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ORIGINAL ARTICLE

Quality of life, post-operative complications, and hernia recurrence following enhanced-view Totally Extra-Peritoneal (eTEP) Rives-Stoppa for incisional and primary ventral hernia repair

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Abstract
The purpose of this study was to evaluate the quality of life (QoL), early post-operative complications, and hernia recurrence rate following laparoscopic enhanced-view Totally Extra-Peritoneal (eTEP) Rives-Stoppa (RS) for incisional and primary ventral hernia repair. Retrospective review of a prospectively maintained database of all patients undergoing eTEP-RS between 2017 and 2020. Data retrieved included demographics, and clinical and operative variables. QoL was assessed using the EuraHS-QoL scale prior to- and following eTEP-RS. During the study period, 61 patients met the inclusion criteria. Age and BMI were 62 (60.4 ± 13.8) years and 29.7 (30.4 ± 6) kg/m^2, respectively. Incisional hernia was the most common pathology ($n = 40$, 65%) followed by primary ventral hernia ($n = 21$, 35%), with 24 patients (39%) having a previous hernia repair. Diastasis-recti repair was undertaken in 34 patients (55%), a concomitant inguinal hernia was repaired in 6 patients (10%), and 13 patients (21%) underwent transversus abdominis release (TAR). Median follow-up time was 13 months and 15 patients (25%) had at least 2 years of follow-up. Hernia recurrence was found in 4 patients (6.5%). Pre-operative and post-operative EuraHS-QOL questionnaire scores were available for 46 patients (75%) and showed significant improvement in pain (7 vs. 0.5, $p < 0.0001$; 5 vs. 0.5, $p < 0.0001$; 5 vs. 1.5; $p < 0.006$), restrictions (median of 5 vs. 0.5, $p < 0.0001$; 5 vs. 0, $p < 0.0001$; median of 5 vs. 1, $p < 0.0001$, of 6.5 vs. 1.5, $p < 0.0001$), and cosmetic appearance (8 vs. 4, $p < 0.0001$). Abdominal wall repair using the eTEP-RS approach significantly improves subjective QoL variables with an acceptable post-operative complications and hernia recurrence rates in a short-term follow-up.

Keywords eTEP · Rives-Stoppa · Laparoscopic incisional hernia repair · Ventral hernia repair · EuraHS · QoL · Hernia recurrence

Introduction

Incisional hernias (IH) are a common long-term complication following abdominal operations which substantially impact patient's quality of life (QoL), along with its potentially life-threatening sequelae of bowel incarceration and necrosis requiring emergent intervention [1, 2]. Assessing the true rate of IH is difficult, nonetheless large studies and meta-analysis estimate a rate as high as 12–35% following operations with various ventral abdominal incisions up to 3 years post-operatively [3–5]. Hernia recurrence following IH repair with mesh, regardless of technique, is estimated at up to 30% [6]. Though primary ventral hernias (PVH) share many common characteristics with IH in terms of complications, classification, and surgical repair options, they differ by their epidemiologic distribution, pathophysiologic features, technical complexity, and short- and long-term post-operative results [7].

The minimally invasive enhanced-view Totally Extra-Peritoneal Rives-Stoppa (eTEP-RS) approach, with or without transversus abdominis release (TAR), has gained popularity as a prominent technique for undertaking complex incisional

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and ventral hernia repairs [8–14]. Although encouraging data regarding outcomes of eTEP for ventral hernia repairs, its superiority and impact on QoL compared to other approaches are contested [15].

The purpose of this study was to evaluate the impact of eTEP-RS on QoL using the European Hernia Society Quality of Life (EuraHS-QoL) score [16] and to evaluate its post-operative course and early hernia recurrence rate. Our hypothesis was that eTEP-RS significantly improves QoL with acceptable post-operative complications and early hernia recurrence rates.

Materials and methods

Following IRB approval, patients undergoing eTEP-RS were prospectively followed between 2017 and 2020 in a large volume abdominal wall reconstruction center. Inclusion criteria was comprised of consecutive patients over the age of 18 with IH, PVH, or recurrent IH. PVH (epigastric or umbilical) with a diameter larger than 4 cm were included, while hernia defects with a diameter between 2 and 4 cm were included only in situations where large diastasis-recti was identified. If a concomitant inguinal hernia was identified, it was repaired in the same retro-muscular plane. Diastasis-recti was repaired with a running 3–0 non-absorbable barbed suture. Exclusion criteria included patients with signs of infected mesh, skin necrosis, history of previous TAR, or primary ventral hernias smaller than 2 cm. Surgical technique was performed as described by Radu et al. [17]. TAR was undertaken in situations where tension precluded closure of the posterior rectus sheath (PRS). A composite mesh was used in situations where the PRS could not be approximated to the midline. Fixation with non-absorbable tacks was made only in situations of a suprapubic hernia repair and was placed just above the ileo-pubic tract bilaterally. In cases where concomitant groin hernias were present, additional meshes were placed to cover each groin independently with fixation of the meshes to the cooper's ligament, without fixation of the retro-rectus meshes.

