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ETEP–RIVES–STOPPA REPAIR IN PRIMARY VENTRAL HERNIA - OUR EXPERIENCE IN A TERTIARY CARE TEACHING HOSPITAL

Subitcha P[1], P. B. Sudarshan*[2], Purushothaman.D[3], B. S. Sundaravadanan[4], Nanditha Gudi[5]

[1]Postgraduate, Department of General Surgery, Saveetha Medical College and Hospital, Chennai
[2*]Professor, HOD of Minimal Access Surgery, Department of General Surgery, Saveetha Medical College and Hospital, Chennai,
E-mail: pbsudarshan@yahoo.co.in
[3]Postgraduate, Department of General Surgery, Saveetha Medical College and Hospital, Chennai
[4]Professor, Department of General Surgery, Saveetha Medical College and Hospital, Chennai
[5]Associate Professor, Department of General Surgery, Saveetha Medical College and Hospital, Chennai
*Corresponding Author: P. B. Sudarshan, E-mail: pbsudarshan@yahoo.co.in

ABSTRACT

Background: Primary ventral hernias, including umbilical, paraumbilical, epigastric and spigelian hernias are among the most frequently encountered abdominal wall defects in general surgical practice. Although open retromuscular repair remains an established treatment modality, the increasing adoption of minimally invasive techniques has transformed ventral hernia surgery. The Enhanced Totally Extraperitoneal Rives–Stoppa (eTEP-RS) repair allows retromuscular mesh placement through a minimally invasive approach while avoiding direct contact between mesh and intra-abdominal viscera. Despite increasing popularity of this technique, studies exclusively evaluating its outcomes in primary ventral hernias remain limited.

Aim-To evaluate the feasibility, safety, and effectiveness of laparoscopic eTEP–Rives–Stoppa repair for the management of primary ventral hernias.

Materials and Methods: A retrospective observational study was conducted in the Department of General Surgery at Saveetha Medical College and Hospital, Chennai, a tertiary care teaching hospital in South India, between January 2021 and December 2024. All procedures were performed by a single surgeon experienced in advanced abdominal wall reconstruction. Forty consecutive patients with primary ventral hernias who underwent laparoscopic eTEP-RS repair were included. Demographic characteristics, operative variables, perioperative outcomes, postoperative complications, and recurrence rates were analyzed.

Results: Forty patients underwent laparoscopic eTEP–Rives–Stoppa repair for primary ventral hernias. The mean age was 46.8 ± 10.2 years, with a male-to-female ratio of 22:18. The mean operative time was 112 ± 22 minutes, and the mean mesh area was 298 ± 30 cm². Standard eTEP-RS repair was performed in 95% of patients, with TAR required in 5% and hybrid-assisted repair in 7.5%. The mean hospital stay was 2.8 ± 0.9 days, with low postoperative pain (2/10). Seroma occurred in 7.5% of patients, while no mesh infections or recurrences were observed during follow-up.

Conclusion: Laparoscopic eTEP–Rives–Stoppa repair is a safe, feasible, and effective technique for the management of primary ventral hernias, including W1 defects, with low postoperative pain, minimal complications, negligible wound-related morbidity, and excellent early outcomes without early recurrence. These findings support its role as a reliable and versatile minimally invasive retromuscular repair across the spectrum of primary ventral hernias.

KEYWORDS: Physical fitness; Muscular strength; Muscular power; Muscular endurance; Running speed; Running agility; Male cricket players; Talent identification.

INTRODUCTION

Ventral hernias constitute a significant proportion of abdominal wall defects encountered in routine surgical practice. Primary ventral hernias include umbilical, paraumbilical, epigastric and spigelian hernia arise due to congenital or acquired weaknesses within the anterior abdominal wall. Although traditionally managed through open surgical techniques,advances in minimally invasive surgery have led to the development of several laparoscopic and robotic approaches aimed at reducing postoperative pain, minimizing wound-related complications, and facilitating early return to normal activities.The commonly used lap tec is ipom plus.

