hernia after inguinal hernias, accounting for approximately 10% of all cases.^[1] Among the various open surgical techniques, the Rives–Stoppa approach (retro muscular repair) is widely preferred. This technique has a reported recurrence rate of less than 10% and offers several advantages: the mesh does not come into direct contact with the bowel, its placement in a deeper anatomical

plane reduces the risk of infection, and intra-abdominal pressure helps secure the mesh in place, in accordance with Pascal’s law.^[2]

In recent years, minimally invasive techniques have become the preferred method for ventral hernia repair because of associated benefits such as shorter hospital stays, faster recovery, and reduced wound complications compared to open surgery.^[3] The earliest minimally invasive approaches included the bridged-intraperitoneal onlay mesh (IPOM) technique introduced by LeBlanc *et al.* and the IPOM plus technique developed by Kukleta *et al.*^[4] However,

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¹Department of Surgery,
²Department of
Radiodiagnosis,
Government Medical
College and Hospital,
Chandigarh, India

Address for correspondence:

Prof. Sanjay Gupta,
Department of Surgery,
Government Medical
College and Hospital,
Chandigarh 160030,
India.
E-mail: sandiv99@gmail.
com

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because the mesh in these procedures is placed intraperitoneally, there is a risk of complications such as seroma formation, mesh erosion, adhesive bowel obstruction, acute and chronic pain from traumatic mesh fixation, and enterocutaneous fistula in rare cases.^[5]

To minimize these risks, alternative methods have been developed, such as the transabdominal preperitoneal (TAPP) approach and the endoscopic mini/less open sublay technique, in which a mesh is placed within the layers of the abdominal wall.^[6] More recently, Belyansky and colleagues introduced the “Enhanced” or “Extended” view totally extraperitoneal retro muscular or sublay repair (eTEP), a technique that combines the extraperitoneal access described by Daes with the posterior component separation method (transversus abdominis release, or TAR) introduced by Novitsky.^[7,8] This approach allows for the closure of large defects without tension on the suture line and enables the use of a simple prolene mesh instead of the more expensive coated mesh required for intraperitoneal placement, thereby significantly reducing the cost of surgery. Additionally, it has been associated with lower rates of postoperative pain and seroma formation than other minimally invasive methods. Encouraged by the promising results of the initial studies after it was first reported by Belyansky *et al.*^[8-10], we began adopting this technique for ventral hernia repair in 2020. In this series, we present our initial experience using the eTEP approach.

Materials and Methods

This prospective observational study included all patients aged ≥ 18 years who underwent ventral hernia

repair using the eTEP technique between January 2022 and April 2025, after obtaining informed consent [Figure 1A–D]. Approval from the Institutional Ethics Committee (IEC) was obtained in November 2022. For patients ($n = 18$) who had undergone surgery prior to IEC approval but met the inclusion criteria, data were retrieved from the medical records department, and additional permission to include these cases in the study was obtained from the IEC. For follow-up, patients were contacted telephonically or assessed in the outpatient department.

Patients were excluded if they had a sinus tract, abdominal wall fistula, ulceration of the abdominal wall skin, active intra-abdominal infection, history of previous retro rectus mesh placement, or loss of domain hernias, defined as more than 30% of abdominal contents lying outside the abdominal cavity within the hernial sac. Additionally, patients with complicated ventral hernias, such as those with incarceration, obstruction, or strangulation, and those who were unfit to tolerate pneumoperitoneum were excluded. All patients underwent surgery performed by a single surgeon.

Preoperative preparation

Detailed history, physical examination, and baseline characteristics such as primary, incisional, or recurrent hernia, body mass index (BMI), sex, age, patient demographics, comorbid factors, history of previous surgery, and hernia details were recorded. Baseline blood tests and other investigations were performed to diagnose comorbid conditions. Abdominal ultrasonography was performed in all patients to objectively assess the number and size of defects, contents of the hernial sac, and any other abdominal pathology that may require surgical

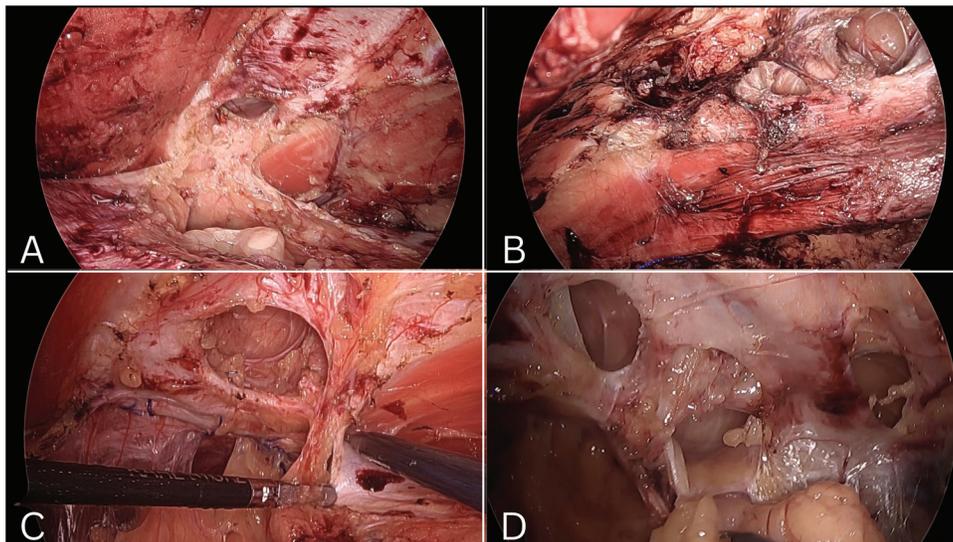


Figure 1: Example of few operated cases: (A) M3 hernia with recti diastasis; (B) incisional hernia with Swiss cheese defect; (C) recurrent M3 hernia; (D) primary hernia with multiple defects

management. Preoperative skin marking for the inter-recti distance, bilateral rectus width (medial and lateral border of the recti), and linea semilunaris was performed under ultrasound guidance.

