

# Novel Technique of Laparoscopic e-TEP (Extended View Totally Extraperitoneal Repair) for Umbilical Hernia at a Tertiary Care Centre of Eastern India: a Case Series

Nitesh KUMAR<sup>a</sup>, Pradeep JAISWAL<sup>a</sup>, Nirupam SINHA<sup>a</sup>, Deepak PANKAJ<sup>a</sup>,  
Vibhuti BHUSHAN<sup>a</sup>, Pawan Kumar JHA<sup>a</sup>, Sweta MUNI<sup>b</sup>

<sup>a</sup>Department of General Surgery, Indira Gandhi Institute of Medical Sciences, Patna, Bihar, India

<sup>b</sup>Department of Microbiology, Indira Gandhi Institute of Medical Sciences, Patna, Bihar, India

## ABSTRACT

**Introduction:** The field of abdominal wall hernias has undergone many innovations. Ventral hernias have conventionally been treated by open on-lay mesh hernioplasty, open retromuscular mesh hernioplasty (Rives-Stoppa procedure) and laparoscopic intraperitoneal mesh hernioplasty.

**Objective:** To develop an alternative strategy where a mesh is placed in retromuscular space by minimal access technique of the laparoscopic extended view totally extraperitoneal approach (e-TEP).

**Methodology:** This was an interventional and prospective study on series of 25 cases of either sex with age  $\geq 18$  years and  $\leq 65$  years presenting with umbilical hernia with abdominal wall defect. Laparoscopic e-TEP (extended view totally extraperitoneal repair) for umbilical hernia was performed and patients were usually discharged within 48–72 hours of the procedure. Follow-up surveillance for complications and recurrence of hernia was performed in an outpatient clinic the sixth week after surgery and by telephonic conversation every sixth months. Demographic profile, medical history, preoperative (comorbidities), perioperative and postoperative (during hospital stay) clinical profile of each patient was documented.

**Results:** Among our study participants there was a female preponderance, with a male to female ratio of 0.47:1. Patients' ages ranged from 27 to 61 years, with a mean (SD) of 41.7 (11.4) years. Average defect size was 4.2 cm<sup>2</sup>. One hernia involved divarication of recti muscles. A polypropylene mesh of size 15 x 15 cm was placed. The mean operative times were 94 minutes, ranging from 60 to 120 minutes. The average hospital stay was three days. The mean follow-up period was 12.6 months. Two patients developed seroma at umbilicus with discharge from suture site which resolved in two weeks with regular dressing. Prolonged ileus was noted in two patients, which resolved spontaneously by the fourth day. None of the patients developed surgical site infection, skin necrosis, wound dehiscence, bowel obstruction, urinary complications, or deep vein thrombosis. Also, none of the patients required conversion to open surgery.

**Conclusion:** The current study generates evidence in support of this technique to be adapted in centers with advanced laparoscopic skills.

**Keywords:** abdominal wall hernia, laparoscopic hernioplasty, polypropylene mesh, surgical site seroma.

Address for correspondence:

Dr. Deepak Pankaj, Assistant Professor

Department of General Surgery, Indira Gandhi Institute of Medical Sciences, Sheikhpura, Patna-800014, Bihar, India

Tel.: +919431060340; email: [drdeepakpankajgims@gmail.com](mailto:drdeepakpankajgims@gmail.com)

Article received on the 11<sup>th</sup> of April 2022 and accepted for publication on the 18<sup>th</sup> of June 2022

## INTRODUCTION

Abdominal wall reconstruction for abdominal defects has always been the domain of the open surgeon. But in the recent times there has been an attempt to replicate the open component separation techniques by minimally invasive (usually laparoscopic and robotic) approaches. There have been various techniques of posterior component separation, including transversus abdominis release (TAR) and Rives-Stoppa repair using the e-TEP approach (1).

Laparoscopy has brought a revolution in the field of surgery after its innovation and most of the procedures are being performed laparoscopically worldwide. There has been an increase in innovative procedures for ventral abdominal wall hernia (2). Laparoscopic hernia has largely replaced the open method for umbilical hernia almost everywhere and has been a less painful, safe and efficient procedure (3).

A minimally invasive technique, popularly known as e-TEP, to place a mesh in retromuscular space has been under discussion between experts for long. This novel technique was first performed by Jorge Daes in 2012, when he tried to address difficult cases of inguinal hernias (4). The idea was to create a larger space to tackle larger defects. Later on, the idea was extended for use in the correction of ventral hernias by Rives and Stoppa (RS) (5). Hence, the procedure has been called extended totally extraperitoneal RS repair (e-TEP RS). For a defect too wide to be closed without tension, a component separation procedure was added. Posterior component separation technique (PCST) as transversus abdominis release (TAR) was described by Novitsky *et al* (6) and was later done using the e-TEP technique under the name e-TEP TAR.

