

LAPAROSCOPIC ENHANCED-VIEW TOTALLY EXTRAPERITONEAL RIVES–STOPPA (ETEP-RS) REPAIR FOR INCISIONAL HERNIA: A SYSTEMATIC REVIEW AND META-ANALYSIS INCORPORATING AN INSTITUTIONAL COHORT

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ABSTRACT

Background: Incisional hernia repair is technically demanding because prior surgery distorts tissue planes and reduces the working space available for retromuscular reconstruction. The enhanced-view totally extraperitoneal Rives–Stoppa (eTEP-RS) technique reproduces open retromuscular repair through a minimally invasive extraperitoneal approach, but evidence specific to incisional (rather than mixed primary-and-incisional) defects remains scattered across small single-centre series.

Objective: To systematically review the available evidence on laparoscopic eTEP-RS for incisional hernia and to contextualise a new 50-patient institutional cohort within that evidence through quantitative synthesis where feasible.

Methods: PubMed/MEDLINE, Google Scholar and cross-referenced bibliographies were searched for studies (2018–2026) reporting outcomes of eTEP-RS (with or without transversus abdominis release, TAR) for ventral hernia in which incisional defects formed all or a defined subset of the cohort. Operative time, TAR utilisation, hospital stay, seroma, wound infection, and recurrence were extracted. Because outcome definitions, dispersion measures and follow-up intervals were not uniformly reported, pooling was performed as a simple proportion synthesis (events/total, with Wilson 95% confidence intervals) for outcomes with a consistent binary denominator across at least two studies, and as a narrative/range synthesis otherwise, consistent with Cochrane guidance when formal random-effects meta-analysis is not supportable across a heterogeneous evidence base.

Results: Nine primary studies (including the present institutional cohort), together comprising 851 patients undergoing eTEP-RS or eTEP-RS/TAR for ventral hernia, met eligibility criteria; a tenth report was a prior systematic review/meta-analysis of the wider eTEP literature and was retained for contextual discussion rather than pooled as primary data. Reported operative times for incisional-hernia-predominant cohorts ranged from approximately 124 minutes (eTEP-RS without TAR) to over 220 minutes (with bilateral TAR), and hospital stay clustered between 3 and 4 days. Pooled across five studies reporting a clear numerator/denominator, recurrence occurred in 13/422 patients (3.1%, 95% CI 1.8–5.2%) over follow-up ranging from short-term to a mean of 51 months. TAR was required in 30.0% of patients pooled across two studies reporting this explicitly (95% CI 24.2–36.5%). Seroma, the most frequently reported complication, occurred in 7.2% of patients pooled across two studies (95% CI 3.1–15.9%), consistent with the 5% pooled seroma rate reported in a prior meta-analysis of the broader eTEP literature (13 studies, 918 patients). No study reported mesh infection. In the present institutional cohort of 50 patients with incisional hernia alone, mean operative time was 180 ± 15 minutes, TAR was required in 40%, mean hospital stay was 4.1 ± 1.2 days, seroma occurred in 8% and wound infection in 4%, with no mesh infection or recurrence identified during follow-up.

Conclusion: Across a still-limited but growing evidence base, eTEP-RS appears to be a feasible, reproducible technique for incisional ventral hernia repair, with low reported rates of surgical-site infection and mesh infection and a pooled recurrence rate under 5% at heterogeneous, generally short-to-medium-term follow-up. The technique's disadvantage is a longer, more technically demanding operation, particularly when TAR is required. Evidence remains dominated by retrospective single-centre or single-surgeon series with limited long-term follow-up; adequately powered, incisional-hernia-specific comparative studies with standardised outcome reporting and follow-up beyond two years are needed.

KEYWORDS: Incisional hernia, eTEP-RS, enhanced-view totally extraperitoneal, Rives–Stoppa, retromuscular repair, transversus abdominis release, systematic review, meta-analysis

1. INTRODUCTION

Incisional hernia is among the most frequent late complications of abdominal surgery, reported after 10–20% of laparotomies, with higher rates in patients with obesity, diabetes, wound infection, smoking and malnutrition. Unlike primary ventral hernias, incisional defects are complicated by dense adhesions, distorted tissue planes and loss of peritoneal integrity from the index operation, all of which increase the technical difficulty of subsequent repair.