All hernias were classified according to the European Hernia Society Classification (EHS).^[11] For hernias spanning multiple zones, the method suggested by the EHS was used. The suggested order of importance is (M1) subxiphoidal > (M5) suprapubic > (M3) umbilical > M2 (epigastric) > M4 (infraumbilical). This method aims to avoid creating additional subgroups (such as M1–2/M1–2–3/M2–3–4). Therefore, hernias that stretch from M1 to M2 to M3 (below the xiphoid process to the umbilicus) are categorized as M1 (subxiphoidal hernia). An umbilical hernia is classified as M3 if it extends from M2 to M3 to M4 (epigastric to infraumbilical).

Operative Technique

In all patients, the procedure was performed under general anesthesia as per standard practice. Preoperative preparation included intravenous antibiotics (amoxicillin 1 g with clavulanic acid 200 mg) half hour before the start of surgery and urinary catheterization. The patient was positioned supine with both arms tucked by the side of the patient. The operating table was positioned at an angle (both the head and foot ends were lowered by 15°)

to hyperextend the patient's upper body and increase the working space.

Port positioning

In the initial 48 cases of M2–M5 hernia, the procedure was performed using four ports [Figure 2A]. The remaining cases were performed using only three lateral ports on the left side of the abdomen [Figure 2B]. For high M2 hernias, where it was difficult to dissect cranial to the defect, an additional port was inserted to the left of the subcostal port medial to the linea semilunaris, after creating the left retro rectus space [Figure 2B, site marked as 'x']. The same ports were used for right-sided TAR; however, for bilateral release, three additional ports were placed on the right side after retro rectus space creation.

Steps of Surgery by Lateral Ports

In our institute, we started performing this procedure using four ports, but with increased experience and confidence, we gradually adopted the three port technique, as described by Shenoy *et al.*^[12] The only difference was the site of initial access and port size. In our series, initial access was gained through a 10-mm port in the left subcostal region instead of a 10-mm port placed just above the level of the umbilicus. Subsequently, the retro rectus space was dissected downward as we found

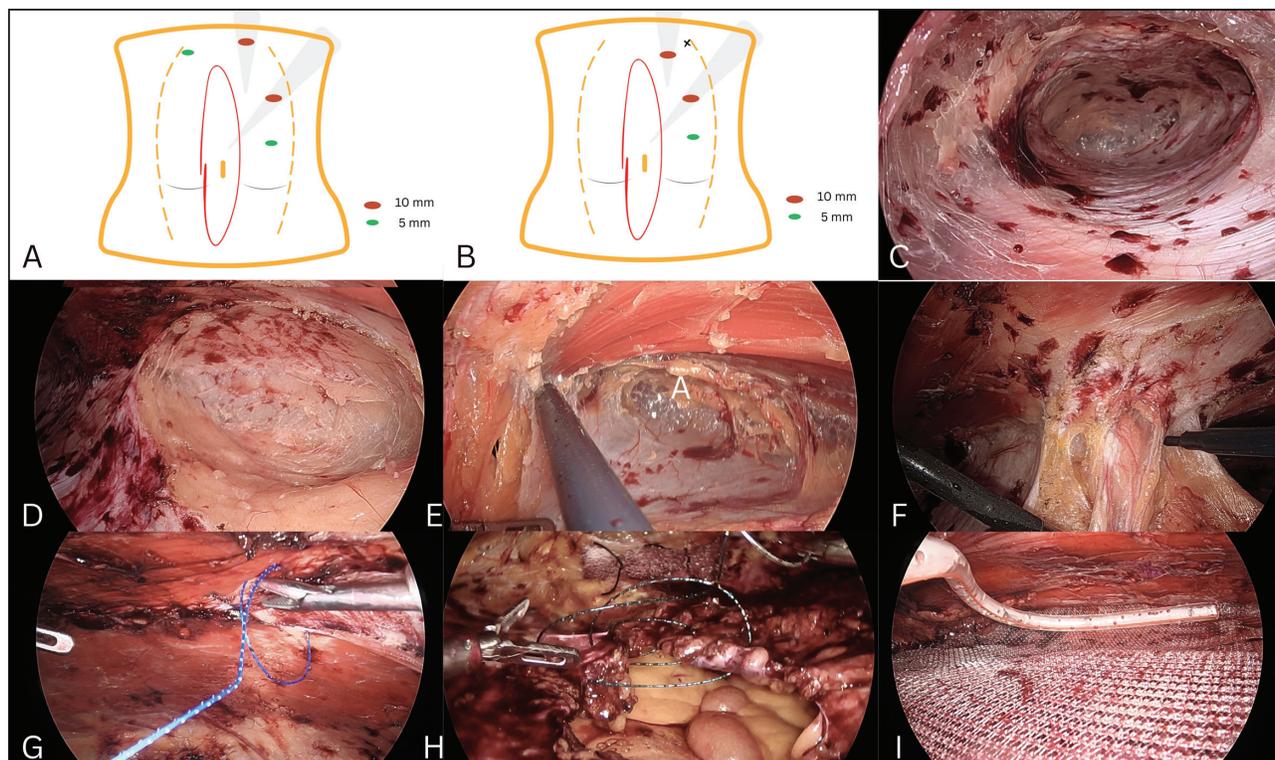


Figure 2: Steps of eTEP-sublay repair. (A) Port placement in four port technique; (B) port placement in three port technique, "x" site of extra port in case of high M2; (C) left retro rectus space; (D) exposure of linea alba; (E) right retro rectus space; (F) reduction of contents; (G) closure of linea alba; (H) closure of PRS; (I) drain placement. eTEP = enhanced-view totally extraperitoneal, PRS = posterior rectus sheath

ourselves more comfortable performing downward retro rectus dissection.

