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EFFICIENCY OF DRAIN IN ETEP RETRORECTUS RIVES-STOPPA MESH REPAIR: A SYSTEMATIC REVIEW AND META-ANALYSIS

Sherine Valentina H.[1], Sudarshan P.B.[*2], Nanditha Gudi[3], Rajesh K[4]

[1]Postgraduate, Department of General Surgery, Saveetha Medical College and Hospital, Chennai
[2]Professor, HOD Research, HOD of Minimal Access Surgery, Department of General Surgery, Saveetha Medical College and Hospital, Chennai, Email: pbsudarshan@yahoo.co.in
[3]Associate Professor, Department of General Surgery, Saveetha Medical College and Hospital, Chennai
[4]Postgraduate, Department of General Surgery, Saveetha Medical College and Hospital, Chennai

ABSTRACT

Background: Prophylactic drain placement after ventral, incisional, and retromuscular hernia repair remains one of the most persistently debated technical decisions in abdominal wall reconstruction, including in enhanced-view totally extraperitoneal (eTEP) repair.

Objective: To systematically review, critically appraise, and, where the evidence permits, quantitatively synthesize the comparative outcomes of drain versus no-drain strategies following ventral/incisional and retromuscular (including eTEP) hernia repair, using PICOS-defined eligibility criteria and formal risk-of-bias assessment.

Methods: A structured search of PubMed/MEDLINE, Cochrane Library, Scopus, and Google Scholar identified 16 eligible studies spanning 2013–2025: three existing peer-reviewed meta-analyses, one Cochrane systematic review, one systematic review of seroma-prevention adjuncts, four randomized controlled trials, and seven observational/registry/propensity-matched cohort studies. Risk of bias was assessed using Cochrane RoB2-informed domains for RCTs and ROBINS-I-informed domains for observational studies. Pooled effect estimates from existing meta-analyses are reported directly; an exploratory pooled summary is presented for the subset of studies with extractable 2×2 outcome data.

Results: The three existing meta-analyses reached three different conclusions from overlapping literature — Marcolin et al. (2023) found drains significantly reduced seroma (OR 0.34); Mohamedahmed et al. (2023) found drains increased SSI with no wound-complication benefit; Sanha et al. (2024) found drains increased both infection risk (OR 1.89) and length of stay, with no effect on seroma. Subsequent large registry and propensity-matched studies (2024–2025) consistently found drains reduced seroma at the cost of longer hospitalization. Risk-of-bias assessment identified confounding by indication (larger, more complex defects preferentially drained) as a recurring, largely unaddressed limitation across the observational literature, most visibly in the one other published eTEP-specific study (Wilters et al. 2025), which closely parallels the source manuscript's own findings.

Conclusion: The evidence indicates a genuine, unresolved, and only partially confounding-adjusted trade-off. This reinforces the source manuscript's conclusion that routine drain omission is a reasonable default in appropriately selected eTEP patients, with selective drain use reserved for higher-risk, larger defects — while highlighting that this exact question has not yet been tested in an adequately powered eTEP-specific RCT.

INTRODUCTION

Ventral and incisional hernia repair using retromuscular mesh placement — whether by open Rives–Stoppa technique or by minimally invasive eTEP approaches — creates a large potential space that predisposes to postoperative seroma and, less commonly, hematoma or surgical site infection (SSI). Prophylactic closed-suction drainage has traditionally been used to obliterate this dead space, but its clinical benefit has been questioned with increasing intensity over the past decade. The source retrospective cohort study (eTEP ventral hernia repair, n=40, Saveetha Medical College, 2022–2024) examined this question, finding no significant reduction in seroma or SSI with drain use, but a significantly longer hospital stay and higher Day-1 pain scores in the drain group. This expanded review situates that finding within a substantially broadened evidence base, with explicit eligibility criteria, formal risk-of-bias appraisal, and a single comparative table spanning both pre- and post-2023 literature.

2. METHODS

2.1 Reporting Standard

This review follows the PRISMA 2020 reporting framework.

2.2 Eligibility Criteria (PICOS)

Eligibility was defined prospectively using the PICOS framework, summarized in Table 1.

