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COMPARATIVE STUDY OF LAPAROSCOPIC ETEP VERSUS IPOM PLUS REPAIR FOR PRIMARY VENTRAL HERNIA IN A TERTIARY CARE TEACHING HOSPITAL

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ABSTRACT
Introduction: Primary ventral hernias are frequently encountered defects of the anterior abdominal wall and include umbilical, paraumbilical, epigastric, and spigelian varieties. Operative repair is advised to avoid complications such as incarceration and intestinal obstruction. Minimally invasive ventral hernia surgery has become increasingly preferred because it provides faster recovery, reduced postoperative discomfort, and fewer wound-related complications. Intraperitoneal Onlay Mesh Plus (IPOM Plus) repair was the most commonly used laparoscopic method of surgery for primary ventral hernia correction, which involves closure of the fascial defect followed by placement of a composite mesh within the peritoneal cavity in sublay position. Although technically less difficult , intraperitoneal mesh positioning may be associated with adhesion formation and persistent postoperative pain. Enhanced-view Totally Extraperitoneal (eTEP) repair was developed to facilitate retromuscular mesh placement while preserving normal abdominal wall dynamics.
Methodology: A comparative observational study was carried out at a tertiary teaching hospital between January 2021 and December 2025. Hundred patients diagnosed with primary ventral hernia underwent laparoscopic repair and were categorized into two groups: IPOM Plus (50 patients) and eTEP (50 patients). Parameters evaluated included operative duration, postoperative pain, duration of hospitalization, perioperative complications, recurrence, and recovery profile.
Results: Patients treated with eTEP experienced lower postoperative pain scores, reduced seroma occurrence, shorter hospital stay, and earlier recovery when compared with the IPOM Plus group. The operative time was longer in the eTEP arm because of the technically demanding retrorectus dissection.
Conclusion: eTEP repair demonstrated improved postoperative recovery and lower morbidity in comparison with IPOM Plus repair for primary ventral hernia, despite requiring greater operative expertise.

KEYWORDS: Primary ventral hernia, eTEP repair, IPOM Plus, laparoscopic abdominal wall reconstruction

INTRODUCTION
Primary ventral hernias are frequently encountered defects of the anterior abdominal wall and include umbilical, paraumbilical, epigastric, and spigelian varieties. Operative repair is advised to avoid complications such as incarceration and intestinal obstruction.[1] Minimally invasive ventral hernia surgery has become increasingly preferred because it provides faster recovery, reduced postoperative discomfort, and fewer wound-related complications.[2,3]Intraperitoneal Onlay Mesh Plus (IPOM Plus) repair involves closure of the fascial defect followed by placement of a composite mesh within the peritoneal cavity.[4] Although effective, intraperitoneal mesh positioning may be associated with adhesion formation and persistent postoperative pain.[5] Enhanced-view Totally Extraperitoneal (eTEP) repair was developed to facilitate retromuscular mesh placement while preserving normal abdominal wall dynamics.Primary ventral hernias arise because of weakness within the musculoaponeurotic layers of the anterior abdominal wall. Common subtypes include umbilical, paraumbilical, epigastric, and spigelian hernias.[1,8]The development of laparoscopic techniques has considerably changed ventral hernia management. Compared with open surgery, minimally invasive repair is associated with reduced tissue trauma, lower infection rates, decreased analgesic requirement, and faster return to normal activity.[2]Laparoscopic IPOM repair gained popularity owing to its reproducibility and technical simplicity.[3] Subsequent modification into IPOM Plus, with closure of the fascial defect before mesh insertion, improved abdominal wall support and decreased postoperative bulging.[4] Nevertheless, placement of mesh within the peritoneal cavity continues to raise concerns regarding adhesions, mesh-related complications, and chronic discomfort.[5,9]
The eTEP approach was later introduced as an advanced minimally invasive retromuscular technique.[6] This method enables mesh deployment in the retrorectus plane while avoiding direct contact between mesh and intra-abdominal viscera. By reproducing the principles of retromuscular abdominal wall reconstruction, eTEP may improve postoperative comfort and long-term outcomes.7[,10]Several recent comparative studies have demonstrated lower postoperative pain scores, reduced seroma formation, and improved patient recovery with eTEP repair compared with IPOM Plus.[11,12]The present

study was designed to compare perioperative and postoperative outcomes between laparoscopic eTEP repair and IPOM Plus repair in patients with primary ventral hernia.