The Rives–Stoppa repair has long been regarded as the gold standard for ventral hernia repair because of its ability to place mesh in the retromuscular position. Retromuscular mesh placement provides superior biomechanical reinforcement while maintaining separation between prosthetic material and intra-abdominal viscera.

The Enhanced Totally Extraperitoneal (eTEP) approach was initially described by Jorge Daes for inguinal hernia repair and subsequently adapted for ventral hernia repair by Belyansky and colleagues. The technique allows surgeons to recreate the principles of open Rives–Stoppa repair through a minimally invasive route. By creating a large retromuscular working

space, eTEP-RS enables placement of a large mesh in the retrorectus plane without entering the peritoneal cavity or exposing intra-abdominal contents to prosthetic material.

Most primary ventral hernias have been managed using minimally invasive techniques such as IPOM or IPOM Plus over the past three decades. Even after the advent of laparoscopic retrorectus repair, small defects continue to be treated with the IPOM Plus technique. The latest EHS guidelines recommend laparoscopic repair in the form of IPOM Plus for defects measuring less than 2 cm. Our hospital, being a tertiary care teaching center, caters to patients from lower socioeconomic backgrounds, many of whom are heavy manual laborers from nearby villages. Due to financial constraints, the benefits of laparoscopic surgery, particularly IPOM Plus, could not be offered to these patients. With the advent of the eTEP procedure for ventral hernia repair, we have adopted this technique to address primary ventral hernias not only in W2 and W3 categories but also in W1. This approach enables us to extend the advantages of minimally invasive surgery to these patients, allowing them to return to their routine work at the earliest, who are the bread winners of the family.

Compared with intraperitoneal onlay mesh (IPOM) repair, eTEP-RS avoids many concerns associated with intraperitoneal mesh placement, including bowel adhesions, mesh erosion, enterocutaneous fistula formation, and chronic pain related to mesh fixation devices. Furthermore, restoration of abdominal wall anatomy and reconstruction of the linea alba can be achieved more physiologically through the retromuscular approach.

Compared with incisional hernia Primary ventral hernias represent an ideal indication for eTEP-RS repair because the anatomical planes are generally well preserved and free from the dense adhesions frequently encountered in incisional hernias. Preservation of the hernia sac is often feasible, facilitating posterior layer reconstruction and reducing the need for advanced abdominal wall reconstruction procedures such as component separation. Consequently, operative dissection is usually more straightforward, resulting in shorter operative times and improved postoperative recovery.

Despite growing global experience with eTEP-RS repair, studies focusing exclusively on primary ventral hernias remain relatively scarce. Most published series combine primary and incisional hernias, making it difficult to assess outcomes specific to primary ventral defects. Understanding the feasibility and safety profile of eTEP-RS in primary ventral hernias is important for optimizing patient selection and surgical planning.

The present study evaluates the feasibility, safety, and early outcomes of laparoscopic eTEP-RS repair in patients with primary ventral hernias treated at a tertiary care teaching hospital in South India over a four-year period.

MATERIALS AND METHODS

Study Design and Setting

This retrospective study was conducted in the Department of General Surgery, Saveetha Medical College and Hospital, Chennai, a tertiary care teaching hospital in South India. The study period extended from January 2021 to December 2024. All procedures were performed by a single surgeon experienced in advanced laparoscopic abdominal wall reconstruction. Institutional Ethics Committee approval was obtained before commencement of the study.

Study Population:

A total of 40 consecutive patients diagnosed with primary ventral hernia who underwent laparoscopic eTEP-RS repair during the study period were included in the analysis.

Patients aged 18 years and above diagnosed with primary ventral hernia who were fit to undergo general anaesthesia and laparoscopic surgery were included in the study. Only patients who provided informed consent for surgery and agreed to participate in postoperative follow-up were enrolled.