Procedure

A left subcostal incision was made for the 10-mm port, as high as possible, just medial to the linea semilunaris. Blunt dissection was performed until the anterior rectus sheath was reached, which was then incised sharply. The retro rectus space was reached by splitting and lifting the fibers of the rectus abdominis (RA) using S-shaped retractors. A 10-mm access port was inserted and secured in the retro rectus plane using a silk suture of size No. 1. Its position was confirmed with a telescope, and CO₂ insufflation was started (14 mm Hg) at a flow rate of 3 L/min. The initial retro rectus dissection was performed using a 0° telescope through a 10-mm subcostal port. During this step, care was taken to avoid leaving any tissue on the posterior rectus sheath (PRS). This was achieved by carefully moving the telescope back and forth under direct vision while maintaining contact with the PRS surface. To expand the space both medially and laterally, the telescope was moved in an upward curved motion both medially and laterally, gently sweeping the tissue from the PRS surface toward the RA [Figure 2C].

Another 10-mm port was then inserted 3–4 cm above the umbilicus medial to the linea semilunaris, and a 5-mm port was inserted at the level of the arcuate line medial to the linea semilunaris. Subsequently, dissection was performed by shifting the telescope to the supraumbilical port and using the uppermost and lowermost ports as working ports. The subcostal port was converted to 5 mm using a port reducer.

Before starting supraumbilical crossover, an adequate left rectus space was created. Medially up to the junction of the left PRS to the linea alba and caudally beyond the arcuate line. This is necessary so that if the small rent occurs in the peritoneum during crossover, the left retro rectus space can be maintained with the help of a left-hand instrument by pushing the PRS downward, and the procedure can be completed without difficulty.

Crossover to the opposite side and right retro rectus dissection

After completion of the left retro rectus dissection, supraumbilical crossover was performed by cutting the left PRS 5 mm from the linea alba. The falciform ligament was lowered from the linea alba to enter the right preperitoneal space [Figure 2D]. Preoperative ultrasound-guided marking of the medial border of the right RA, as well as the Marshmallow sign,^[13] acts as a useful guide to identify the junction of the linea alba and the right PRS. The PRS was cut on the right side, and the right retro rectus space was entered [Figure 2E]. Thus, the right and left rectus spaces were combined and further expanded caudally to the hernial defect and beyond, up to the spaces

of the Retzius and Bogros, depending on the defect site after reducing the contents [Figure 2F]. The neurovascular bundle (“lamppost sign”) guided the lateral limit of the dissection on the right side.^[14]

For incisional hernia, especially with the M2 hernia defect, after creating an adequate left retro rectus space, the left PRS along with the peritoneum (PRS complex) is cut at its junction with the linea alba to allow inspection of the peritoneal cavity for any visceral adhesions to the scar site. Hernial contents were reduced, and the right retro rectus space was then accessed by incising the right PRS complex from within the peritoneal cavity. A similar approach was used if inadvertent injury to the peritoneum occurred during the supraumbilical crossover. The peritoneal rent was widened, and the right retro rectus space was approached from within the peritoneal cavity. Out of the 68 patients, this approach was used in six cases—three with incisional hernias and three with primary hernias.

Reconstruction of linea alba and closure of PRS

After creating an adequate retro rectus space around the hernial defect, closure of hernial defects and reconstruction of the linea alba and closure of PRS was done before placement of the mesh and drain [Figure 2G–I]. Linea alba reconstruction was performed using the No. 1 barbed non-absorbable polybutylene terephthalate suture (V-Loc™ Polybutester-PBT No.1). This was done by standing on the left side of the patient by the reverse back hand movement of the needle holder (needle tip pointing toward the left side), where three ports were used. The uppermost part of the linea alba was repaired by the back hand movement of the needle holder (needle tip pointing toward the right side) [Figure 3]. In patients in whom four ports were used, this was performed by standing on the head end of the patient for the lower part of the linea alba, with the right subcostal port acting as the right-hand working port. The uppermost part was sutured using three left lateral ports in a similar manner. Gentle compression of the abdominal wall from outside with left hand or by an assistant helps suturing the linea alba. A portion of the sac was taken in the suture line to obliterate dead space and prevent seroma formation.

The PRS on both sides was approximated using a 1–0 absorbable barbed suture (V-Loc™ 180 Polyglyconate No.1). If there was tension in the closing/inability to close the PRS, the following options were attempted [Figure 4].

- Division of fascia transversalis ± division of the lowermost 4–5 cm of the PRS close to the linea semilunaris on the right or both sides.
- Dissection of the spaces of Retzius ± Bogros on both sides.
- Plugging the defect with the sac.
- Component separation in the form of TAR

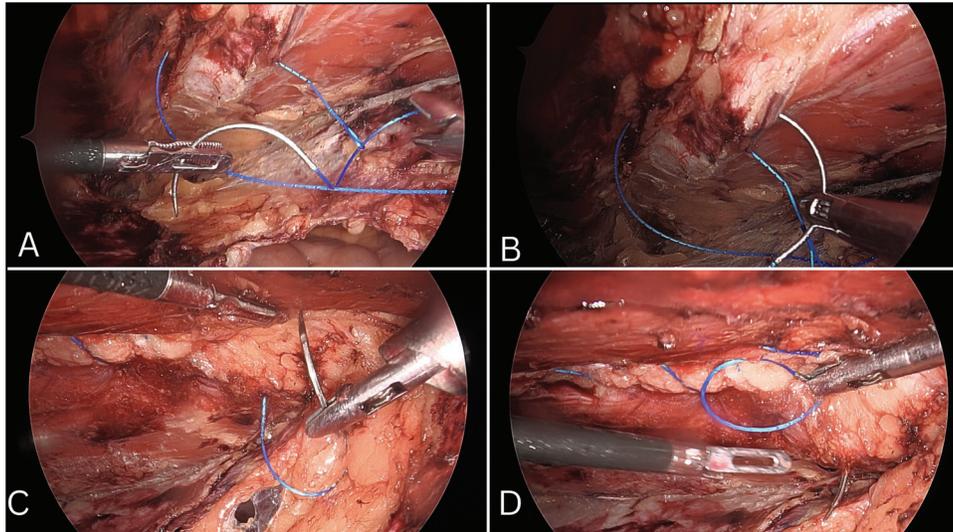


Figure 3: Direction of the needle while suturing linea alba by using the three-port technique. (A, B) Suturing of the lower part; (C, D) suturing of the upper part