Mesh placement in retromuscular space helps in better vascularity of the mesh bilaterally, with apparently lesser problems in fixation, which helps not only lessen recurrence and postoperative pain but also reduce the risk of bowel adhesions. The technique is also economical as the mesh is low cost (7). This was previously used for laparoscopic inguinal hernia repairs (8). Frequently performed surgeries and conventional approaches for ventral hernias include open on lay mesh hernioplasty, open retromuscular mesh hernioplasty (Rives-Stoppa procedure) and lapa-

roscopic intraperitoneal mesh hernioplasty. Evidence seems to suggest that retromuscular mesh hernioplasty has advantages over other procedures regarding recurrence and surgical site occurrences. Umbilical hernia is not a very uncommon condition encountered in surgical OPD. It commonly presents with complaints of dragging pain. Two major risk factors are associated, including obesity and smoking. Surgery is the treatment of choice. Placement of mesh has been recommended to close the defect as suture repairs resulted in higher recurrence rates (9, 10).

With this background, a study was planned to introduce a current and newer modality of surgical technique for umbilical hernia that is feasible and safer approach with less postoperative pain, shorter hospital stays, better cosmesis and cost-effectiveness. Our research envisaged to overcome the limitations of classical TEP technique of limited space for dissection and low tolerance for accidental pneumoperitoneum. □

## MATERIALS AND METHODS

### Study site and duration

This study was carried out in the Department of General Surgery at Indira Gandhi Institute of Medical Sciences (IGIMS), Patna, India, for a total period of one year, from August 2019 to February 2020 (seven months) and September 2020 to January 2021 (five months).

### Inclusion criteria

Patients of either sex with age  $\geq 18$  years and  $\leq 65$  years presenting with umbilical hernia with abdominal wall defect were included in the present study.

### Exclusion criteria

Patients with severe/decompensated cardiopulmonary failure, infection of abdominal wall, severe coagulopathy, those who were either unfit for general anesthesia, or had irreducible, incarcerated, obstructed and strangulated hernia, or refused to give consent, and pregnant women were all excluded from the study.

### Study design and ethical permission

This was an interventional and prospective study on series of 25 cases with diagnosis of isolated umbilical hernia (n=18) and umbilical hernia with abdominal wall defect (n=7). The cases

were enrolled based on the previously described inclusion and exclusion criteria. Recruitment of cases and study started after approval from the Institutional Ethics Committee of IGIMS, Patna (Letter No.-939/IEC/IGIMS/2019/Dated-03-07-2019). Duly signed informed consent form was obtained from eligible patients after having been informed about the potential risks and benefits of their participation. Patients were also assured that their participation in this study was voluntary.

**Methodology**

All patients were subjected to complete preoperative evaluation in the form of medical history and clinical examination (Table 1). Under general anesthesia with full aseptic precaution, a 10 mm incision was given in palmer space (below the ninth costal cartilage on the left side) and the muscle was split. Air space was created between the muscle and posterior rectus. Retromuscular space was created through telescopic dissection and proper space to be created. Another two ports of 5 mm were created laterally on the left side, one at the level of umbilicus and another below it. Adhesiolysis was done, hernia sac and content were reduced. Retromuscular

space was created from opposite to midline and after forming the adequate space, a 15 x 15 cm polypropylene mesh was placed and then fixed at two places with a tacker/suture; after proper positioning of the mesh, air was gradually released (Figures 1–5). Ports were closed. We allowed clear liquids 6–8 hours after surgery and oral feeds the morning after. Drains were usually not given. Analgesics were used in the first five days routinely.