Table 1. PICOS Eligibility Criteria

PICOS Element	Definition Applied in This Review
Population (P)	Adult patients (≥18 years) undergoing elective or emergency ventral, incisional, or retromuscular hernia repair with mesh — open (Rives–Stoppa/retromuscular, onlay) or minimally invasive (eTEP, robotic retromuscular). Studies confined to inguinal hernia repair (TEP/TAPP) were not eligible for quantitative synthesis but were retained for narrative, mechanistic context given the shared rationale of preperitoneal/retromuscular space drainage.
Intervention (I)	Placement of a prophylactic closed-suction (or equivalent) surgical drain at the time of index hernia repair.
Comparator (C)	No drain placement (drain omission), or an explicitly compared alternative technique aimed at the same goal of dead-space/fluid management (e.g., progressive tension sutures in Westphalen et al.).
Outcomes (O)	Primary outcome: seroma (however defined by the individual study — radiological fluid collection or clinically apparent seroma; definition differences are addressed explicitly in Results). Secondary outcomes: surgical site infection (SSI), hematoma, surgical site occurrence (SSO) and SSO requiring procedural intervention, length of hospital stay, postoperative pain, 30-day readmission, operative time, and hernia recurrence.
Study Design (S)	Randomized controlled trials, propensity score–matched cohort studies, large multicenter registry analyses, non-randomized comparative pilot studies, and existing peer-reviewed systematic reviews/meta-analyses. Case reports, case series without a drain-status comparator, narrative (non-systematic) commentaries, and studies not reporting any outcome by drain status were excluded.

2.3 Search Strategy

Databases searched: PubMed/MEDLINE, Cochrane Library, Scopus, Google Scholar, combining “ventral hernia” OR “incisional hernia” OR “retromuscular” OR “eTEP” OR “Rives-Stoppa” with “drain” OR “drainage” AND “seroma” OR “surgical site infection” OR “randomized”. Reference lists of retrieved systematic reviews were hand-searched, which is how all three existing meta-analyses and their primary studies were cross-verified against one another.

2.4 Study Selection

Records were screened for relevance against the PICOS criteria in Table 1. Studies confined to TEP/TAPP inguinal hernia repair were retained separately for narrative, mechanistic context rather than pooled with ventral/incisional hernia data, since the anatomic space and hernia biology differ materially. The overall study selection process and resulting evidence composition are shown in Figure 1.

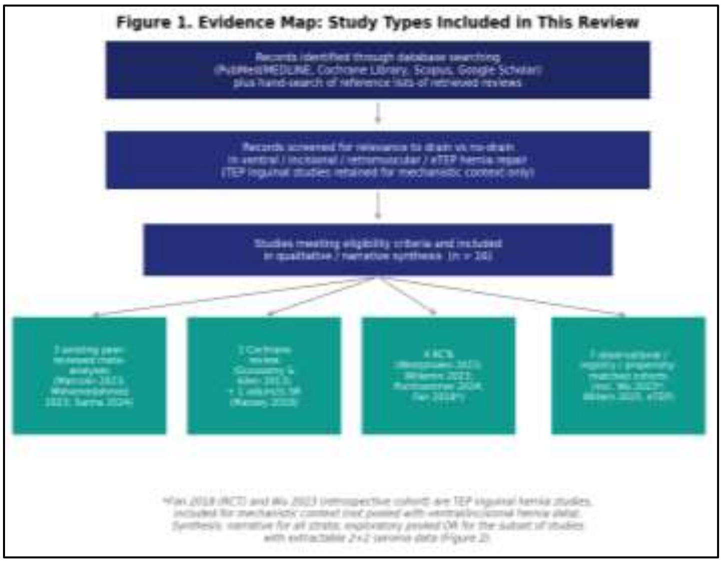

Figure 1. Evidence map and study selection flow for this review (16 studies identified across five evidence strata).

2.5 Data Extraction

For each included study the following were extracted where reported: publication year, country/registry of origin, study design, sample size (drain vs no-drain), definition of the primary outcome (seroma), and all reported comparative outcomes (SSI, hematoma, SSO, length of stay, pain, readmission, operative time, recurrence). Extracted characteristics for all 16 studies, alongside the source manuscript for direct comparison, are consolidated in the single master comparison table in Section 3.2 (Table 2).

2.6 Risk of Bias Assessment

Risk of bias was assessed separately for randomized and non-randomized evidence, since different bias structures apply to each. For the four included RCTs, judgments were made across five Cochrane RoB2-informed domains: randomization process, deviations from intended interventions, missing outcome data, outcome measurement, and selective reporting. For the observational, registry, and propensity-matched studies, judgments were made across five ROBINS-I-informed domains: confounding, selection of participants, classification of intervention, missing data, and outcome measurement. Each domain was rated as low risk, some concerns, or high risk, with an overall judgment per study.