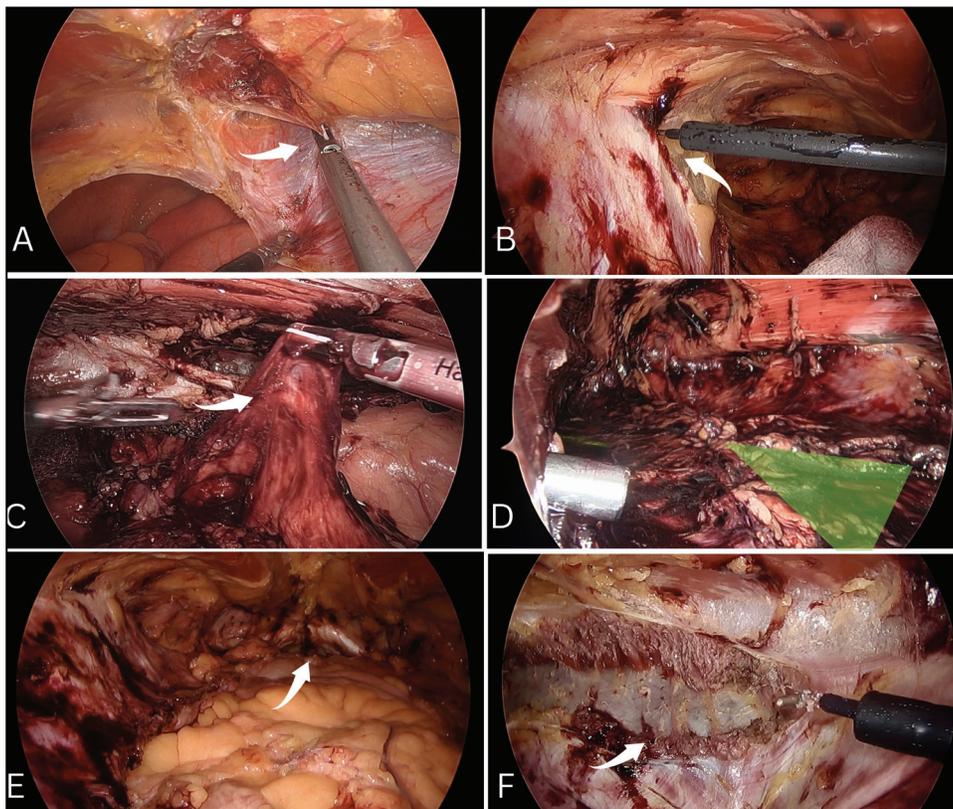


Figure 4: Creation of posterior “barrier” for mesh placement in difficult PRS closure. (A) Division of fascia transversalis; (B) division of the lower part of PRS close to linea semilunaris; (C) preservation of the hernial sac; (D) use of hernial sac for posterior “barrier” – marked as a green area; (E) dissection of space of Retzius; (F) transverse abdominis release. PRS = posterior rectus sheath

Performing TAR has always been the last resort.

Mesh placement and closure

The size (length and breadth) of the retro rectus space was measured using umbilical tape. A prolene mesh of adequate size, as per the above measurements, was

then placed to cover the hernial defect for at least 5 cm in all the directions. No mesh fixation was performed in any case. The drain was placed in the retro rectus space above the mesh via the lowermost port in the initial 48 patients. All ports were closed with a skin stapler, and an abdominal binder was applied postoperatively.

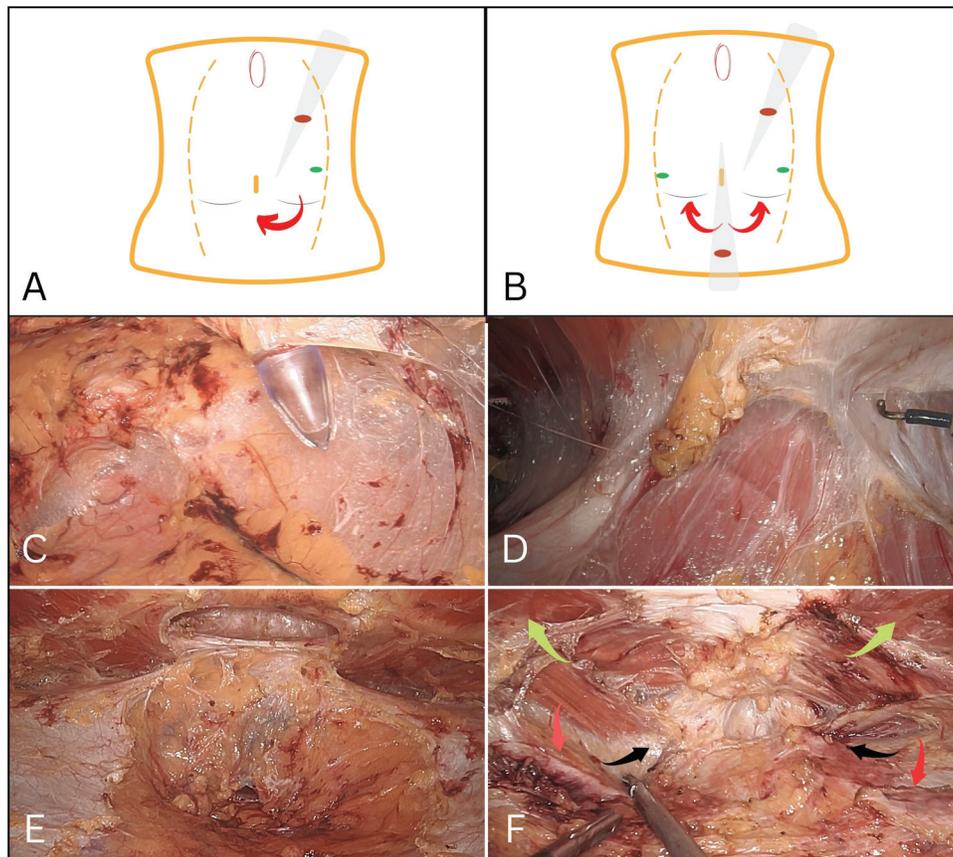


Figure 5: Repair of M1 hernia. (A) Port placement for infra umbilical cross over; (B) port placement for supra umbilical dissection; (C) dissected infraumbilical space; (D) contents entering into the defect; (E) hernial defect; (F) bilateral rectus muscle (green arrows), divided margins of transverse abdominis muscle (red arrows), entry to subdiaphragmatic space (black arrows)