Patients were usually discharged within 48–72 hours of the procedure. Follow-up surveillance for complications and recurrence of



**FIGURE 1.** Port placement

<b>Demographic profile</b>	<ol style="list-style-type: none"> <li>1) Gender</li> <li>2) Age</li> <li>3) Marital status</li> <li>4) Body weight and height for calculation of body mass index (BMI)</li> <li>5) History of moving or lifting heavy objects</li> <li>6) History of strenuous/heavy exercise</li> </ol>
<b>Medical history</b>	<ol style="list-style-type: none"> <li>1) Number of pregnancies</li> <li>2) History of multiple gestation pregnancies (having twins, triplets, etc)</li> <li>3) History of abdominal surgery</li> <li>4) History of persistent and heavy cough</li> </ol>
<b>Preoperative clinical profile (comorbidities)</b>	<ol style="list-style-type: none"> <li>1) Hypertension</li> <li>2) Diabetes mellitus</li> <li>3) Chronic obstructive pulmonary disease</li> <li>4) Coronary heart disease</li> <li>5) Smoking</li> </ol>
<b>Perioperative clinical profile</b>	<ol style="list-style-type: none"> <li>1) Mean operation time</li> <li>2) Hernia defect area (cm<sup>2</sup>)</li> <li>3) Mesh area (cm<sup>2</sup>)</li> </ol>
<b>Postoperative clinical profile (during hospital stay)</b>	<ol style="list-style-type: none"> <li>1) Average hospitalization time</li> <li>2) Average ASA score</li> <li>3) Complications</li> <li>4) Mean follow-up time</li> </ol>

**TABLE 1.** Information collected from each patient



FIGURE 2. Creation of retromuscular space

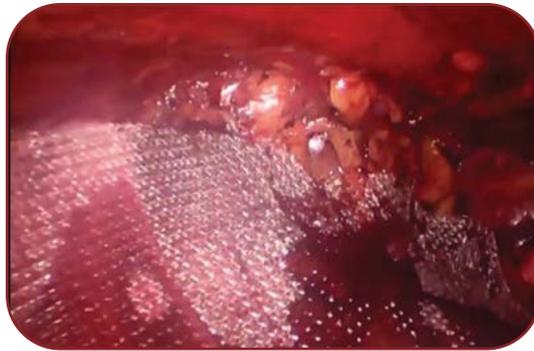


FIGURE 4. Mesh placement

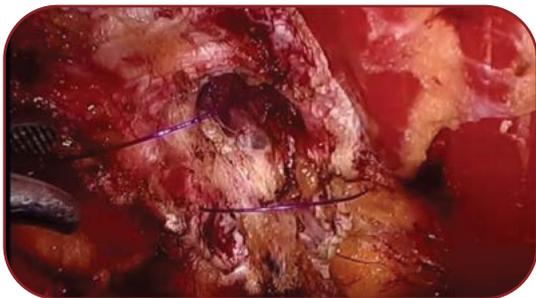


FIGURE 3. Hernial defect with closure with prolene suture



FIGURE 5. Gradual withdrawal of pneumo

hernia was performed in an outpatient clinic at the six weeks after surgery and by telephonic conversation every six months.

### Statistical analysis

All collected information were entered and analyzed using Statistical Package for Social Sciences ver 21.0 (IBM, Chicago), with obtained results being discussed and illustrated in the current report. □

## RESULTS

A total of 25 patients underwent laparoscopic e-TEP and were reviewed. There was a female preponderance, with male to female ratio of 0.47:1. Patients' ages ranged from 27 to 61 years, with a mean ( $\pm$ SD) of 41.7 ( $\pm$ 11.4) years. Demographic and medical characteristics of the study population have been summarized in Table 2.

Study patients had an average defect size of 4.2cm<sup>2</sup> (range, 3–8cm<sup>2</sup>). One hernia involved divarication of recti muscles. A polypropylene mesh of size 15 x 15 cm was placed. The average operative time was 94 minutes, ranging from 60 to 120 minutes. The average hospital stay was three days (range, two to four days).

Follow-up surveillance for complications and recurrence of hernia was performed in an outpatient clinic six weeks after surgery and by telephonic conversation every six months. The mean follow-up period was 12.6 months. Two patients developed seroma at umbilicus with discharge from the suture site, which resolved in two weeks with regular dressing. Prolonged ileus was noted in two patients, which resolved spontaneously by the fourth day after surgery. None of the patients developed surgical site infection, skin necrosis, wound dehiscence, bowel obstruction, urinary complications, or deep vein thrombosis. Also, none of the patients required conversion to open surgery. □

## DISCUSSION

The last few decades have witnessed a tremendous progress in the development of effective methods for the surgical treatment of umbilical hernias, but optimal treatment remains uncovered (11-13). Current knowledge in the field supports that the mesh should be placed in the retromuscular or preperitoneal space (14-16). The second key is to place the largest mesh possible for the patient (11). It is well known that a margin of 5 cm around the defect is insufficient