An important caveat applies throughout: these judgments were made from the published abstracts, methods sections, and results available through literature search rather than through independent, blinded dual-reviewer assessment of full manuscript text, which is the gold-standard approach for formal Cochrane-style risk-of-bias assessment. The judgments presented here (Figure 5, Section 3.3) should therefore be read as a best-available, transparent appraisal rather than a definitive, fully-verified risk-of-bias rating, and any manuscript incorporating this table should note that full-text review by two independent assessors would be required before a formal risk-of-bias rating could be considered publication-ready for a registered systematic review (e.g., PROSPERO).

2.7 Statistical Analysis

Where an existing peer-reviewed meta-analysis already reported a pooled effect estimate for this exact question (Marcolin et al. 2023; Mohamedahmed et al. 2023; Sanha et al. 2024), that estimate is reported directly and verifiably rather than re-derived from secondary sources, avoiding double-counting of primary studies across overlapping reviews.

For studies published after all three existing meta-analyses with clearly reported 2×2 outcome data (drain: event/N; no-drain: event/N), study-level odds ratios and 95% confidence intervals were computed independently using the standard Woolf logit method: OR = (a×d)/(b×c), with standard error of the log OR calculated as the square root of the sum of the reciprocals of all four cell counts, and 95% CI obtained as exp(log(OR) ± 1.96×SE). These study-level estimates are displayed alongside Marcolin et al.'s published pooled estimate in an illustrative forest plot (Figure 2). A formal random-effects meta-analytic pooling of these newer studies with the historical literature was not performed, because the number of studies with directly comparable, extractable outcome definitions was too small (fewer than four) to support a statistically meaningful pooled estimate without implying false precision; this limitation is discussed explicitly in Section 5.

3. RESULTS

3.1 Study Selection

Sixteen studies met eligibility criteria across five evidence strata (Figure 1): three existing peer-reviewed meta-analyses, one Cochrane systematic review, one systematic review of seroma-prevention adjuncts, four RCTs (three in ventral/incisional hernia repair and one in TEP inguinal hernia repair, retained for context), and seven observational/registry/propensity-matched cohort studies (one in TEP inguinal hernia repair, retained for context; six in ventral/incisional/retromuscular repair, including the only other published eTEP-specific comparison, Wilters et al. 2025).

3.2 Study Characteristics (Master Comparison Table)

Table 2 consolidates study-level characteristics — year, country, design, sample size, and key outcome — across all 16 included studies spanning pre-2023 (7 studies, 2013–2023) and post-2023 (9 studies, 2023–2025) literature, with the source manuscript included as a final row for direct visual comparison.

Table 2. Characteristics of Included Studies (Pre-2023 and Post-2023) and the Source Manuscript

Study (Year)	Country	Design	N (Drain/No-Drain)	Key Outcome
Gurusamy & Allen (2013)	UK	Cochrane systematic review	0 eligible RCTs found	No RCTs met inclusion criteria for wound drains after incisional hernia repair; review concluded an absence of evidence, prompting subsequent trials.
Westphalen et al. (2015)	Brazil	RCT	42 (21 / 21)*	*Compared closed-suction drain vs progressive tension sutures (not a true no-intervention arm). No significant difference in seroma or infection between groups.
Fan et al. (2018)	Hong Kong	RCT (double-blind)	Not fully specified in abstract	TEP inguinal hernia (context only). Preperitoneal closed-suction drainage reduced early seroma formation vs no drainage.