Patients with incisional hernias, recurrent ventral hernias following previous repair, obstructed or strangulated hernias requiring emergency surgery, or hernia defects measuring more than 10 cm were excluded. Patients with overlying skin ulceration, those medically unfit for laparoscopic surgery or general anaesthesia, and patients unwilling to undergo surgical intervention or participate in postoperative follow-up were also excluded.

Data Collection

Patient demographics, preoperative imaging, operative records, and follow-up data were retrospectively reviewed.

The following variables were analysed:

Demographic variables included age, sex, and body mass index (BMI), along with relevant clinical factors such as diabetes mellitus, hypertension, smoking history, and other associated comorbidities. These variables were recorded to assess baseline patient characteristics and their potential influence on surgical outcomes.

Perioperative variables included defect size, presence of divarication of recti, and mesh size. Intraoperative details such as operative duration, type of surgical procedure performed, and the need for hybrid repair or component separation were also recorded. Additional factors like drain placement and occurrence of accidental pneumoperitoneum were documented to evaluate their impact on surgical outcomes.

Postoperative outcomes were evaluated based on pain score, seroma formation, wound infection, mesh infection, length of hospital stay, and recurrence. Pain was assessed using a standardized scale, while complications such as seroma, wound infection, and mesh infection were recorded clinically. Hospital stay was measured in days from surgery to discharge, and recurrence was defined as the reappearance of hernia during follow-up.

Statistical Analysis

Data were entered into Microsoft Excel and analysed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Statistical significance was considered at a p-value of less than 0.05.

STEPS OF PROCEDURE

All procedures were performed under general anaesthesia by a single surgeon experienced in advanced laparoscopic abdominal wall reconstruction.

1. Patient Positioning and Port Placement

The patient was positioned supine with both upper limbs tucked. Appropriate padding was provided to pressure points. The abdominal wall was marked preoperatively to identify the linea alba, rectus muscles, semilunar lines, and hernia defect.

Access to the retrorectus space was obtained using either an open technique or a visiport approach. Carbon dioxide insufflation was maintained between 12 and 15 mmHg. The initial port was introduced into the retrorectus space and subsequent working ports were placed under direct vision according to the location and extent of the hernia defect.

Port placement was individualized to facilitate adequate retrorectus dissection while ensuring ergonomic instrument handling.

2. Retrorectus Dissection

Following access, blunt telescopic dissection was performed within the retrorectus plane. The posterior rectus sheath was carefully separated from the rectus muscle while preserving tissue integrity.

Dissection was extended caudally beyond arcuate line towards the pubic symphysis whenever required. Lateral dissection was continued up to the linea semilunaris to create an adequate retromuscular space for mesh placement.

Primary ventral hernias generally demonstrated well-preserved anatomical planes, facilitating easier dissection compared to secondary or incisional hernias, thereby reducing the risk of early peritoneal breach during retrorectus dissection.

3. Crossover and Hernia Reduction

Following completion of ipsilateral retrorectus dissection, crossover to the contralateral side was performed by incising the medial edge of the posterior rectus sheath approximately 3–5 mm from the linea alba, preserving sufficient tissue for subsequent posterior layer closure.

For supraumbilical defects, superior crossover was achieved by entering the prefalciform space. Dissection was carried out anterior to the peritoneum and posterior to the linea alba beneath the falciform ligament. The contralateral posterior rectus sheath was identified and opened, thereby establishing communication between the right and left retrorectus compartments above the hernia defect. This maneuver created a continuous retromuscular plane across the upper abdomen and facilitated adequate mesh overlap beyond the defect margins.

For infraumbilical defects, inferior crossover was performed by dissecting across the midline posterior to the linea alba and anterior to the peritoneum, allowing entry into the opposite retrorectus compartment below the defect. This connected both lower retrorectus spaces and enabled development of a large retromuscular working space.

Following successful superior and/or inferior crossover, the contralateral retrorectus space was further developed laterally up to the linea semilunaris. The hernia sac was then identified and carefully dissected from the surrounding tissues.