Patients' demographics (n=25)	Value
<b>Gender</b>	
Male (n)	8
Female (n)	17
<b>Mean age (±SD)</b>	41.7 years (±11.4)
<b>Marital status</b>	
Married	24
Unmarried	1
<b>Mean body mass index (BMI) (±SD)</b>	29.8 (±6.2) kg/m <sup>2</sup>
<b>History of moving heavy objects or strenuous activity</b>	7/25
<b>Comorbidity</b>	
Hypertension	6/25
Diabetes mellitus	4/25
Chronic obstructive pulmonary disease	3/25
Coronary heart disease	1/25
Smoking	11/25
<b>Number of pregnancies</b>	
Nulliparous	0
Primiparous	4/17
Multiparous	13/17
<b>History of multiple pregnancies</b>	4/17
<b>History of any abdominal surgery</b>	6/25
<b>History of persistent cough</b>	13/25
<b>ASA score</b>	
I	7/25
II	14/25
III	4/25
IV	0
V	0
VI	0

**TABLE 2.**  
Demographic and medical characteristics of patient population

for medium and large hernias. Hence, the mesh width should be kept at least four times larger than the orifice radius (12, 17). Superadded infection is one of the associated hazards of this repair, which invariably reverses the effect of the surgical procedure, requires long-term treatment, and inevitably leads to recurrence (17, 18). For any surgical procedure, the use of minimally invasive techniques definitely reduces the incidence of such infections (11-13). This prompts development of a minimally invasive technique that allows retromuscular placement of a larger synthetic mesh. Laparoscopic eTEP is the currently used procedure of this type that requires very precise dissection in the appropriate layer of the abdominal wall. Perfect knowledge of the anat-

omy of individual layers, including the muscles and fascia, is the key factor for success, as any incorrect identification or misinterpretation of anatomical structure may lead to failure or recurrence.

Here in this context, two areas are susceptible to accidental damage to the case. Linea alba that crosses the falciform ligament to the other side is one of the two vulnerable sites. Not correctly placed incision in the anterior rectus sheath may lead to separation of the rectus muscle from the linea alba leading to hernia. Moreover, damage to the linea alba also creates a defect. Apart from linea alba, the second prone area for damage is the lateral edge of the rectus sheath that is the linea semilunaris. This structure

may be torn if the balloon dissector is inflated too strongly. Also, lateral dissection beyond the neurovascular bundles sometimes lead to detachment of the transverse or oblique abdominal muscles. Hence, correct knowledge of the anatomy and functions of individual vascular and neural structures is essential to minimize any iatrogenic damage.

The linea alba plays a key role by maintaining necessary strength of the anterior abdominal wall. It supports the muscles and the mesh. Hence, maintaining the anatomy of linea alba is an essential prerequisite for the success of this procedure (19). Hence, just repairing the hernia orifice is not sufficient, as this defect is also having an effect on the entire length of the linea alba. Therefore, even for a small hernia along with, the mesh must possess appropriate margins and it should cover linea alba along with the defect. Also, the widened edges of the linea alba should be reapproximated.

One of the greatest advantages of the procedure is that it does not require additional instruments. The use of a standard flat hernia mesh is sufficient and fixation is also not mandatory (20). However, longer duration of the repair procedure adds to patient-borne costs. The technique requires longterm and meticulous dissection of the retromuscular space. Presence of adhesion, also adds to the difficulty. Similar results have been previously presented by many researchers (2, 5). But with growing experience, the operating time has gradually come down. The noteworthy point here is that, despite longer operative time, the risk of infection associated with this method is lower than the one seen with open surgery. This may be due the fact that the procedure is performed in a closed space. It should be borne in mind that extensive reconstructions of the abdominal wall require long-term procedures in open repairs as well.

This procedure is a promising tool for surgeons but still it should be introduced with great caution. Compliance with the key principles of surgery and identification of technical nuances that may improve the safety of the procedure are necessary for further popularization of this method and final determination of its effectiveness. The study promises possibility of early discharge and enhanced recovery (21). It was shown to be associated with diminished pain, better chances of early mobilization and unrestricted movements. This may be attributed to diminished pain, greater likelihood of early mobilization and unrestricted movements.