METHODOLOGY

This study was a retrospective comparative study conducted in the Department of General Surgery, Saveetha Medical College and Hospital, Chennai, over a period of five years (January 2021 to December 2025). A total of 100 patients who underwent laparoscopic repair for primary ventral hernia were included and divided into two groups: Group I (IPOM Plus, n = 50) and Group E (eTEP, n = 50). Patients aged more than 18 years with primary ventral hernia undergoing elective surgery and having a hernia defect size ≤5 cm were included in the study. Patients with recurrent hernia, incisional hernia, complicated hernia, emergency presentations, or those unfit for laparoscopic surgery were excluded from the analysis.

Operative Procedure - Laparoscopic IPOM Plus Repair:

All procedures were performed under general anaesthesia by a single surgeon experienced in advanced laparoscopic ventral hernia repair. A standardized operative protocol was followed for all patients undergoing Intraperitoneal Onlay Mesh Plus (IPOM Plus) repair.

1. Patient Positioning and Port Placement: The patient was positioned supine with both upper limbs tucked comfortably by the sides. Adequate padding was applied over all pressure points to prevent compression injuries. Following induction of general anaesthesia, the abdomen was prepared and draped in a sterile fashion.Pneumoperitoneum was established using either a Veress needle or an open (Hasson) technique at a site away from the hernia defect. Carbon dioxide insufflation was maintained between 12 and 15 mmHg throughout the procedure. A 10-mm camera port was inserted, and additional 5-mm working ports were placed under direct laparoscopic vision on the contralateral side of the defect to facilitate optimal instrument triangulation. Port placement was individualized according to the size and location of the hernia.

2. Diagnostic Laparoscopy and Adhesiolysis: A thorough laparoscopic examination of the abdominal cavity was performed to assess the size, location, and contents of the hernia defect. Adhesions between the abdominal wall and intra-abdominal viscera were carefully divided using sharp and blunt dissection with ultrasonic or bipolar energy devices.Meticulous adhesiolysis was performed to avoid bowel injury while ensuring complete exposure of the hernia margins. Hernia contents were gently reduced into the peritoneal cavity, and the sac was left in situ whenever appropriate.

3. Measurement of the Hernia Defect: Following complete adhesiolysis and reduction of the hernia contents, the margins of the fascial defect were clearly identified. The defect dimensions were measured both externally and laparoscopically using a sterile measuring scale or spinal needle technique.The required mesh size was selected to provide at least a 5-cm overlap beyond all margins of the fascial defect.

4. Primary Fascial Closure (IPOM Plus): The pneumoperitoneum pressure was reduced to approximately 8–10 mmHg to facilitate approximation of the abdominal wall. The fascial defect was closed primarily using interrupted or continuous non-absorbable or slowly absorbable sutures placed with a transfascial suture passer.Closure of the fascial defect restored the continuity of the abdominal wall, reduced postoperative seroma formation, improved functional and cosmetic outcomes, and minimized mesh bulging. In patients with associated rectus diastasis, limited plication of the linea alba was performed whenever feasible to improve midline reconstruction.

5. Intraperitoneal Mesh Placement and Fixation: A composite anti-adhesion mesh of appropriate size was introduced into the abdominal cavity through the 10-mm port. The mesh was carefully unfolded and positioned to ensure uniform overlap of at least 5 cm in all directions beyond the repaired defect.Fixation was achieved using a combination of transfascial stay sutures placed at the cardinal points and circumferential absorbable or non-absorbable tackers in a double-crown configuration. Mesh orientation and fixation were carefully inspected to ensure complete expansion without folds or displacement.Following satisfactory fixation, the pneumoperitoneum pressure was gradually reduced while confirming stable mesh positioning and adequate abdominal wall contour.