The contents of the hernia sac were completely reduced into the abdominal cavity. Preservation of the hernia sac was attempted in larger defects whenever feasible, as it provided additional tissue for posterior layer reconstruction, facilitated tension-free closure, and reduced the need for component separation.

4. Reconstruction of defect and linea alba

Following complete reduction of the hernia contents, attention was directed towards restoration of the abdominal wall anatomy. The posterior rectus sheath and peritoneal defects were closed using continuous 2-0 barbed absorbable sutures or 2-0 PDS or 2-0 vicryl to recreate the posterior layer.

Subsequently, the anterior fascial defect was approximated in the midline using continuous 1-0 ,2-0 barbed sutures. Reconstruction of the linea alba re-established normal muscle biomechanics.

In patients with associated divarication of recti, plication was performed concurrently to achieve satisfactory midline reconstruction and tension-free closure.

5. Mesh Placement

Following completion of defect closure, dissected space measured and an appropriate large polypropylene mesh was introduced into the retromuscular space.

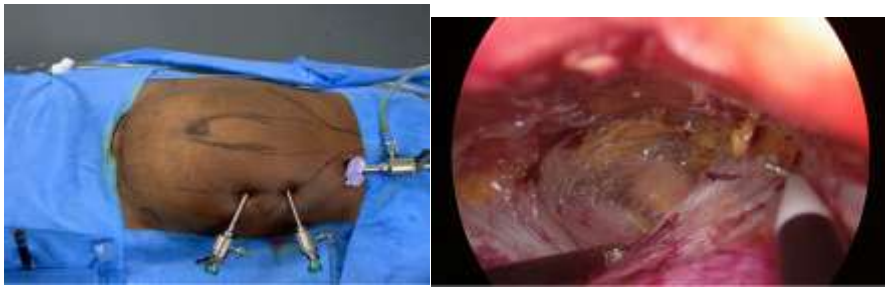
The mesh was carefully spread within the retrorectus compartment, ensuring complete coverage of the repaired area. Routine mesh fixation was not performed. The retromuscular position, together with intra-abdominal pressure and surrounding tissue planes, provided stable mesh placement.

Component separation or Transversus Abdominis Release (TAR) was performed selectively in cases where tension-free closure of the posterior layer or linea alba could not be achieved.

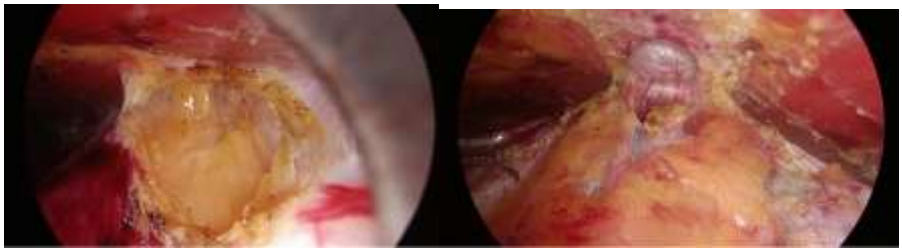
6. Postoperative Care

Patients were mobilized on the day of surgery (Postoperative Day 0), and oral feeding was initiated as tolerated. Postoperative pain was effectively controlled using multimodal analgesia, with an average pain score of approximately 2/10, facilitating early ambulation and recovery.

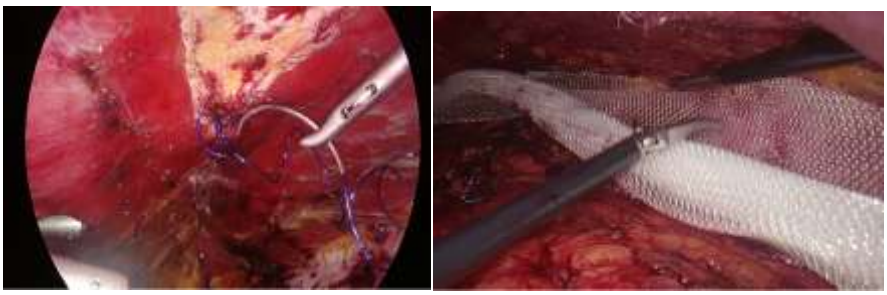
Most patients achieved satisfactory pain control, ambulation, and oral intake within the first postoperative day and were discharged within 1–2 days following surgery. Follow-up evaluations were performed to assess wound healing, postoperative pain, seroma formation, surgical site infection, mesh-related complications, and recurrence.