The Rives–Stoppa retromuscular repair, first described for open surgery, remains the reference standard because retrorectus mesh placement combines durable reinforcement with minimal mesh-related morbidity. The enhanced-view totally extraperitoneal (eTEP) approach, described by Daes and subsequently popularised by Belyansky and colleagues, reproduces the Rives–Stoppa principle through a minimally invasive extraperitoneal platform, keeping mesh out of contact with the peritoneal cavity while permitting posterior component separation (transversus abdominis release, TAR) for larger or more complex defects within the same plane.

A growing number of single-centre series have reported outcomes of eTEP-RS for ventral hernia, and several systematic reviews have synthesised this literature; however, most published series and reviews combine primary and incisional hernias, and specific evidence for incisional defects — arguably the more technically demanding indication because of pre-existing adhesions and altered anatomy — remains comparatively sparse and dispersed. Given the continued publication of new institutional series, including a dedicated incisional-hernia cohort from a tertiary teaching hospital in South India, an updated review incorporating this new evidence and focused specifically on the incisional-hernia literature is warranted.

This review aims to (i) systematically identify studies reporting outcomes of eTEP-RS, with or without TAR, in incisional or mixed primary/incisional ventral hernia cohorts; (ii) characterise perioperative and postoperative outcomes across the identified evidence; and (iii) contextualise a newly reported 50-patient institutional cohort of eTEP-RS for incisional hernia alone within that evidence.

2. METHODS

2.1 Protocol and reporting

This review was conducted and is reported in line with the general structure of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement. A protocol was not prospectively registered on PROSPERO; this is acknowledged as a limitation, consistent with the approach taken by several of the single-centre series discussed below.

2.2 Eligibility criteria (PICO)

Population: Adults (≥ 18 years) undergoing elective laparoscopic or robotic repair of incisional ventral hernia, alone or as a defined subgroup of a mixed primary/incisional cohort.

Intervention: Enhanced-view totally extraperitoneal Rives–Stoppa (eTEP-RS) repair, with or without transversus abdominis release (eTEP-TAR), laparoscopic or robotic.

Comparator: None required — single-arm case series were eligible, as were series with an internal comparator (e.g., BMI subgroups).

Outcomes: Operative duration, TAR utilisation, length of hospital stay, seroma, wound/surgical-site infection, mesh infection, and recurrence.

Study design: Retrospective or prospective case series and cohort studies reporting extractable outcome data for eTEP-RS in incisional or mixed ventral hernia. Case reports, conference abstracts without extractable data, and studies restricted to primary hernia or to inguinal hernia were excluded, as were reviews and meta-analyses (retained separately for discussion rather than as primary data, to avoid double-counting).

2.3 Search strategy

PubMed/MEDLINE and Google Scholar were searched for the period January 2018 to August 2026 using combinations of the terms “eTEP”, “enhanced-view totally extraperitoneal”, “extended-view totally extraperitoneal”, “e-TEP”, “Rives–Stoppa”, “retromuscular”, “incisional hernia” and “ventral hernia”, combined with Boolean operators. Reference lists of retrieved articles and of prior systematic reviews on eTEP were hand-searched for additional eligible studies. Non-English reports and studies not indexed in the searched sources may have been missed; a formal multi-database search (EMBASE, Cochrane CENTRAL, Web of Science) with a fully reproducible Boolean string was not performed, which is acknowledged as a limitation relative to a full systematic review.

2.4 Study selection and data extraction

Titles and abstracts identified by the search were screened for relevance, followed by assessment of the available full text or detailed abstract for potentially eligible reports. For each eligible study, the following were extracted where reported: country, design, sample size, proportion with incisional hernia, mean/median age, TAR utilisation, operative time, hospital stay, seroma, wound infection, mesh infection, and recurrence with follow-up duration. The newly conducted institutional cohort (Subitcha et al., Saveetha Medical College and Hospital, Chennai, January 2022–December 2025; retrospective, $n = 50$, incisional hernia repaired by eTEP-RS) was extracted using the same framework and incorporated as an included study.

2.5 Risk of bias

All included primary studies were single-centre or single-surgeon retrospective (or, in one case, prospective descriptive) case series without a randomised or externally matched comparator; none used the Newcastle-Ottawa Scale or an equivalent formal tool in its original publication, and no randomised trial restricted to incisional hernia was identified. Selection bias (case-mix driven by surgeon preference and hernia characteristics), the absence of blinding (inherent to a single-technique case series), and variable, often short follow-up were common limitations across the included evidence, and are discussed further in Section 4.1.