Data retrieved included demographics, anthropometrics, co-morbidities, previous surgical history, hernia size, type of mesh used, post-operative course, hernia recurrence, and need for secondary surgery. All patients underwent a pre-operative abdominal & pelvic CT scan as well as a history and physical exam by a senior surgeon from the abdominal wall surgery service prior to eTEP-RS and hernias were classified according to the European Hernia Society (EHS) classification [18]. Hernia recurrence was defined as disruption of the previously repaired anterior rectus fascia and confirmed via physical exam and CT scan when suspected. Active smokers were counseled on cessation. Post-operative complications were graded according to the Clavien–Dindo Classification (CD) and major complications were considered at CD ≥ 3 [19]. Post-operative pain was assessed using the visual analogue scale (VAS). QoL was assessed using the EuraHS-QOL scale prior to and at 1 year following eTEP-RS. Questionnaires were answered via telephone, email, or during clinic visit. A separate analysis of IH and PVH was also performed to reduce confounding.

Statistical analysis

Data analysis was performed using SPSS version 28 (Armonk, NY) software with two-sided significance level of $\alpha = 0.05$. Descriptive statistics are presented using prevalence and percentage values for categorical variables, while continuous variables are presented with means and standard deviation, and skewed distributed variables are presented by median and range. Questionnaire group comparisons were tested using Wilcoxon signed-rank test for non-parametric comparisons of dependent samples. For illustrative purposes, data are presented as median (mean ± SD).

Results

During the study period, 61 patients met the inclusion criteria out of 116 abdominal wall operations. Age and BMI were 62 (60.4 ± 13.8) years and 29.7 (30.4 ± 6) kg/m^2, respectively. There were 40 females (65%) and 21 males (35%). IH was the most common pathology ($n = 40$, 65%) followed by primary ventral hernia ($n = 21$, 35%). Of the patients undergoing IH repair, 24 patients (39%) had a recurrent hernia following a previous ventral hernia repair. Eighteen patients (30%) had type 2 diabetes and 11 patients (18%) were actively smoking (Table 1). The majority of defects were classified as EHS M2-3 and W1-2 (Table 2). Operative time was 144 (148 ± 55) min. Diastasis-recti repair was undertaken in 34 patients (55%), a concomitant inguinal hernia was repaired in 6 patients (10%) and 13 patients (21%) underwent TAR. The majority ($n = 48$, 79%) of patients had a large (> 30 cm) mesh placed and had a partially absorbable mesh ($n = 42$, 69%; Table 3). Hospital stay was 2 (2.8 ± 1.5) days and maximal VAS score during admission was 1 (2.2 ± 2.6). There were no conversions to 'open' operations and there were no mortalities. Pre- and post-operative EuraHS-QOL questionnaire scores were available for 46 patients (75%) and showed significant improvement in pain (7 vs. 0.5, $p < 0.0001$; 5 vs. 0.5, $p < 0.0001$; 5 vs. 1.5; $p < 0.006$), restrictions (median of 5 vs. 0.5, $p < 0.0001$; 5 vs. 0, $p < 0.0001$; median of 5 vs. 1, $p < 0.0001$, of 6.5 vs. 1.5, $p < 0.0001$), and cosmetic appearance (8 vs. 4, $p < 0.0001$; Fig. 1a). Similarly, upon breakdown of the EuraHS-QoL scale into IH and PVH, patients