Repair of M1 hernia

For M1 hernia, infraumbilical crossover was performed using two ports using the same technique as described for inguinal hernia.^[15] Supra umbilical dissection and repair were performed by standing between the legs of the patient using three ports. Bilateral TAR was done to access the space below the diaphragm [Figure 5].

Postoperative assessment and care

Postoperative assessment and care followed the institutional protocols. Early outcomes were evaluated on the basis of pain, presence of seroma, recurrence, surgical site infection, and cosmetic satisfaction. These were recorded at 1 week, 1 month, and 3 months. Pain was assessed using the visual analogue scale (VAS) score, and cosmetic satisfaction was assessed using a 5-point Likert scale (5 = excellent, 4 = very good, 3 = good, 2 = satisfactory, and 1 = not satisfactory).

Statistical analysis

The occurrence of postoperative complications was registered as “yes” or “no.” The results from the self-assessment questionnaires regarding postoperative pain and cosmetic satisfaction were registered as a value corresponding to that reported by the patient.

The sample size was too small to draw any statistically significant conclusions from the frequency of each of the postoperative complications. Therefore, the frequencies of these are presented descriptively as numbers and per cent.

Data were analyzed using Microsoft Excel (office 365) version 16.42.

Ethical considerations

This study was approved by the Institute Ethical Committee of Government Medical College and Hospital, Chandigarh, India on November 26, 2022 with wide reference number GMCH/IEC/2022/854R.

Procedures followed were in accordance with the guidelines of the Helsinki Declaration of 1975.

Results

Between January 2022 and April 2025, a total of 122 patients with ventral hernias (including both primary and incisional types) underwent laparoscopic repair. Figure 6 summarizes the procedures performed and the number of patients followed up at 1 week, 1 month,

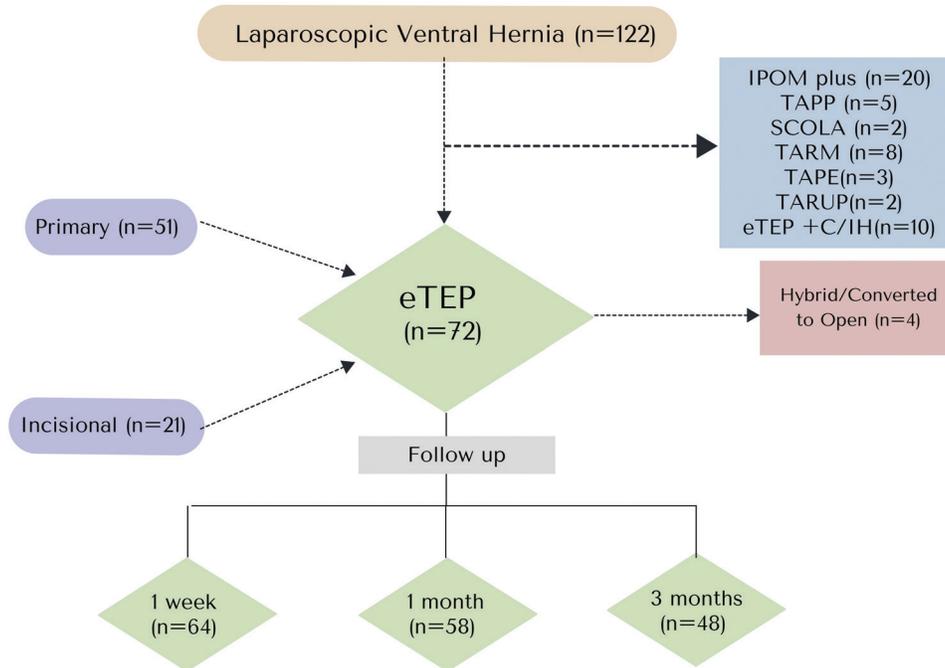


Figure 6: Flow of the minimal invasive procedure performed during the study period and number of patients followed at different interval IPOM = intraperitoneal onlay mesh, TAPP = transabdominal preperitoneal, SCOLA = subcutaneous onlay laparoscopic approach, TARM = transabdominal retro muscular, TAPE = transabdominal partial extraperitoneal, TARUP = transabdominal retro muscular umbilical prosthetic hernia repair; eTEP+C/IH = eTEP with cholecystectomy/inguinal hernia

and 3 months postoperatively for VAS score, seroma formation, and cosmetic satisfaction. Procedures other than eTEP were performed in patients with defect sizes less than 2 cm, those with lateral hernias, or when concomitant cholecystectomy was required. These patients were excluded from the present study. Furthermore, patients who underwent eTEP repair in combination with cholecystectomy or inguinal hernia repair ($n = 10$) were also excluded from further analysis.

eTEP-sublay repair for a midline ventral hernia was attempted in 72 patients. Table 1 summarizes the patient characteristics and the operative and postoperative details of the patients. Of the 72 patients in whom eTEP was attempted, four were converted to open surgery. Three patients had incisional hernias, and one had a primary hernia. Bilateral TAR was performed in all four patients who were subsequently advised for open procedures. In two patients, the procedure was converted to open due to difficulty in closure of the hernial defect after closure of the posterior defect due to lack of working space, with both having W2 defects (>4 cm to <10 cm). Therefore, hybrid eTEP-sublay was performed in these patients. One eTEP was converted to open surgery because of iatrogenic enterotomy, for which primary repair was performed. One eTEP was converted to an open owing to dense adhesions and multiple Swiss cheese defects (M3W3).