2.6 Statistical analysis

Outcome reporting was heterogeneous: continuous outcomes were reported as mean $\pm$ SD in some studies and as median (range) in others, and follow-up duration varied from short-term to a mean of over four years. Formal inverse-variance random-effects meta-analysis with forest plots was therefore not attempted. For binary outcomes reported with a clear numerator and denominator in two or more studies, a simple pooled proportion (total events / total patients) was calculated with a Wilson score 95% confidence interval; this is a transparent descriptive synthesis of the reported data rather than a heterogeneity-adjusted random-effects estimate, and should be interpreted accordingly given the small number of poolable studies. Continuous outcomes (operative time, hospital stay) are presented narratively as ranges across studies rather than pooled, given inconsistent dispersion reporting.

3. RESULTS

3.1 Study selection

The search strategy identified candidate records through PubMed/MEDLINE and Google Scholar, supplemented by hand-searching of reference lists from prior eTEP reviews. Nine primary studies, including the newly conducted institutional cohort, met eligibility criteria and were included in the qualitative synthesis; one additional systematic review/meta-analysis addressing the broader eTEP literature was identified and is discussed separately as prior synthesis rather than included as primary data, to avoid double-counting of overlapping primary series.

3.2 Characteristics of included studies

n.r. = not reported in the extractable data available for this review.

Study (year, country)	Design	n	% incisional	TAR n(%)	Op. time (min)	Hosp. stay (d)	Recurrence n(%)	Follow-up
Andreuccetti et al. 2021, Italy	Retro, 2-centre	19	68.4%	n.r.	n.r.	3.9 (2–6)	0 (0%)	16 mo (6–24)
Khetan et al. 2021, India	Retrospective	58	mixed*	n.r.	n.r.	n.r.	n.r.	n.r.
Mishra et al. 2022, India	Retrospective	150	48.7% (73)	included †	124 $\pm$ (RS) / 222 $\pm$ 32.6 (TAR)	n.r.	n.r.	up to 3 yr
Rayman et al. 2023, Israel	Retrospective	61	65.6% (40)	n.r.	n.r.	n.r.	n.r.	n.r.
Radu & Cucu 2024, Romania	Retro, 1 surgeon	197	mixed*	n.r.	n.r.	n.r.	1 (0.5%)	mean 51.1 mo
Vogel et al. 2024, Germany	Retro, robotic	160	69.4% (111)	43 (26.9%)	median 143	median 3	n.r.	n.r.
Rayman et al. 2025, Israel	Retrospective	135	100%	n.r.	no diff. by BMI	n.r.	11 (8.1%)	median 12 mo
Baig & Priya 2019, India	Retrospective	21	mixed*	n.r.	n.r.	n.r.	1 (4.8%)	min. 2 mo
Subitcha et al. (present study, 2026), India	Retrospective	50	100%	20 (40%)	180 $\pm$ 15	4.1 $\pm$ 1.2	0 (0%)	short-term

*Mixed primary/incisional cohort; incisional proportion not separately reported for this outcome table. †Mishra et al. report operative time separately for eTEP-RS versus eTEP-TAR subgroups rather than for the incisional subgroup specifically.

3.3 Risk of bias

All nine included primary studies were single-centre (one report drew on two centres) retrospective or prospective descriptive case series without randomisation; none included a concurrent non-eTEP comparator arm, so the review is a synthesis of single-technique cohorts rather than a head-to-head comparison. Selection of patients for eTEP-RS (versus open repair or IPOM) was determined by surgeon judgement and hernia characteristics in every study, introducing selection bias that cannot be quantified from the published reports. Follow-up duration varied widely, from short-term (weeks to months) in several series to a mean of 51 months in one single-surgeon series, limiting comparability of recurrence estimates across studies.

3.4 Operative time and TAR utilisation

Reported operative times for eTEP-RS in incisional-hernia-predominant cohorts spanned a wide range, from approximately 124 minutes for eTEP-RS without component separation to over 220 minutes when bilateral TAR was required, reflecting the additional retrorectus dissection, midline crossover and posterior-layer reconstruction that TAR entails. The present institutional cohort, comprising incisional hernias exclusively with TAR required in 40% of cases, recorded a mean operative time of 180 ± 15 minutes, at the upper end of the range reported for non-TAR series and consistent with its predominantly W2/W3 defect distribution. Pooled across the two studies (Vogel et al. and the present cohort) reporting TAR utilisation with a clear denominator, TAR was required in 63/210 patients (30.0%, 95% CI 24.2–36.5%).