(A) **(B)**



(C) **(D)**



(E) **(F)**

(A)Ports Placement, (B)Retrorectus Dissection, (C) Crossover, (D)Defect, (E)Reconstruction of linea alba, (F)Mesh placement.

RESULTS

A total of 40 patients with primary ventral hernias underwent laparoscopic eTEP-Rives–Stoppa repair during the study period.

The study population consisted predominantly of middle-aged adults with a mean age of 46.8 ± 10.2 years, with a slight male predominance. The mean BMI was 27.1 ± 2.9 kg/m², with most patients falling into the overweight category. Comorbidities such as diabetes mellitus and hypertension were present in a subset of patients.

Table 1: DEMOGRAPHIC CHARACTERISTICS OF STUDY POPULATION

VARIABLE	VALUE
Number of patients	40
Mean age (years)	46.8 ± 10.2
Sex Distribution (M:F)	22:18
Mean BMI (kg/m²)	27.1 ± 2.9
Diabetes Mellitus	10 (25%)
Hypertension	12 (30%)
Smoking History	5 (12.5%)
Coronary Artery Disease	2 (5%)

According to the European Hernia Society (EHS) classification, the majority of hernias were W2 defects (70%), followed by W3 (20%) and W1 (10%). The relatively smaller defect sizes and well-preserved tissue planes facilitated retromuscular dissection. The mean operative time was 112 ± 22 minutes. During the initial learning phase, the operative time ranged from 2.5 to 3 hours; however, with increasing surgical experience and standardization of the technique, the procedure was routinely completed within 90 minutes. The mean mesh area used was 298.0 ± 30 cm². Divarication of the recti was present in 28 patients (70%). Hybrid-assisted repair was required in three patients (7.5%). Two of these cases were performed during the initial learning curve, while the third required a hybrid approach because of a large redundant skin fold that required excision. Transversus abdominis release (TAR) was performed in four patients (10%), of whom three underwent unilateral TAR and one underwent bilateral TAR to achieve tension-free abdominal wall reconstruction.

Table 2: PERIOPERATIVE CHARACTERISTICS

VARIABLE	VALUE
Defect Width Classification (EHS)	
W1 (<2 cm)	4 (10%)
W2 (2-4 cm)	28 (70%)
W3 (>4 cm)	8 (20%)
Mean Mesh Area (cm²)	298.0 ± 30
Mean Operative Time	112 ± 22
Divarication of Recti Present	28 (70%)
eTEPP-Rives-Stoppa Repair	38 (95%)
Transversus Abdominis Release TAR	4 (10%)
Hybrid Repair Assisted	3 (7.5%)

Postoperative outcomes were favourable, with a mean hospital stay of 2.8 ± 0.9 days and a low mean postoperative pain score of 2/10, indicating minimal postoperative pain following laparoscopic eTEP-RS repair. Seroma formation was the most common complication, occurring in 7.5% of patients, and resolved spontaneously within one month. No wound infections, mesh infections, or recurrences were observed during the follow-up period.

Table 3: POSTOPERATIVE OUTCOME

VARIABLE	VALUE
Mean Pain Score (overall)	2.0/10
Seroma	3 (7.5%)
Mesh Infection	0
Wound Infection	0
Mean Hospital Stay (days)	2.8 ± 0.9
Recurrence	0

DISCUSSION

The present study demonstrates that laparoscopic eTEP–Rives–Stoppa repair is a safe, feasible, and effective technique for the management of primary ventral hernias. By combining the advantages of minimally invasive surgery with the established biomechanical benefits of retromuscular mesh placement, eTEP-RS offers an attractive alternative to both open retromuscular repair and intraperitoneal mesh-based techniques [1–4].