6. Completion of Procedure: The operative field was irrigated and inspected for haemostasis. The integrity of the bowel and other intra-abdominal organs was reassessed to exclude inadvertent injury. Pneumoperitoneum was released under direct vision, ports were removed, and fascial closure was performed for all ports measuring 10 mm or larger. Skin incisions were closed using absorbable subcuticular sutures or skin staples according to surgeon preference.

7. Postoperative Care: Patients were mobilized on the day of surgery whenever clinically feasible. Oral fluids followed by a regular diet were initiated as tolerated. Multimodal analgesia was administered to provide adequate pain control and facilitate early ambulation.Patients were generally discharged within one to three postoperative days after achieving satisfactory pain control, independent ambulation, and adequate oral intake. Follow-up visits were scheduled to evaluate wound healing, postoperative pain, seroma formation, surgical-site infection, mesh-related complications, chronic pain, and hernia recurrence.

(A)

(B)

(C)

(D)

(A)Clinical picture (B)Content, (C) Defect Closed (D)Mesh placement.

Operative Procedure of eTEP:
All procedures were performed under general anaesthesia by a single consultant surgeon with extensive experience in minimally invasive abdominal wall reconstruction using the enhanced-view totally extraperitoneal (eTEP) technique.

1. Patient Preparation and Retrorectus Access : The patient was placed in the supine position with both arms tucked alongside the body to facilitate unrestricted movement of laparoscopic instruments. Adequate padding was applied over all pressure points to prevent position-related injuries. Prior to skin preparation, the abdominal wall was carefully marked to identify the linea alba, rectus muscles, semilunar lines, and the boundaries of the hernia defect.Retrorectus access was established using either an open Hasson technique or optical trocar entry according to surgeon preference. Carbon dioxide insufflation was maintained at an intra-abdominal pressure of 12–15 mmHg. After creation of the initial retrorectus working space, additional ports were inserted under laparoscopic vision. Port positions were tailored according to the site and dimensions of the hernia to optimize instrument ergonomics and facilitate complete retromuscular dissection.

2. Development of the Retrorectus Plane : Dissection commenced within the retrorectus compartment using a combination of blunt telescopic dissection and energy devices. The posterior rectus sheath was meticulously separated from the rectus abdominis muscle while preserving both fascial integrity and vascular supply. Cranial and caudal dissection was continued to obtain adequate working space, extending below the arcuate line towards the pubic symphysis whenever indicated. Laterally, the dissection proceeded up to the linea semilunaris to ensure sufficient space for prosthetic mesh placement.Primary ventral hernias usually demonstrated well-defined tissue planes, allowing relatively straightforward retrorectus dissection, whereas previous surgical intervention in incisional hernias often resulted in fibrosis requiring more meticulous tissue handling.

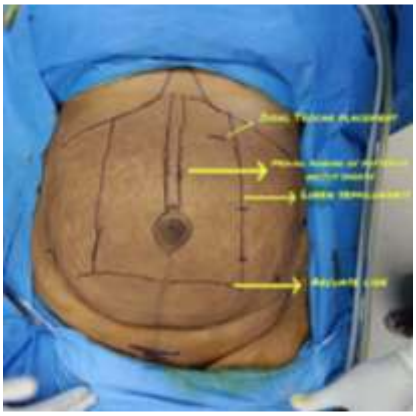
3. Midline Crossover and Hernia Sac Reduction: After completion of unilateral retrorectus dissection, crossover to the opposite retrorectus compartment was performed by incising the medial margin of the posterior rectus sheath approximately 3–5 mm from the linea alba, leaving an adequate fascial edge for later reconstruction.For defects located above the umbilicus, the dissection was continued through the prefalciform plane beneath the falciform ligament, remaining anterior to the peritoneum. The contralateral posterior rectus sheath was then entered, thereby creating a continuous retromuscular compartment across the upper abdomen.In infraumbilical hernias, crossover was achieved by dissecting beneath the linea alba posteriorly and entering the opposite retrorectus plane inferior to the defect. Once communication between both retrorectus spaces had been established, lateral dissection was completed up to the semilunar line on the opposite side.The hernia sac was subsequently identified, circumferentially dissected, and reduced completely into the abdominal cavity. Whenever feasible, particularly in larger defects, the sac was preserved to augment posterior layer reconstruction and facilitate tension-free closure.