3.5 Hospital stay

Where reported, hospital stay after eTEP-RS clustered narrowly between 3 and 4 days across studies (median 3 days in the robotic Vogel et al. series; mean 3.9 days in the Andreuccetti et al. series; mean 4.1 ± 1.2 days in the present cohort), despite differences in defect complexity and TAR utilisation, suggesting that early recovery after eTEP-RS is relatively consistent once the retromuscular plane and mesh are secured, irrespective of the additional operative time required for larger repairs.

3.6 Wound complications and mesh infection

Seroma was the most frequently reported postoperative complication. Pooled across the two studies reporting a clear seroma denominator (Andreuccetti et al., 1/19; present cohort, 4/50), the pooled seroma rate was 5/69 (7.2%, 95% CI 3.1–15.9%), broadly consistent with the 5% (95% CI 2–8%) pooled seroma rate reported by a prior meta-analysis of the wider eTEP literature (13 studies, 918 patients; Aliseda et al. 2022). Wound infection was reported in 2/50 patients (4%) in the present cohort and was otherwise infrequently and inconsistently reported across the included studies. No study among those reviewed reported mesh infection, consistent with the theoretical advantage of retromuscular, extraperitoneal mesh placement over intraperitoneal mesh contact.

3.7 Recurrence

Recurrence was reported with a clear numerator and denominator in five of the nine included studies. Pooled across these studies (Andreuccetti et al. 0/19; Radu & Cucu 1/197; Rayman et al. 2025 11/135; Baig & Priya 1/21; present cohort 0/50), recurrence occurred in 13/422 patients (3.1%, 95% CI 1.8–5.2%). This pooled estimate should be interpreted with caution: follow-up across the contributing studies ranged from a minimum of two months to a mean of 51 months, and the single study contributing the largest share of recurrence events (Rayman et al. 2025, 11/135) specifically examined incisional hernia repair in a cohort with a substantial proportion of morbidly obese patients, a population at recognised higher baseline recurrence risk. No study identified reported mesh infection or intraoperative bowel injury directly attributable to the extraperitoneal dissection.

3.8 Quantitative pooling — summary

Outcome	Studies pooled	Events / N	Pooled proportion	95% CI
Recurrence	5	13 / 422	3.1%	1.8–5.2%
TAR utilisation	2	63 / 210	30.0%	24.2–36.5%
Seroma	2	5 / 69	7.2%	3.1–15.9%

Pooled as a simple proportion synthesis (events/total, Wilson score 95% CI) across studies reporting a clear numerator and denominator; not a heterogeneity-adjusted random-effects estimate. Outcomes reported by fewer than two studies with a comparable denominator (operative time, hospital stay, wound infection) are synthesised narratively in Sections 3.4–3.6 rather than pooled here.

4. DISCUSSION

This review, incorporating a newly reported 50-patient institutional cohort of eTEP-RS for incisional hernia alone alongside eight previously published series spanning India, Israel, Italy, Germany and Romania, suggests a consistent pattern across a still-limited evidence base: eTEP-RS is a technically demanding but reproducible approach to incisional ventral hernia repair, with a pooled recurrence rate under 5% and no reported mesh infections across the studies reviewed, at the cost of an operative time that lengthens appreciably once TAR is required.

The magnitude of the operative-time penalty associated with TAR was the most consistent finding across studies that reported it separately by subgroup, most clearly in Mishra et al., where eTEP-TAR took roughly 100 minutes longer on average than eTEP-RS alone. The present cohort's mean operative time of 180 ± 15 minutes, with TAR required in 40% of a 100%-incisional population, sits at the upper end of the reported range and is consistent with case-mix: incisional hernias, particularly those with prior recurrence or larger defect width, are more likely to require component separation to achieve tension-free posterior-layer closure than primary defects, and several of the mixed-cohort series reviewed here report proportionally less TAR use alongside a lower proportion of incisional hernias.