Table 1 Demographics, pre-operative data

	N = 61	%
Age in years, mean (range)	60.4 (29–83)	
Gender		
Male, *n* (%)	21	35
Female, *n* (%)	40	65
BMI, mean (range)	30.4 (18.3–45.8)	
ASA score, median (mean ± SD)	2 (2.2 ± 0.6)	
Previous medical history, *n* (%)		
Hypertension	33	54
Diabetes	18	30
Dyslipidemia	20	32
COPD	3	5
Coronary artery disease	2	3.2
Anti-coagulant or anti-platelet therapy, *n* (%)	12	20
Active smokers, *n* (%)	11	18
Mean pack/year	39	–
Hernia type		
Incisional hernia, *n* (%)	40	66
Primary ventral hernia, *n* (%)	21	34
Previous abdominal operation, *n* (%)	44	72
Ventral hernia repair, *n* (%)	11	18
Umbilical hernia repair, *n* (%)	13	21
Inguinal hernia repair, *n* (%)	4	7
Any laparoscopic operation, *n* (%)	17	28
Laparoscopic cholecystectomy,*n* (%)	11	18
Bariatric surgery, *n* (%)	8	13
Colon resection, *n* (%)	5	8
Urologic operations, *n* (%)	3	5
OBGYN operation, *n* (%)	14	22

undergoing eTEP-RS for IH had significant improvement in all parameters (Fig. 1b). There were no significant improvements in pain during rest and pain during physical activity for patients undergoing eTEP-RS for PVH (0 vs 1, $p = 0.14$ and 4 vs 0, $p = 0.109$). The rest of the parameters for patients undergoing repair of PVH all showed significant improvement (Fig. 1c). Median follow-up time was 12 ± 9 months and hernia recurrence were found in 4 patients (6.5%). There were 4 (6.5%) patients with major post-operative complications of CD ≥ 3 requiring emergent re-operation in the immediate post-operative period (Table 4). Three patients suffered from small bowel obstruction secondary to PRS dehiscence. The first of these was a 41-year-old lady with an M3W1R1 IH which underwent eTEP-RS without TAR who complained of abdominal pain on POD1 without signs of sepsis or peritonitis. Due to non-resolving abdominal pain, she underwent an abdominal CT scan on POD 2 which showed incarcerated bowel above the dehisced PRS (Fig. 2). An emergent laparotomy was followed which showed PRS dehiscence incarcerating a loop of necrotic small bowel. She underwent mesh removal and small bowel resection with primary anastomosis. The patient had hernia recurrence upon follow-up examination. The second and third patients underwent laparoscopic revision on POD 1 did not show evidence of bowel ischemia. Both patients underwent bowel reduction, re-suturing of the PRS and a composite mesh was placed to overlap the oversewn dehisced PRS. Both patients did not show evidence of recurrence on physical exam and CT at follow-up at 21 and 29 months post-op, respectively.

The fourth patient requiring emergent re-operation was a 74-year-old lady with an M3W2R1 IH repair who underwent eTEP-RS without TAR presented 5 days following discharge with abdominal pain and sepsis on POD 7. The patient underwent an emergent laparotomy and found to have right colonic perforation secondary to thermal injury. She underwent right hemicolectomy with primary anastomosis and mesh removal. The patient had hernia recurrence on follow-up examination.

Late recurrences in our study included 2 patients; the first was an M1 IH which recurred at 4 months post-op and the second was an M23L2 IH which recurred at 16 months secondary to ovarian carcinomatosis.

Clinical and radiological signs of seroma were evident in 7 patients (11%), 2 (3.2%) of which underwent drainage, both subcutaneous, one with clear serous drainage and one with a hematoma which grew *Staphylococcus aureus* and treated with IV antibiotics. Of the patients who presented with seroma, 5 (9.8%) had undergone a unilateral TAR during the repair and none had hernia recurrence.

Discussion

eTEP-RS is emerging as a prominent approach for treating a large spectrum of abdominal wall defects. As the field of minimally invasive abdominal wall surgery is constantly advancing, specific guidelines on the approach to treating primary, incisional and recurrent ventral hernias have yet to uniformly advocate a single technique or approach to address the variety of defects [2, 9, 20]. While initial data on eTEP-RS demonstrate several advantages over other approaches, the literature regarding its efficacy and impact on QoL is scarce. Our study aims at assessing the efficacy of treating ventral hernias of any etiology with eTEP-RS, while evaluating QoL, post-operative complications, and hernia recurrence rate. To our knowledge, this is the first study addressing QoL following eTEP-RS.