4. Reconstruction of the Posterior Layer and Fascial Closure : Following complete reduction of the hernia contents, reconstruction of the abdominal wall was undertaken. Any defects in the posterior rectus sheath or peritoneum were closed using continuous absorbable barbed sutures to restore the posterior retromuscular layer.The anterior fascial defect was then approximated using continuous slowly absorbable barbed sutures, restoring the integrity of the linea alba and improving abdominal wall biomechanics. In patients with associated rectus diastasis, simultaneous plication was performed to recreate the normal midline contour and achieve durable fascial reconstruction.

5. Retromuscular Mesh Placement : The dimensions of the dissected retromuscular compartment were measured to determine the appropriate mesh size. A large polypropylene mesh was introduced laparoscopically and deployed within the retrorectus space, ensuring generous overlap beyond all margins of the hernia defect.Routine fixation of the mesh was not required, as the retromuscular compartment, together with physiological intra-abdominal pressure, maintained stable mesh positioning. Posterior component separation with Transversus Abdominis Release (TAR) was reserved for selected patients in whom primary closure of the posterior layer or linea alba could not be achieved without undue tension.

6. Postoperative Management: Patients were encouraged to ambulate on the day of surgery whenever clinically appropriate. Oral fluids and diet were initiated as tolerated. Multimodal analgesia was administered to provide effective postoperative pain control, permitting early mobilisation and enhanced recovery.

Most patients recovered uneventfully and fulfilled discharge criteria within one to two postoperative days. Follow-up assessments included evaluation of wound healing, postoperative pain, seroma formation, surgical-site infection, mesh-related complications, and hernia recurrence.


(A)


(B)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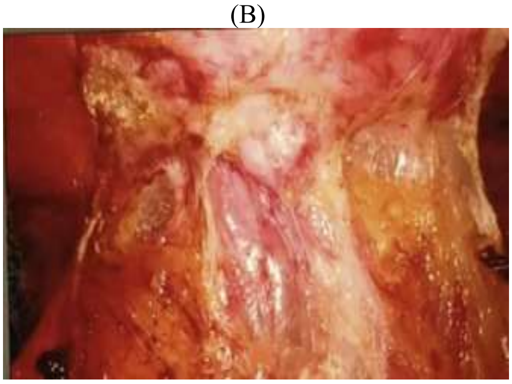
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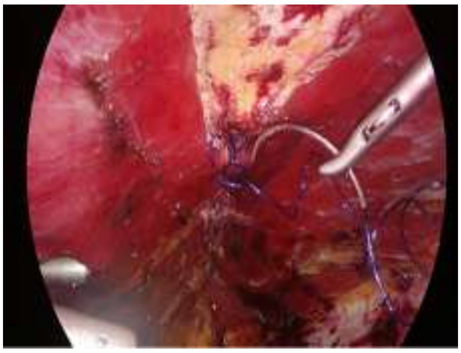
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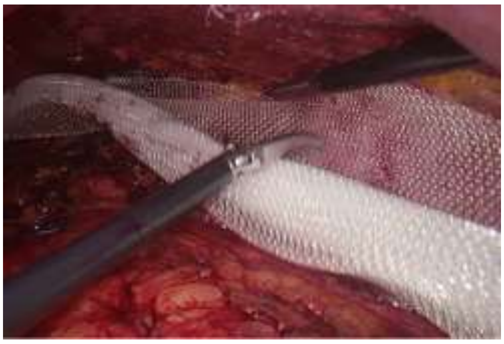