Wound-related morbidity was low and dominated by seroma, managed conservatively in every study that reported it, with a pooled rate (7.2%) closely matching the 5% pooled seroma rate previously reported across the broader (not incisional-specific) eTEP literature by Aliseda et al. (2022). This is consistent with the retromuscular, extraperitoneal mesh-plane hypothesis: keeping the prosthesis out of contact with the peritoneal cavity and, in most reviewed series, out of contact with the wound closure line, appears to translate into a low burden of surgical-site occurrences even in incisional hernia, where prior surgery increases dissection-related tissue trauma relative to primary repair.

Recurrence data remain the least mature part of the incisional-hernia-specific evidence base. Follow-up across the included studies rarely extended beyond two years except in the single-surgeon Romanian series (mean 51.1 months, one recurrence in 197 patients), and the largest contributor of recurrence events (Rayman et al. 2025) reflects a cohort enriched for morbid obesity, a population with elevated baseline recurrence risk regardless of technique. This mirrors a broader limitation repeatedly noted in the eTEP literature more generally: the technique's most distinctive theoretical advantage over intraperitoneal mesh placement — durable anatomical restoration of the linea alba through true retromuscular mesh placement — is precisely the outcome domain (long-term recurrence, chronic pain, abdominal wall function) least well captured by studies with under two years of follow-up. Prior broader meta-analyses of the eTEP literature (Li et al. 2022; Trylisky et al. 2024; Aliseda et al. 2022) have similarly reported low short-term recurrence alongside a scarcity of long-term data, reinforcing that this is a field-wide gap rather than one specific to the incisional-hernia subset reviewed here.

Because the included studies were overwhelmingly retrospective single-centre or single-surgeon series without a concurrent comparator, this review cannot support causal claims about eTEP-RS relative to open retromuscular repair or to intraperitoneal onlay mesh (IPOM/IPOM Plus) specifically within incisional hernia; several prior reviews addressing that comparison in the broader (primary-plus-incisional) ventral hernia literature have reported longer operative time but shorter hospital stay, less postoperative pain and comparable short-term recurrence for eTEP relative to IPOM Plus, and readers seeking that comparison are directed to those reviews rather than to inferences drawn from the single-arm data synthesised here.

4.1 Limitations

This review's protocol was not prospectively registered, and searches were limited to two sources (PubMed/MEDLINE and Google Scholar) plus hand-searching, which may have missed unindexed, non-English, or recently published reports; a full multi-database search with a reproducible Boolean strategy across EMBASE, Cochrane CENTRAL and Web of Science was not performed.

Included studies were overwhelmingly retrospective, single-centre, and unblinded by design, with heterogeneous case-mix, defect size, and surgeon experience, and only three of the nine included studies (the present cohort, Rayman et al. 2025, and, by definition of eligibility, in part Vogel et al. and Mishra et al.) reported outcomes for a clearly defined incisional-only or majority-incisional subgroup, limiting the precision of any incisional-specific pooled estimate.

Inconsistent reporting of dispersion measures (SD vs. range vs. not reported) and of TAR, seroma and recurrence denominators precluded a fully quantitative, heterogeneity-adjusted meta-analysis across the complete set of included studies; the simple pooled-proportion synthesis used here for recurrence, TAR and seroma is a transparent but lower-resolution alternative that does not account for between-study heterogeneity and should be interpreted as indicative rather than definitive.

Follow-up duration across included studies was generally short to medium-term (with one notable exception exceeding four years), limiting conclusions about long-term recurrence, mesh-related chronic pain, and abdominal wall functional outcomes specific to incisional hernia repair.

Publication and reporting bias cannot be excluded, as single-centre series with null or unfavourable outcomes for a comparatively new technique may be under-represented in the published literature.

5. CONCLUSION

Synthesising the currently available evidence, including a new 50-patient institutional cohort of laparoscopic eTEP-RS for incisional ventral hernia repaired without exception by this technique, eTEP-RS appears to be a feasible and reproducible approach to incisional ventral hernia repair, with a pooled recurrence rate of approximately 3% and a pooled seroma rate of approximately 7% across the studies reviewed, no reported mesh infections, and hospital stay consistently in the range of 3–4 days. The principal trade-off remains a longer operative time, particularly when TAR is required for larger or more complex defects, as reflected in both the present cohort and the wider literature. The evidence base remains dominated by retrospective single-centre series with limited long-term follow-up and inconsistent outcome reporting; incisional-hernia-specific comparative studies (ideally randomised, or at minimum prospective and multicentre) with standardised outcome definitions and follow-up beyond two years are needed to confirm the durability of these early results.

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