Primary ventral hernias present several anatomical advantages that facilitate eTEP-RS repair. Unlike incisional hernias, the tissue planes remain largely undisturbed by previous surgical intervention. This preservation of anatomical planes

permits easier retrorectus dissection, reduces operative difficulty, and minimizes the need for extensive adhesiolysis [2,4,5].

The mean operative time of 112 ± 22 minutes compares favourably with previously published eTEP series [3,5,6]. During the initial learning phase, operative time ranged from 2.5 to 3 hours; however, with increasing surgical experience and standardization of the technique, the procedure was routinely completed within 90 minutes. The reduced operative duration in primary ventral hernias largely reflects the absence of dense adhesions and scar tissue commonly encountered during incisional hernia repair.

One of the important observations in the present study was the low requirement for posterior component separation. Although defect size remains an important determinant, preservation of the hernia sac facilitated posterior layer reconstruction and enabled tension-free closure in most patients without the need for advanced abdominal wall release procedures [4,6,7].

Hybrid-assisted repair was required in only three patients (7.5%). Two of these procedures were performed during the initial learning phase, while the third required a hybrid approach because of a large redundant skin fold requiring excision. This finding further supports the suitability of primary ventral hernias for a predominantly minimally invasive retromuscular approach.

Postoperative outcomes were favourable. Patients experienced minimal postoperative pain, with a mean pain score of 2/10, facilitating early mobilisation and discharge. Seroma formation occurred in 7.5% of patients and resolved spontaneously with conservative management within one month. No wound infections, mesh infections, or recurrences were observed during the follow-up period.

An important finding of this study was the successful application of laparoscopic eTEP-RS repair across all primary ventral hernia defect-width categories, including W1 and W2 defects. Most small and moderate-sized defects were successfully repaired without posterior component separation. Even in larger defects, preservation of the hernia sac facilitated posterior layer reconstruction and reduced the need for Transversus Abdominis Release (TAR). Unilateral TAR was required in three patients with defects larger than 6 cm, while bilateral TAR was required in one patient. Furthermore, mesh fixation was not required in any patient, and no recurrences were observed during follow-up, representing an important advantage of retromuscular eTEP-RS repair over conventional IPOM repair [1,4,8].

The present study further highlights the reproducibility of eTEP-RS when performed by an experienced surgeon. Standardized port placement, meticulous retrorectus dissection, preservation of the hernia sac, restoration of the linea alba, and retromuscular mesh placement contributed to favourable perioperative outcomes. These findings support the expanding role of laparoscopic eTEP-RS as an effective, economical, and durable minimally invasive technique for the management of primary ventral hernias [2,5,8–10].

Limitations

The limitations of this study include its retrospective design, single-centre setting, relatively small sample size, and performance by a single surgeon. Long-term follow-up is required to accurately assess recurrence rates and durability of repair.

CONCLUSION

Laparoscopic eTEP–Rives–Stoppa repair is a safe, feasible, and effective approach for the management of primary ventral hernias. The presence of intact anatomical planes facilitates retromuscular dissection, allowing tension-free mesh placement with low morbidity, shorter operative times, rapid postoperative recovery, and excellent early outcomes.

In our tertiary care teaching hospital, serving predominantly patients from lower socioeconomic backgrounds, laparoscopic eTEP-RS has been successfully adopted for even W1 and W2, primary ventral hernias. The technique enables the use of an economical polypropylene mesh while preserving the advantages of minimally invasive surgery, thereby reducing treatment costs and facilitating an early return to routine work.

With increasing surgical expertise and standardization of technique, eTEP-RS has the potential to become a preferred minimally invasive retromuscular repair for appropriately selected primary ventral hernias, particularly in resource-limited healthcare settings

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