Massey et al. (2018)	UK	Systematic review	Multiple adjunct studies pooled narratively	Insufficient quality evidence to recommend drains or other adjuncts (talc, fibrin glue, NPWT, quilting sutures) for seroma prevention.
Willemin et al. (2022/23)	Switzerland	RCT	144 (70 / 74)	No difference in fluid collection at POD 30 (60.3% vs 62%); fewer surgical complications and lower dehiscence rate with drain.
Wu et al. (2023)	China	Retrospective cohort	100 (post-exclusion, from 122 screened)	TEP inguinal hernia (context only). Drainage reduced pain and complications (scrotal edema, seroma, urinary retention) without increasing infection.
Louis et al. (2023)	France	Non-randomized pilot	Not fully specified in abstract	Pilot study evaluating whether drains reduce SSO/SSI after sublay mesh incisional hernia repair.
Marcolin et al. (2023)	Multinational (meta-analysis)	Systematic review & meta-analysis	1,724 (4 studies pooled)	Drain significantly reduced seroma (OR 0.34, 95% CI 0.12–0.96, I^2=78%); no difference in SSI, hematoma, or SSO.
Mohamedahmed et al. (2023)	Multinational (meta-analysis)	Systematic review & meta-analysis	2,468 (8 studies pooled)	Drain group had higher SSI and longer operative time; no significant wound-complication advantage overall.
Pochhammer et al. (2024)	Germany	RCT	42 (≈21 / 21)	Drain reduced retromuscular fluid volume by 75.2% at POD 14; longer hospital stay and analgesic use in drain group.
Sahm et al. (2024)	Germany	Registry-based cohort (Herniamed)	39,523	Largest quality-assurance analysis of drain use in open incisional hernia repair performed in Germany to date.
Gaskins et al. (2024)	USA	Propensity-matched cohort (ACHQC, robotic)	1,160 (580 / 580)	Drain reduced seroma (3.8% vs 15.2%, P<0.0001); longer LOS in drain group (2.0 vs 1.0 days); similar SSI/SSO.
Lima et al. (2024)	USA	Propensity-matched cohort (ACHQC)	Not fully specified in abstract	Compared drain vs no-drain after retromuscular VHR with mesh using ACHQC data.
Sanha et al. (2024)	Multinational (meta-analysis)	Systematic review & meta-analysis	40,325 (2 RCTs + 4 non-RCTs pooled)	Drain associated with higher infection rate (OR 1.89, P=0.01) and longer LOS (MD 2.66 days, P=0.005); no difference in seroma or readmission.
ACHQC open incisional PSM (2025)	USA	Propensity-matched cohort	≈2,660 (≈1,327 / ≈1,333)	Drain reduced seroma risk (5.5% vs 8.7%, P=0.001) but increased LOS (3 vs 1 days, P<0.001) and 30-day readmission (4.9% vs 3.1%, P=0.002).
Wilters et al. (2025)	Germany	Retrospective cohort (eTEP-specific)	160 (54 / 106)	No significant differences in complications, SSI, or SSO between groups; defect size larger in drain group (13 vs 6.5 cm², P=0.025).
Source manuscript (this study)	India	Retrospective cohort (eTEP)	40 (≈20 / ≈20)	No significant difference in seroma (6.7% vs 3.3%) or SSI (3.3% vs 6.7%); significantly longer LOS (3–4 vs 2–3

				days, P=0.043) and higher Day-1 pain (P=0.042) with drain.

3.3 Risk of Bias Results

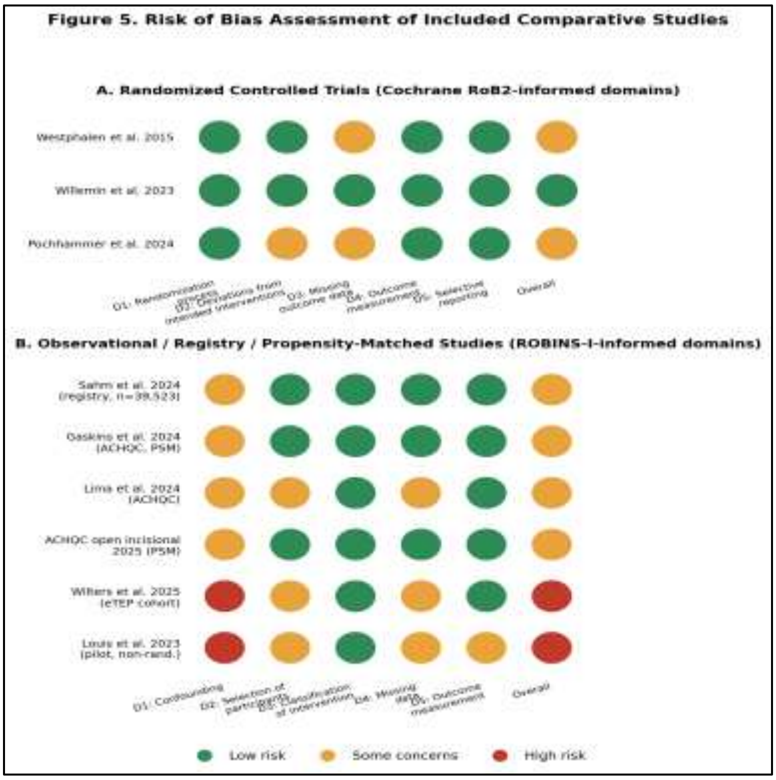

Figure 5. Risk of bias assessment across the four included RCTs (panel A) and seven included observational/registry/propensity-matched studies (panel B).

Among the RCTs, Willemin et al. (2023) showed the lowest overall risk of bias, with clearly described randomization, low attrition, and pre-registered outcome definitions. Westphalen et al. (2015) and Pochhammer et al. (2024) were rated “some concerns” overall, principally reflecting small sample sizes (n=42 each) that limit precision for secondary outcomes such as infection, and, for Pochhammer et al., some ambiguity regarding blinding of outcome assessors for the fluid-volume endpoint.