A high dropout rate was observed for VAS score, seroma formation, and cosmetic satisfaction, primarily due to the inclusion of patients ($n = 18$) who underwent surgery prior

to obtaining IEC approval. As a result, if the procedure had been performed more than 3 months before study approval, it was not feasible to evaluate these patients at the 1-week, 1-month, and 3-month follow-up intervals. However, of these patients, sixteen were contacted telephonically, and none reported any postoperative complications. Seroma was observed in 4 (5.9%), 4 (5.9%), and 2 (2.9%) study participants at 1 week, 1 month, and 3 months, respectively. Two patients experienced hernia recurrence after the eTEP-sublay repair. In both patients, initially, it was M3 hernia, but on follow-up, it recurred with M2 hernia. Both were repaired using IPOM plus. Two patients with eTEP and one patient with eTEP with TAR experienced chronic pain on the VAS (4/10) at the 3-month follow-up. One patient with eTEP and TAR developed ileus on postoperative day (POD) 2 and was managed conservatively. One patient in the eTEP group developed SAIO on POD 7, was readmitted, and was managed conservatively by maintaining NPO, nasogastric tube drainage, and intravenous fluid and electrolyte administration. Cosmetic satisfaction on the 5-point Likert scale was excellent at 3 months (mean \pm SD) (4.35 ± 0.4). None of the study participants reported surgical site infections at any follow-up interval. We also did not encounter any cases of PRS rupture after eTEP repair.

Discussion

The eTEP approach, which was initially developed for inguinal hernia repair, is now the preferred minimally invasive technique for ventral hernia repair, including

Table 1: Patient characteristics, operative and post operative details

Patient characteristics (n = 72)		
Age (mean ± SD) (years)		53.81 ± 12.40
Gender (male: female)		30:42
Comorbidity (n) (%)	Hypertension	10 (13.9%)
	Diabetes mellitus	19 (26.4%)
	Others	10 (13.9%)
		11 (14.6%)
Smoking (n) (%)		11 (14.6%)
BMI (kg/m ²) (n) (%)	Normal (18.5–24.9)	20 (27.8%)
	Overweight (25–29.9)	33 (45.8%)
	Obese (30 and above)	19 (26.4%)
		21:48:3
ASA Grade (I: II: III)		
Primary hernia (n = 51)		
Site (n) (%)	M1	0
	M2	17 (33.3%)
	M3	34 (66.6%)
Width (n) (%)	Small (<2 cm)	06 (11.8%)
	Medium (2–4)	41 (80.4%)
	Large (>4)	4 (7.8%)
Rectus diastasis	D1 = >2–3 cm	6 (11.8%)
	D2 = >3–5 cm	12 (23.5%)
	D3 = >5 cm	7 (13.7%)
Multiple defects (n) (%)		7 (13.7%)
Incisional hernia (n = 21)		
Site	M1	3 (14.2%)
	M2	3 (14.2%)
	M3	11 (52.4%)
	M4	0
	M5	4 (19.4%)
Width	<4 cm	14 (66.6%)
	4–10 cm	7 (33.3%)
	>10 cm	0
Operative details (n = 72)		
Operative time (mean ± SD) (min)	First 36 cases	155.5 ± 40.2
	Last 36 cases	135.4 ± 35.0
Conversion to open (n) (%)		4 (5.6%)
TAR	Unilateral	10 (13.9%)
	Bilateral	7 (9.7%)
Peritoneal sac preservation		4 (5.6%)
Drain placement		46 (63.9%)
Mesh size (cm ²) (mean) (range)		330.35 (210–441)
Post operative course (n = 68)		
Hospital stay (mean ± SD) (days)		2.06 ± 0.63
VAS score (mean ± SD)	At 1 week	5.40 ± 1.10
	At 1 month	3.11 ± 0.28
	At 3 months	2.09 ± 0.32
Recurrence (at 3 months) (n) (%)		2 (2.9%)

BMI = body mass index, TAR = transversus abdominis release, VAS = visual analogue scale

primary, incisional, and lateral hernias. This technique involves the placement of a mesh in the retro muscular (Rives-Stoppa) plane. This offers several advantages such as better mesh integration, reduced risk of complications, and prevention of direct contact between the mesh and intra-abdominal contents, thereby minimizing the risk of adhesions, fistulas, and mesh migration. In addition, because the mesh is not exposed to intraperitoneal organs, an uncoated mesh can be used,

which significantly lowers the cost of the procedure.^[16] While eTEP offers clear benefits, its use in smaller defects and certain technical aspects warrants further discussion.

Adequate mesh placement often necessitates extensive bilateral retro rectus dissection, sometimes extending into the spaces of the Retzius or Bogros. Some surgeons argue that for smaller defects (<4 cm), eTEP may be excessive and favor the more straightforward IPOM

technique in such cases.^[17] However, in addition to providing anatomical repair and extraperitoneal mesh placement, eTEP offers superior outcomes. A systematic review and meta-analysis by Chuah *et al.*^[18] which included 12 studies and 868 patients, demonstrated that while eTEP had a longer operative time, patients who underwent IPOM plus experienced significantly more postoperative pain (on day 7) and longer hospital stays. The complication and recurrence rates were similar between the two techniques.^[18] Considering the proven benefits of eTEP repair, we advocate its use, even in patients with small hernia defects. Technical complexity and longer operative times should not be viewed as barriers to adoption of this technique in such patients.