The majority of patients included in our study were overweight, females, with a previous midline abdominal operation, an EHS classification of M2-3, W1-2 and nearly 40% suffered from recurrent hernias. Our results show significant improvement in all parameters of the EuraHS-QOL scores (pain, activity, and cosmesis) for

Table 2 Hernia characteristics

European Hernia Society Classification		
Location	Class	*n*
Midline		
Subxiphoid	M1	8
Epigastric	M2	31
Umbilical	M3	42
Infraumbilical	M4	11
Suprapubic	M5	4
Lateral		
Subcostal	L1	2
Flank	L2	4
Iliac	L3	2
Lumbar	L4	0
Width		
< 4 cm	W1	27
4–10 cm	W2	32
> 10 cm	W3	4
	n	%
Recurrent	24	39

Table 3 Intra-operative characteristics

	n	%
Diastasis-recti repair, *n* (%)	34	55
Concomitant inguinal hernia repair, *n* (%)	6	10
Transversus abdominis release, *n* (%)	13	21
Left	3	5
Right	9	16
Bilateral	3	6
Type of mesh		
Non-absorbable	15	24
Partially absorbable	42	69
Composite	4	6.5
Mesh size		
Small < 15 cm	1	1
Medium 15–30 cm	12	20
Large > 30 cm	48	79
Drain	17	21
Operation duration in minutes, median (mean ± SD)	144 (148 ± 55)	

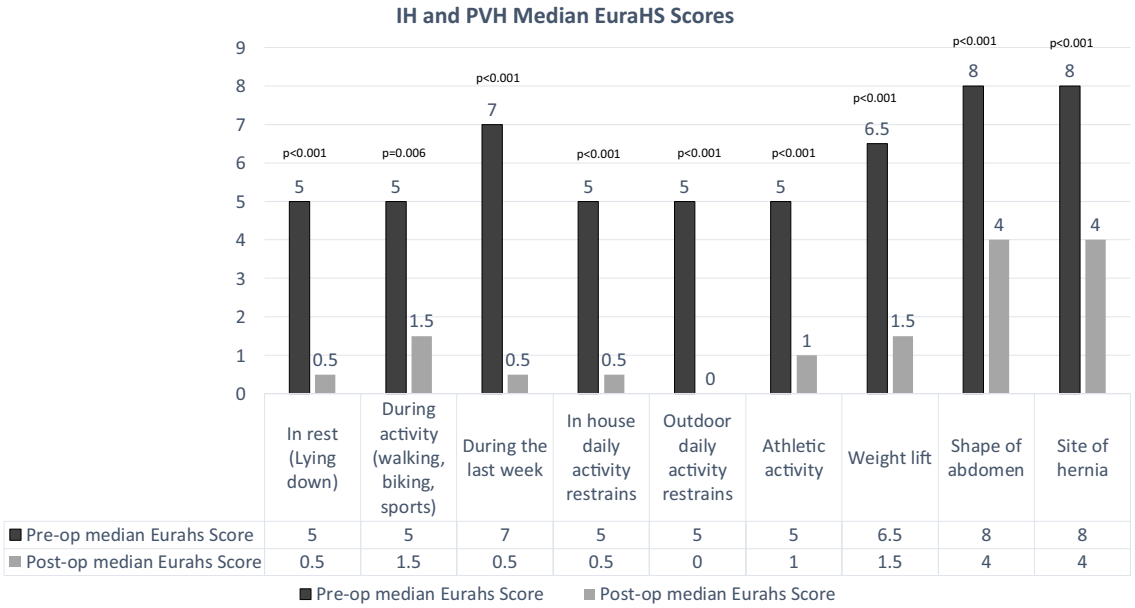
patients undergoing eTEP-RS for IH and PVH, with an acceptable post-operative course and hernia recurrence rate at a short-term follow-up. While the EuraHS-QOL of IH showed similar results to the entire population, patients undergoing eTEP-RS for PVH did not show symptomatic improvement regarding pain during rest and physical activity.

Though IH and PVH carry risks of incarceration necessitating emergent operations, many patients resort to hernia repair due to QoL nuisances. Asencio et al. reported EuraHS-QoL following a randomized-controlled trial of laparoscopic intra-peritoneal on-lay (IPOM) vs 'open' repair showed no difference in QoL and a 21% hernia recurrence rate in both arms at 10 years of follow-up [21]. A randomized-controlled trial comparing IPOM to "open" ventral hernia repair using the short-form 36 (SF36) to evaluate QoL by Rogmark et al. showed that utilizing the laparoscopic approach for ventral hernia repair induced significant improvement of SF36 QoL parameters [22]. A prospective cross-sectional observation study by Cherla et al. measured QoL using the modified Activity Assessment Scale (AAS) following ventral hernia repair and showed improvement in QoL scores to levels similar to the general population [23].