To the best of our knowledge, there is a dearth of study evaluating the results of laparoscopic eTEP for umbilical hernia repairs in this region of the country. Though the study involved a small group, the preliminary results are promising. Hence, evaluations of long-term treatment outcomes in a larger group of patients are recommended. □

## CONCLUSION

The laparoscopic eTEP technique comes up as a safer alternative to open repair and allows placement of larger mesh. Precise knowledge of the anatomy is inevitable for a safe and effective repair. Compliance with recommendations of the laparoscopic eTEP operation improves outcome of the procedure. □

*Conflicts of interest: none declared.*

*Financial support: none declared.*

*Acknowledgement: We are thankful to the healthcare workers and faculty members of the Department of Surgery of Indira Gandhi Institute of Medical Sciences, Patna, Bihar, India, for their support.*

## REFERENCES

1. **Ramana B, Igor B.** e-TEP: a new approach to abdominal wall reconstruction. *Surg Endosc* 2018;32:1525-1532.
2. **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.
3. **Abhishek V, Mallikarjuna MN, Shivaswamy BS.** Laparoscopic Umbilical Hernia Repair: Technique Paper. *J Minimally Invasive Surgery* 2012;906405.
4. **Daes J.** The enhanced view-totally extraperitoneal technique for repair of inguinal hernia. *Surg Endosc* 2012;26:1187-189.
5. **Belyansky I, Daes J, Radu VG, et al.** A novel approach using the enhanced-view totally extraperitoneal (eTEP) technique for laparoscopic retromuscular

- hernia repair.  
*Surg Endosc* 2018;32:1525-1532.
6. **Novitsky YW, Elliott HL, Orenstein SB, Rosen MJ.** Transversus abdominis muscle release: A novel approach to posterior component separation during complex abdominal wall reconstruction. *Am J Surg* 2012;204:709-716.
  7. **Binnebösel M, Klink CD, Otto J, et al.** Impact of mesh positioning on foreign body reaction and collagenous ingrowth in a rabbit model of open incisional hernia repair. *Hernia* 2010; 14:71-77.
  8. **Belyansky I.** A novel approach using the enhanced-view totally extraperitoneal (eTEP) technique for laparoscopic retromuscular hernia repair. *Surgical Endoscopy* 2017;32(5).
  9. **Hakan K.** Current options in Umbilical hernia repair in adult patients. *Turkish Journal of Surgery* 2015;31:157-161.
  10. **Klinge U, Prescher A, Klosterhalfen B, Schumpelick V.** Development and pathophysiology of abdominal wall defects. *Chirurg* 1997;68:293-303.
  11. **Bittner R, Bingener-Casey J, Dietz U, et al.** Guidelines for laparoscopic treatment of ventral and incisional abdominal wall hernias (International Endohernia Society (IEHS)) – part 1. *Surg Endosc* 2014;28:2-29.
  12. **Bittner R, Bingener-Casey J, Dietz U, et al.** Guidelines for laparoscopic treatment of ventral and incisional abdominal wall hernias (International Endohernia Society (IEHS)) – part 2. *Surg Endosc* 2014;28:353-379.
  13. **Bittner R, Bingener-Casey J, Dietz U, et al.** Guidelines for laparoscopic treatment of ventral and incisional abdominal wall hernias (international Endohernia Society (IEHS)) – part III. *Surg Endosc* 2014;28:380-404.
  14. **Burger JW, Luijendijk RW, Hop WC, et al.** Long-term follow-up of a randomized controlled trial of suture versus mesh repair of incisional hernia. *Ann Surg* 2004;240:578-583.
  15. **Rives J, Pire JC, Flament JB, et al.** Treatment of large eventrations (a propos of 133 cases). *Minerva Chir* 1977;32:749-756.
  16. **Stoppa RE.** The treatment of complicated groin and incisional hernias. *World J Surg* 1989;13:545-554.
  17. **Blatnik JA, Brunt LM.** Controversies and techniques in the repair of abdominal wall hernias. *J Gastrointest Surg* 2019;23:837-845.
  18. **Munoz-Rodriguez JM, Lopez-Monclus J, San Miguel Mendez C, et al.** Outcomes of abdominal wall reconstruction in patients with the combination of complex midline and lateral incisional hernias. *Surgery* 2020;168:532-542.
  19. **Fiori F, Ferrara F, Gobatti D, et al.** Surgical treatment of diastasis recti: the importance of an overall view of the problem. *Hernia* 2020;25:871-882.
  20. **Pielaciński K, Puła B, Wróblewski T, et al.** Totally extraperitoneal inguinal hernia repair with or without fixation leads to similar results. Outcome of randomized prospective trial. *Videosurgery Miniinv* 2020;15:1-10.
  21. **Zychowicz A, Pisarska M, Łaskawska A, et al.** Patients' opinions on enhanced recovery after surgery perioperative care principles: a questionnaire study. *Videosurgery Miniinv* 2019;14:27-37.