At our institution, a resource-limited government-run tertiary care center, our preferred approach for all ventral hernias with defect sizes of up to 8–10 cm remains eTEP, although other minimally invasive procedures were performed during the study period. Exceptions to this approach include small primary hernias (<2 cm) without rectus diastasis, for which other extraperitoneal techniques, such as TAPP, laparoscopic TARUP, or TARM, are preferred. IPOM is reserved for patients who can afford it or when hernia repair is combined with another abdominal procedure such as cholecystectomy. IPOM was also used for lateral hernias because of limited experience with eTEP in such cases. In performing eTEP for 2–4 cm defects, we aimed to minimize unnecessary dissection by performing cross over 4–5 cm above the umbilicus and limiting distal dissection to 2–3 cm beyond the arcuate line.

The technique of the eTEP approach is largely standardized, except for minor variations such as port position and number of ports.^[19] This variation depends on the personal experience and surgical skill of the operating surgeon. A critical technical step in eTEP is the approximation of PRS after bilateral retro rectus space creation. Advocates suggest that this helps preserve the abdominal wall contour, and non-closure can manifest as an upper abdominal bulge in some patients.^[2] However, a recent study by Daes *et al.*^[20] used CT-based measurements to show that PRS non-closure alone is not responsible for this bulging. Other contributing factors include neurovascular bundle injury and post-surgical patient inactivity. Hence, closure of the PRS is neither necessary nor mandatory in all cases,^[20] but the posterior “barrier” should always be established to prevent contact of the mesh with the abdominal viscera. In our practice, we perform PRS closure when feasible and possibly achieved without undue tension.

Several strategies have been proposed to create a posterior “barrier” for the mesh when primary retro rectus sheath (PRS) closure without tension is not

feasible. These include the use of a bladder flap, the falciform ligament, or the hernia sac; dissection of the spaces of Retzius and Bogros; lowering intra-abdominal pressure to 6–8 mm Hg; suturing the peritoneum in the direction of least tension; and dividing the distal 4–5 cm of the PRS near the linea semilunaris to enter the preperitoneal space.^[21] Since the posterior defect is typically wider than the hernial defect, we have found that these techniques are effective for closing posterior defects associated with hernias up to approximately 4 cm when PRS closure is challenging. For larger hernial defects, posterior component separation, unilateral or bilateral TAR, depending on defect size, is often required due to the broader PRS complex defect. However, this is not absolute as the feasibility of medial mobilization of the PRS and closure of the defect also depends on other factors such as BMI, body habitus, abdominal wall compliance, and the location of the hernia (e.g., suprapubic, subxiphoid, or periumbilical).^[17] Preservation and use of the hernia sac for posterior closure are recommended for large hernias^[21]; however, in our experience, this is often technically difficult and possible when significant fat content is present between the sac and skin. When the sac is adherent to the skin, it usually tears. Moreover, in patients with “Swiss cheese” hernias, this is not feasible, and there is always an inadvertent loss of tissue. We were only able to utilize the hernial sac for posterior closure in four cases.

Although increasingly favored, the eTEP approach is not devoid of complications. Superficial wound issues, such as subcutaneous seromas and hematomas, are relatively common, with reported incidences ranging from 0.6% to 13.5%. These seromas are often associated with hernial sites.^[2] To reduce their occurrence, it is recommended to either completely excise the hernial sac or incorporate it into the suture line during reconstruction of the linea alba.^[22] Our preferred technique involves incorporating the sac into the suture line to minimize the dead space. In our series, subcutaneous seroma was observed in five patients, with persistence noted in three cases at the 3-month follow-up. However, because these patients remained asymptomatic, no intervention was deemed necessary. Other complications include retro muscular hematomas from injury to epigastric vessels or neurovascular bundles during dissection or trocar placement or retro muscular seromas due to the mesh-induced inflammatory response. Such complications are rare and typically respond well to conservative management.^[23,24]

More serious complications include PRS rupture, disruption of the linea alba, complete blowout, and hollow viscus injury.^[9,10,24] Among these, PRS disruption, although underreported, is a significant challenge. It usually arises from closure of the posterior rectus

complex or peritoneum under tension, leading to disruption and intraparietal herniation of abdominal contents. These patients often present with small bowel obstruction and typically require re-exploration, either laparoscopically or via open surgery, to prevent progression to strangulation.^[21] We did not encounter any PRS ruptures in our series, likely because of the liberal use of various techniques to minimize tension during posterior layer closure. Disruption of the linea alba and complete blowouts are rare and generally associated with technical errors during closure. Hollow viscus injuries, particularly those involving the small bowel, may occur during adhesiolysis or crossover in patients who have undergone previous abdominal surgery having a midline scar.^[25] These injuries can be catastrophic if unrecognized and necessitate immediate re-exploration and repair. We identified a small bowel injury in one patient due to dense adhesions, prompting conversion of surgical approach to open surgery.

With regard to feasibility, the eTEP procedure was successfully completed in 68 out of 72 patients (94.4%). Postoperative pain scores and other outcomes were consistent with those reported in the existing literature.^[7,23] We observed only two recurrences at the 3-month follow-up, and the recurrence rate in our study was comparable to that reported in other published studies.^[7] Although it is difficult to identify the exact cause of these early recurrences, we suspect that inadvertent injury to the linea alba during the crossover may have been a contributing factor as both patients initially had M3 hernias and subsequently presented with M2 hernias at follow-up.

Although our results are promising, this study had certain limitations. This was an observational analysis of 72 patients, without comparison to other open or minimally invasive techniques. As this was our initial experience, factors such as operative time and management of large defects may not be comparable to the outcomes achieved by more experienced surgeons. Additionally, the short follow-up period limits the assessment of the long-term results.

Therefore, to establish eTEP as the optimal minimally invasive technique for ventral hernia repair, larger randomized trials with extended follow-up are needed to evaluate its feasibility and outcomes compared to other approaches.

Conclusion

In our early experience, eTEP proved to be a safe, effective, and cost-efficient option for ventral hernia repair. Management of the PRS complex is critical for the success of this procedure, and complications can be minimized by careful dissection following surgical

principles and a tension-free closure. With appropriate patient selection and surgical expertise, eTEP can be considered the preferred approach for ventral hernia repair.