As initial evidence shows that eTEP-RS is a feasible repair option for a large spectrum of ventral defects with acceptable post-operative outcomes [9, 20], there are several common post-operative complications that question its utilization. The management of early technical failures, such as early recurrence and PRS dehiscence [24], each pose challenging aspects regarding management, treatment options and timing of intervention if needed. Lu et al. have compared a laparoscopic to a robotic approach for eTEP-RS (120 vs 86 patients) and showed increased operative time, increased costs and less post-operative complications utilizing the robotic approach. The authors reported 2 complete fascial dehiscence (0.8% and 1.1%), one in each group and one PRS dehiscence in the laparoscopic eTEP-RS (0.8%) [25]. In a retrospective study by Parkhar et al. examining 170 eTEP-RS, there were no PRS dehiscence and 3 (1.7%) events of recurrence at 3 months post-op [26].

As the primary advantage of an eTEP approach entails creating a large pre-peritoneal space for maneuvering large meshes [8], utilizing this approach on a large area, i.e., the entire abdominal wall, provides a potential space for seroma formation with a further risk of seroma infection and subsequent surgical site infection (SSI) occurrence. The initial experience of robotic eTEP-RS with or without TAR by Belyanski et al. of 37 patients documented 2 patients (5%) in the group undergoing TAR which developed a post-operative seroma requiring drainage by interventional radiology without documenting any surgical site infections (SSI) [20]. Parkhar et al. have reported on 171 patients undergoing eTEP-RS which 50 of them (30%) underwent TAR with a 2.3% seroma rate and 3% SSI. The authors advocate the use of close suctions drains and the use of an abdominal binder to decrease this occurrence [26]. In a retrospective review comparing eTEP-RS with eTEP-TAR by Khetan et al., the

a. Pre-operative vs post-operative EuraHS quality of life score in patients undergoing eTEP-RS for Incisional hernia and primary ventral hernia repair



b. Pre-operative vs post-operative EuraHS quality of life score in patients undergoing eTEP-RS for Incisional hernia

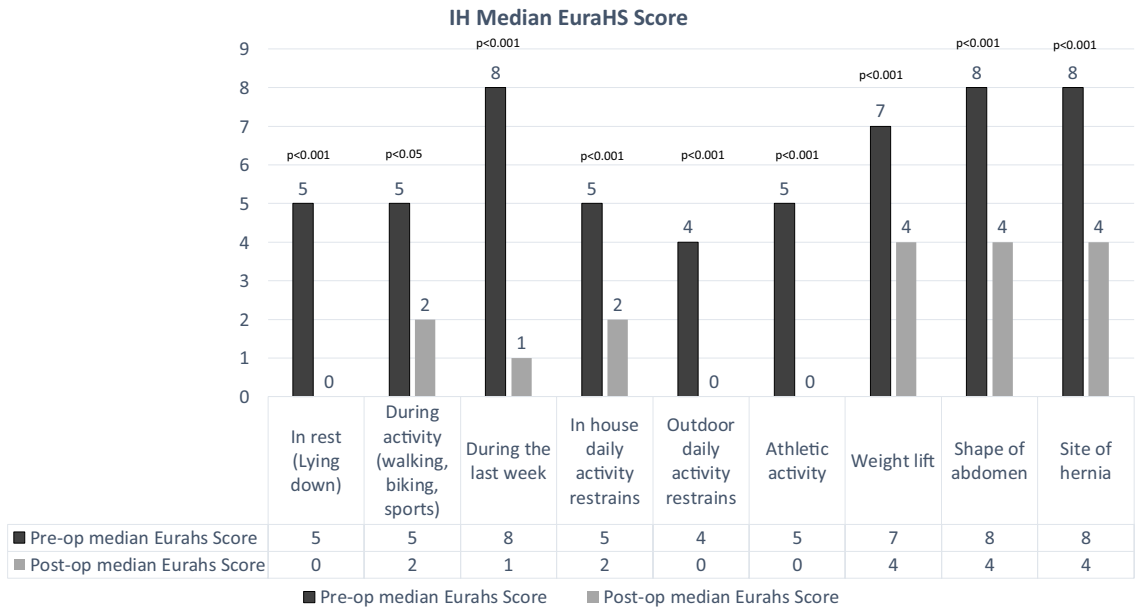


Fig. 1 European HerniaSociety Quality of Life Score before and after enhanced-view Totally Extra-Peritoneal Ventral Hernia Repair

rates of seroma occurrence and SSI were 12% and 2.3%, respectively [27].