(F)

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

RESULTS

Table 1 summarizes the baseline demographic and clinical characteristics of the study population. Both the IPOM Plus and eTEP groups were comparable with respect to age, gender distribution, body mass index, and associated comorbidities, with no statistically significant differences observed ($p > 0.05$). The mean age was 43 ± 11 years in the IPOM Plus group and 45 ± 10 years in the eTEP group ($p = 0.71$). Male patients constituted 46% and 50% of the IPOM Plus and eTEP groups, respectively ($p = 0.69$). The mean BMI was 26 ± 2 kg/m² in the IPOM Plus group and 27 ± 3 kg/m² in the eTEP group ($p = 0.36$). Diabetes mellitus was present in 10% and 15% of patients ($p = 0.37$), while hypertension was observed in 20% of patients in both groups ($p = 1.00$).

Table 1: Demographic profile of study participants

Parameters	**IPOM Plus (n=50)**	**eTEP (n=50)**	**p-value**
Mean age (years)	43± 11	45 ± 10	0.71
Male	23 (46%)	25 (50%)	0.69
Female	27 (54%)	25 (50%)	0.69
Mean BMI (kg/m²)	26 ± 2	27 ± 3	0.36

Parameters	IPOM Plus (n=50)	eTEP (n=50)	p-value
Diabetes mellitus	5(10%)	8 (15%)	0.37
Hypertension	10 (20%)	10 (20%)	1.00

Table 2 presents the distribution of hernia characteristics and defect dimensions between the IPOM Plus and eTEP groups. The eTEP group had significantly larger and more complex hernia defects than the IPOM Plus group. Umbilical hernias were significantly more common in the IPOM Plus group (70% vs. 36%; p = 0.001), whereas paraumbilical hernias were more frequently managed with eTEP (50% vs. 20%; p = 0.002). The incidence of epigastric hernias was comparable between the groups (10% vs. 14%; p = 0.54). Patients undergoing eTEP had significantly greater mean defect width (3.5 ± 0.9 cm vs. 2.3 ± 0.6 cm; p = 0.001), mean defect length (2.6 ± 0.7 cm vs. 2.1 ± 0.5 cm; p = 0.001), and mean defect area (9.1 ± 2.4 cm² vs. 4.8 ± 1.6 cm²; p = 0.001) compared with those undergoing IPOM Plus.

Table 2: Hernia types and defect size:

Parameters	IPOM Plus	eTEP	p-value
Umbilical	35(70%)	18(36%)	0.001
Paraumbilical	10(20%)	25(50%)	0.002
Epigastric	5 (10%)	7(14%)	0.54
Mean defect width (cm)	2.3± 0.6	3.5 ± 0.9	0.001
Mean defect length (cm)	2.1 ± 0.5	2.6 ± 0.7	0.001
Mean defect area (cm²)	4.8 ± 1.6	9.1± 2.4	0.001