Author contributions

SG: concept, design, literature search, data acquisition, data analysis, manuscript preparation, manuscript editing, and manuscript review. TK: literature search, data acquisition, and data analysis. AA, AKA, and RK: manuscript preparation, manuscript editing, and manuscript review.

Ethical policy and Institutional Review Board statement

The study conformed to the principles outlined in the Declaration of Helsinki. No clinical trials were involved as it is only a observational study.

Declaration of patient consent

All patients signed consents for surgical treatment and were aware of placement in the registry that would be used for research purposes.

Data availability statement

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

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Conflicts of interest

There are no conflicts of interest.

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References

1. Le HNR, Mege D, Ouaïssi M, Sielezneff I, Sastre B. Incidence and prevention of ventral incisional hernia. *J Visc Surg* 2012;149:e3-14.
2. Mazzola Poli de Figueiredo S, Belyansky I, Lu R. Pitfalls and complications of enhanced view totally extraperitoneal approach to abdominal wall reconstruction. *Surg Endosc* 2023;37:3354-63.
3. Looft P, Alfarawan F, Bockhorn M, El-Sourani N. Beyond traditional repair. Comparing eTEP and open sublay for ventral hernia repair. *J Clin Med* 2025;14:2586.
4. LeBlanc KA, Gonzalez A, Dickens E, Olsofka J, Ortiz-Ortiz C, Verdeja JC, *et al.*; Prospective Hernia Study Group. Robotic-assisted, laparoscopic, and open incisional hernia repair: Early outcomes from the Prospective hernia study. *Hernia* 2021;25:1071-82.
5. Mitura K, Romańczuk M, Kisielewski K, Mitura B. eTEP-RS for incisional hernias in a non-robotic center. Is laparoscopy enough to perform a durable MIS repair of the abdominal wall defect? *Surg Endosc* 2023;37:1392-400.
6. Jain M, Krishna A, Prakash O, Kumar S, Sagar R, Ramachandran R, *et al.* Comparison of extended totally extra peritoneal (eTEP) vs intra peritoneal onlay mesh (IPOM) repair for management of

- primary and incisional hernia in terms of early outcomes and cost effectiveness-A randomized controlled trial. *Surg Endosc* 2022;36:7494-502.
7. Quezada N, Grimoldi M, Besser N, Jacobovsky I, Achurra P, Crovari F, et al. Enhanced view totally extraperitoneal (eTEP) approach for the treatment of abdominal wall hernias: Mid-term results. *Surg Endosc* 2022;36:632-9.
 8. 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.
 9. 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.
 10. Radu VG, Lica M. The endoscopic retromuscular repair of ventral hernia: The eTEP technique and early results. *Hernia* 2019;23:945-55.
 11. 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.
 12. Shenoy KG, Karthik AS, Ramesh BS, Sandeep D. "Modified three-port technique" of extended totally extra peritoneal-rives stoppa (eTEP-RS) repair for midline ventral hernias. *Indian J Surg* 2024;86:482-7.
 13. Kinet S, Maes H. Comment to: "Signs and landmarks in eTEP rives stoppa repair of ventral hernias". *Hernia* 2023;27:473-5.
 14. Ramana B, Arora E, Belyansky I. Signs and landmarks in eTEP rives-stopppa repair of ventral hernias. *Hernia* 2021;25:545-50.
 15. Gupta S, Attri AK, Iqbal Mir Z, Bansal I. Pre-peritoneal fat as a guide to extended view total extraperitoneal (eTEP) repair for inguinal hernia. *Cureus* 2024;16:e52327.
 16. Wieland L, Alfarawan F, Bockhorn M, El-Sourani N. Comparison of eTEP and IPOM for ventral hernia surgery in the early postoperative period: A retrospective cohort study of a tertiary university centre. *Hernia* 2024;28:2195-206.
 17. Chowbey P, Wadhawan R, Subramanian D, Bhandarkar D, Gandhi J, Kumari KL, et al. Ventral hernia repair in India: A Delphi consensus. *Hernia* 2024;28:1511-23.
 18. Chuah YHD, Lloyd A, Sahebally SM. IPOM versus eTEP as minimally invasive approaches for ventral/incisional hernias: A systematic review and meta-analysis. *Hernia* 2025;29:144.
 19. Shenoy KG, Thomas M, Ramesh BS, Jeur AS, Jan N. Novel laparoscopic "lateral three-port technique" of extended totally extra peritoneal approach for ventral hernias: Short-term results and technical aspects of 100 consecutive cases from a single center. *Int J Abdominal Wall Hernia Surg* 2024;7:113-23.
 20. Daes J, Luque E, Hanssen A, Rocha J. eTEP Rives-Stoppa impact on abdominal contour: A retrospective observational and clinical quality improvement study using Ellipse 9 tool. *Surg Endosc* 2024;38:2197-204.
 21. Baig SJ, Gandhi JA, Gajjar AP, Priya P, Sane D. Strategies for closing the posterior rectus sheath during enhanced view totally extraperitoneal rives-stopppa repair. *J Minim Access Surg* 2024;20:387-92.
 22. 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.
 23. Bellido LJ, Gomez RJC, Bellido LA, Gomez MJ, Suarez GJM, Sanchez MI, et al. Endoscopic retromuscular technique (eTEP) vs conventional laparoscopic ventral or incisional hernia repair with defect closure (IPOM +) for midline hernias. A case-control study. *Hernia* 2021;25:1061-70.
 24. Lu R, Addo A, Ewart Z, Broda A, Parlacoski S, Zahiri HR, et al. Comparative review of outcomes: Laparoscopic and robotic enhanced view totally extraperitoneal (eTEP) access retrorectus repairs. *Surg Endosc* 2020;34:3597-605.
 25. Salido FS, Fraile VM, Osorio SI, Georgiev HT, Bernar de OJ, González-Ayora S, et al. Extended totally extraperitoneal (eTEP) approach for ventral hernia repair: Initial results. *Cir Esp (Engl Ed)* 2020;98:260-6.