Our study represents the first quantitative assessment of QoL using the EurasHS-QoL questionnaire following an eTEP approach for ventral hernia repairs, along with our initial experience and outcomes of post-operative complications and recurrences. Our results show significant improvement in QoL for the majority of patients with an acceptable hernia recurrence rate and post-operative complications. Our findings offer some insight on expected

c. Pre-operative vs post-operative EuraHS quality of life score in patients undergoing eTEP-RS for primary ventral hernia repair

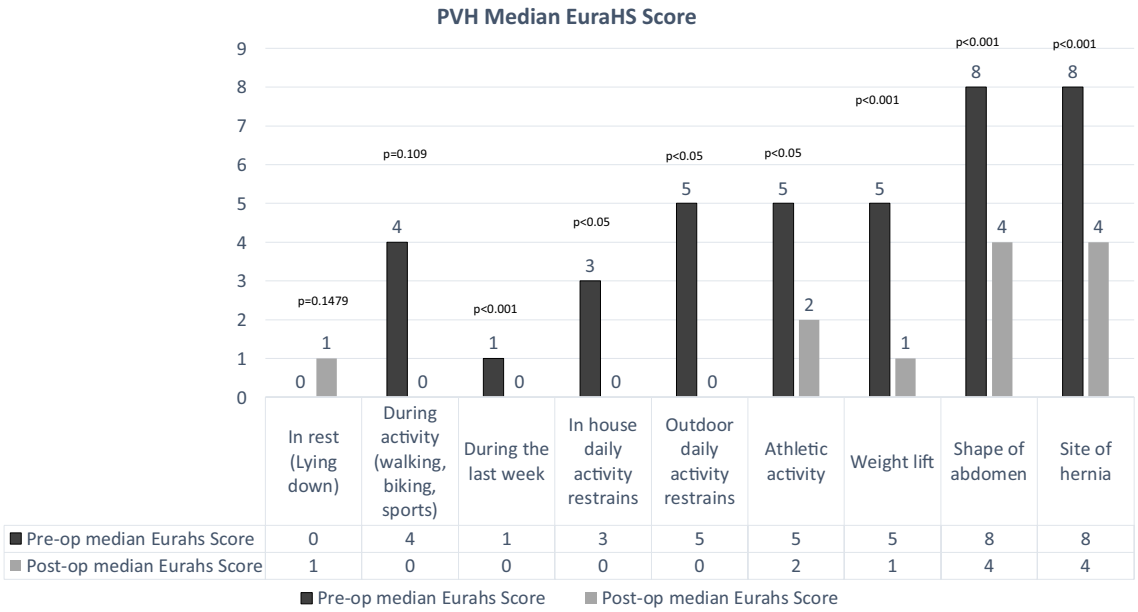


Fig. 1 (continued)

Table 4 Post-operative course

	n	%
Opiate analgesia	29	48
NSAID analgesia	17	27
Maximal VAS score, median (mean ± SD)	1 (2.6 ± 2.3)	
Length of stay, median (mean ± SD)	2 (2.8 ± 1.5)	
Months of follow-up, median (mean ± SD)	13 (16 ± 8)	
Follow-up at 24 months, *n* (%)	15	24
Hernia recurrence, *n* (%)	4	6.5
Clavien–Dindo classification		
4b	1	1.5
3b	3	5
2	2	3.2
1	6	10
Total	12	20

Fig. 2 CT scan showing a pathognomonic sign of incarcerated small bowel above a dehisced posterior rectus sheath

post-operative outcomes for patients undergoing complex abdominal wall repairs. Our findings of dissimilar results of EurasHS-QoL questionnaire scores between IH and PVH further advocate that aside from their classification by the EHS and the operative approach of eTEP-RS, IH, and PVH differ in many aspects [7]. Thus, due to the extensive dissection of the eTEP-RS approach, and the possibility of lack of symptomatic improvement following its utilization, it is our opinion that this technique for small, primary, EHS class M2/M3/M4 hernias should be applied in select situations. Conversely, for large, recurrent, and EHS class M1/M5 hernias, our opinion is that the eTEP-RS should be considered as the "gold-standard" approach.

While early recurrences in our study required emergent operative intervention with mesh removal, our thoughts regarding hernia repair following early recurrence are somewhat reserved and if an emergent operation is not indicated,

planning ahead a definitive repair may be of benefit. As the retro-muscular planes have been violated, with or without TAR, the options of achieving a proper viable repair, in our opinion, are presumed low, and the timing of a repeat TAR, IPOM or on-lay repair as a salvage operation, should be carefully weighed. Nevertheless, in situations of PRS dehiscence, we advocate early minimally invasive intervention that includes reducing of visceral tissue into the abdominal cavity and re-suturing of the PRS to prevent bowel adhesion to the exposed mesh with risk