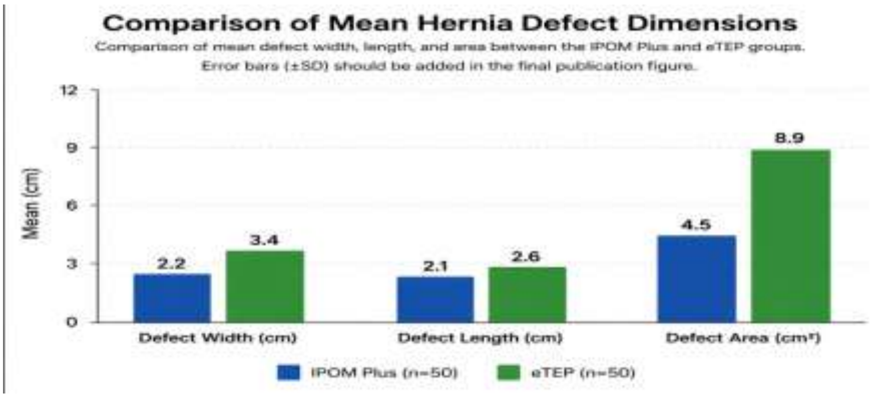
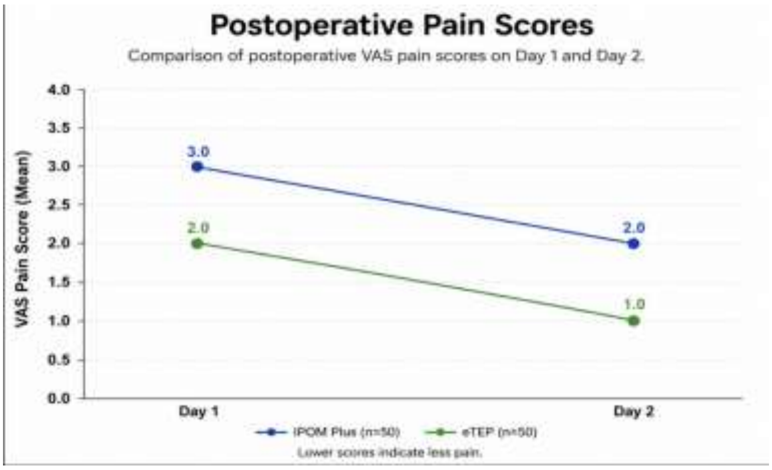


Table 3: Postoperative parameters

Parameters	IPOM Plus	eTEP	p-value
Mean operative duration (min)	72 ± 14	158± 18	0.001
Mean hospital stay (days)	2	2	0.041
VAS day 1 VAS day2	3 ± 1 2±1	2 ± 1 1	0.001
Paralytic ileus	4 (20%)	1 (5%)	0.15
Recurrence	0	0	0
Average surgical Cost of procedure	70,000	35,000	0

The mean operative duration was significantly longer in the eTEP group than in the IPOM Plus group (158 ± 18 vs 72 ± 14 minutes, p = 0.001). The mean hospital stay was comparable between the two groups (2 vs 2 days, p = 0.041). Postoperative pain, assessed using the Visual Analogue Scale (VAS), was significantly lower in the eTEP group on both postoperative Day 1 (2 ± 1 vs 3 ± 1, p = 0.001) and Day 2 (1 vs 2 ± 1, p = 0.001). Paralytic ileus was observed more frequently in the IPOM Plus group (20% vs 5%, p = 0.15), although the difference was not statistically significant. No recurrence was noted in either group during the follow-up period. Furthermore, the overall treatment cost was substantially lower in the eTEP group (₹35,000 vs ₹70,000). Despite requiring a longer operative time, eTEP was associated with superior postoperative recovery, reduced pain, lower treatment cost, and a trend toward fewer postoperative complications compared with IPOM Plus repair.



DISCUSSION

The Present study demonstrates that eTEP repair offers superior postoperative outcomes compared to IPOM Plus.The operative duration in eTEP was significantly longer, similar to findings by Binthaf et al.[11] and Claus et al.[1]Postoperative pain was significantly lower in eTEP, which is consistent with Sholapur et al.[12] and Belyansky et al.[7] This may be due to retromuscular mesh placement and avoidance of tack fixation.Hospital stay was shorter in eTEP, reflecting early ambulation and reduced bowel manipulation.[11,12]Recurrence occurred only in IPOM Plus patients, similar to Itani et al.[10]The anatomical retromuscular mesh placement in eTEP provides better abdominal wall dynamics and reduces mesh-related complications.[6,7]

CONCLUSIONS

Laparoscopic eTEP repair provides superior postoperative outcomes compared to IPOM Plus in primary ventral hernia repair. Although technically more demanding and associated with longer operative duration, it offers lower postoperative pain, fewer complications, reduced recurrence, and improved patient recovery. This gives all the advantages of laparoscopic surgery for patients who belong tp lower socioeconomic group , who are the bread winners of their family. establishing it as a safe, cost-effective, and preferred surgical approach for primary ventral hernia repair.

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