of bowel obstruction and fistulization. Furthermore, we believe the early PRS failures we have experienced occurred in part due to our learning curve and lack of awareness that these situations required a TAR relaxation, and thus, our recommendation is to err on the side of caution and implement TAR where doubted. When re-operating for PRS dehiscence with difficulty to achieve a sealed PRS barrier between the viscera and the exposed mesh, the use of an omentum patch or a composite mesh may be of help. An additional consequence of the learning observed in this study was apparent in our delayed diagnosis of our initial encounter with PRS dehiscence and bowel incarceration. This oversite occurred on POD 1, as the patient's sole complaint was abdominal pain without objective findings in vital signs, physical examination, or lab studies. The CT scan performed on POD2 proved incarcerated bowel which lead to her re-operation. This event has lead us to perform early abdominal CT scans whenever a PRS dehiscence is suspected, which proved of benefit to the other two patients who suffered from PRS dehiscence with bowel incarceration and were reoperated on POD 1.

Due to the nature of the extra-peritoneal approach of eTEP-RS, the colonic perforation we encountered at POD 7 for an M3W2R1 hernia was unexpected. The late presentation of the patient and the location of the perforation have lead us to assume that it was induced from thermal injury during the lateral PRS dissection using the hook cautery.

Limitations of this study include its short-term follow-up and the low although expected follow-up rate. Our findings are limited to a laparoscopic approach by a dedicated abdominal wall service and the majority of patients treated were selected for a minimally invasive repair which may pose as a selection bias.

Conclusion

Abdominal wall repair using the eTEP-RS approach significantly improves subjective QoL variables with an acceptable post-operative complications and hernia recurrence rate in a short-term follow-up.

Author contributions SR—writing of manuscript and interpretation of data analysis. EG and NN—acquisition of data. DA—statistical and data analysis. NN, IC, and JR—critical revision of manuscript. YM—study conception and design, and interpretation.

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Data Availability The data supporting the findings of this study are available upon request.

Declarations

Conflict of interest All authors have no conflict of interest or financial ties to disclose, relevant for this paper.

Human participants and/or animals In accordance with the publication guidelines, we would like to confirm our study did not involve research with animal participants.

Informed consent Verbal informed consent was obtained upon answering of the quality of life questionnaires.

References

1. Kao AM, Huntington CR, Otero J et al (2018) Emergent laparoscopic ventral hernia repairs. J Surg Res 232:497–502. https://doi.org/10.1016/j.jss.2018.07.034
2. Bittner R, Bain K, Bansal VK et al (2019) Update of Guidelines for laparoscopic treatment of ventral and incisional abdominal wall hernias (International Endohernia Society (IEHS))—part A. Surg Endosc 33:3069–3139. https://doi.org/10.1007/s00464-019-06907-7
3. Bosanquet DC, Ansell J, Abdelrahman T et al (2015) Systematic review and meta-regression of factors affecting midline Incisional hernia rates: analysis of 14 618 patients. PLoS ONE 10:1–18. https://doi.org/10.1371/journal.pone.0138745
4. Fink C, Baumann P, Wente MN et al (2014) Incisional hernia rate 3 years after midline laparotomy. Br J Surg 101:51–54. https://doi.org/10.1002/bjs.9364
5. Chen-Xu J, Bessa-Melo R, Graça L, Costa-Maia J (2019) Incisional hernia in hepatobiliary and pancreatic surgery: incidence and risk factors. Hernia 23:67–79. https://doi.org/10.1007/s10029-018-1847-4
6. Muysoms FE, Antoniou SA, Bury K et al (2015) European Hernia Society guidelines on the closure of abdominal wall incisions. Hernia 19:1–24. https://doi.org/10.1007/s10029-014-1342-5
7. Stabilini C, Cavallaro G, Dolce P et al (2019) Pooled data analysis of primary ventral (PVH) and incisional hernia (IH) repair is no more acceptable: results of a systematic review and metanalysis of current literature. Hernia 23:831–845
8. Daes J (2012) The enhanced view-totally extraperitoneal technique for repair of inguinal hernia. Surg Endosc 26:1187–1189. https://doi.org/10.1007/s00464-011-1993-6
9. Belyansky I, Daes J, Radu VG et al (2018) A novel approach using the enhanced-view totally extraperitoneal (eTEP) technique for laparoscopic retromuscular hernia repair. Surg Endosc 32:1525–1532. https://doi.org/10.1007/s00464-017-5840-2
10. Novitsky YW, Elliott HL, Orenstein SB, Rosen MJ (2012) Transversus abdominis muscle release: a novel approach to posterior component separation during complex abdominal wall reconstruction. Am J Surg 204:709–716. https://doi.org/10.1016/j.amjsurg.2012.02.008

11. Ramana B, Arora E, Belyansky I (2021) Signs and landmarks in eTEP Rives-Stoppa repair of ventral hernias. Hernia 25:545–550. https://doi.org/10.1007/s10029-020-02216-4
12. Bellido Luque J, Gomez Rosado JC, Bellido Luque A et al (2021) Endoscopic retromuscular technique (eTEP) vs conventional laparoscopic ventral or incisional hernia repair with defect closure (IPOM+) for midline hernias. A case–control study. Hernia 25:1061–1070. https://doi.org/10.1007/s10029-021-02373-0
13. Aliseda D, Sanchez-Justicia C, Zozaya G et al (2022) Short-term outcomes of minimally invasive retromuscular ventral hernia repair using an enhanced view totally extraperitoneal (eTEP) approach: systematic review and meta-analysis. Hernia. https://doi.org/10.1007/s10029-021-02557-8
14. Andreuccetti J, Sartori A, Lauro E et al (2021) Extended totally extraperitoneal rives-stoppa (eTEP-RS) technique for ventral hernia: initial experience of The Wall Hernia Group and a surgical technique update. Updates Surg 73:1955–1961. https://doi.org/10.1007/s13304-021-01067-7
15. Li J, Wang Y, Wu L (2022) The comparison of eTEP and IPOM in ventral and incisional hernia repair: a systematic review and meta-analysis. Surg Laparosc Endosc Percutaneous Tech. https://doi.org/10.1097/SLE.0000000000001191
16. Muysoms F, Campanelli G, Champault GG et al (2012) EuraHS: the Development of an international online platform for registration and outcome measurement of ventral abdominal wall Hernia repair. Hernia 16:239–250. https://doi.org/10.1007/s10029-012-0912-7
17. Radu VG, Lica M (2019) The endoscopic retromuscular repair of ventral hernia: the eTEP technique and early results. Hernia 23:945–955. https://doi.org/10.1007/s10029-019-01931-x
18. Muysoms FE, Miserez M, Berrevoet F et al (2009) Classification of primary and incisional abdominal wall hernias. Hernia 13:407–414. https://doi.org/10.1007/s10029-009-0518-x
19. Clavien PA, Barkun J, De Oliveira ML et al (2009) The Clavien–Dindo classification of surgical complications: five-year experience. Ann Surg 250:187–196. https://doi.org/10.1097/SLA.0b013e3181b13ca2
20. Belyansky I, Reza Zahiri H, Sanford Z et al (2018) Early operative outcomes of endoscopic (eTEP access) robotic-assisted retromuscular abdominal wall hernia repair. Hernia 22:837–847. https://doi.org/10.1007/s10029-018-1795-z
21. Asencio F, Carbó J, Ferri R et al (2021) Laparoscopic versus open incisional hernia repair: long-term follow-up results of a randomized clinical trial. World J Surg 45:2734–2741. https://doi.org/10.1007/s00268
22. Rogmark P, Petersson U, Bringman S et al (2013) Short-term outcomes for open and laparoscopic midline incisional hernia repair: a randomized multicenter controlled trial: the prolove (prospective randomized trial on open versus laparoscopic operation of ventral eventrations) trial. Ann Surg 258:37–45. https://doi.org/10.1097/SLA.0b013e31828fe1b2
23. Cherla DV, Moses ML, Viso CP et al (2018) Impact of abdominal wall hernias and repair on patient quality of life. World J Surg 42:19–25. https://doi.org/10.1007/s00268-017-4173-6
24. Carbonell AM (2008) Interparietal hernias after open retromuscular hernia repair. Hernia 12:663–666. https://doi.org/10.1007/s10029-008-0393-x
25. Lu R, Addo A, Ewart Z et al (2020) Comparative review of outcomes: laparoscopic and robotic enhanced-view totally extraperitoneal (eTEP) access retrorectus repairs. Surg Endosc 34:3597–3605. https://doi.org/10.1007/s00464-019-07132-y
26. Prakhar G, Parthasarathi R, Cumar B et al (2021) Extended view: totally extra peritoneal (e-TEP) approach for ventral and incisional hernia—early results from a single center. Surg Endosc 35:2005–2013. https://doi.org/10.1007/s00464-020-07595-4
27. Khetan M, Dey A, Bindal V et al (2021) e-TEP repair for midline primary and incisional hernia: technical considerations and initial experience. Hernia 25:1635–1646. https://doi.org/10.1007/s10029-021-02397-6