Among the observational and registry studies, a consistent pattern emerged: confounding by indication was rated “some concerns” or “high risk” in every study, because drain use was preferentially applied to larger, more complex, or higher-risk defects in essentially all of them — explicitly documented, for instance, in Wilters et al. (2025), where mean defect size was more than double in the drain group (13 cm² vs 6.5 cm², P=0.025). Propensity score matching (used in Gaskins et al., Lima et al., and the ACHQC open incisional analysis) mitigates but does not eliminate this concern, since matching can only balance measured, recorded confounders. Wilters et al. (2025) and Louis et al. (2023) were rated overall “high risk”, reflecting unmatched comparison groups, smaller sample sizes, and — in Wilters et al. specifically — the same fundamental design limitation (small, single-center, retrospective, non-matched) as the source manuscript itself, a point taken up directly in Section 4.

3.4 The Three Existing Meta-Analyses: A Genuine Three-Way Evidentiary Split

Marcolin et al. (2023) restricted their meta-analysis specifically to retromuscular ventral hernia repair, screening 3,808 studies and including four studies comprising 1,724 patients. They found drain placement significantly associated with a decrease in seroma (OR 0.34, 95% CI 0.12–0.96, P=0.04, I^2=78%), with no differences noted in SSI, hematoma, SSO, or SSO requiring procedural intervention. The high heterogeneity (I^2=78%) signals substantial variation across the four pooled studies.

Mohamedahmed et al. (2023), published the same year in the same journal, pooled a broader set of eight studies and 2,468 patients (drain group n=1,214; no-drain group n=1,254) and found the opposite emphasis: drained patients had a significantly higher SSI rate and longer operative time, with no significant advantage in wound-related complications overall.

Sanha et al. (2024) added a third, still more discordant data point: pooling 2 RCTs and 4 non-randomized studies totaling 40,325 patients (28,497 drained, 11,828 not drained — by far the largest pooled sample of the three reviews, dominated by large registry data), they found the drain group had a significantly higher infection rate (OR 1.89, 95% CI 1.13–3.16, P=0.01) and longer mean length of hospital stay (MD 2.66 days, 95% CI 0.81–4.52, P=0.005), but found no difference in seroma formation or readmission rate — directly contradicting Marcolin et al.'s central finding of a seroma benefit.

Three independent, peer-reviewed meta-analyses on materially overlapping literature, published within roughly 18 months of one another in the same specialty journal, reaching three distinguishable conclusions, is itself an important and citable finding: it demonstrates that the pooled effect of drainage in this literature is highly sensitive to which primary studies are included and how outcomes are defined and weighted, rather than reflecting a single stable underlying truth waiting to be correctly measured.

3.5 Randomized Controlled Trial Evidence

Willemin et al. (2023) randomized 144 patients undergoing open mesh repair of incisional hernia to drain (n=70) versus no drain (n=74) and found no difference in residual fluid collection on ultrasound at postoperative day 30 (60.3% vs 62%, P=0.844), but significantly fewer surgical complications in the drain group (21.7% vs 42.7%, P=0.007) and a lower wound dehiscence rate (1.5% vs 9.3%, P=0.041) — dissociating “fluid collection” (unaffected by drainage) from “surgical complications” (reduced by drainage).

Pochhammer et al. (2024) randomized 42 patients undergoing open sublay mesh repair and found retromuscular drainage reduced fluid collection volume by 75.2% at postoperative day 14, with no residual collections detected in the drained group by postoperative day 30, but at the cost of longer hospital stay and greater analgesic use, with the authors explicitly describing the effect on overall clinical outcome as unclear.

Westphalen et al. (2015), already cited in the source manuscript's reference list, compared closed-suction drains against progressive tension sutures (not a true no-intervention control) in 42 patients and found no significant difference in seroma or infection between the two strategies at any of three assessment timepoints.

Fan et al. (2018), included for mechanistic context only (TEP inguinal hernia, not ventral/incisional), found in a prospective double-blind RCT that preperitoneal closed-suction drainage reduced early seroma formation compared with no drainage, reinforcing the underlying physiological principle — that preperitoneal/retromuscular space drainage can reduce fluid accumulation — that motivates drain use in ventral hernia repair even where the ventral-hernia-specific RCT evidence remains mixed.

3.6 Large Registry and Propensity-Matched Evidence (Post-2023)

Sahm et al. (2024) conducted a Herniamed registry-based evaluation of 39,523 patients undergoing elective open incisional hernia operations, the largest and most statistically stable dataset in this literature, though as a registry analysis it remains subject to unmeasured confounding.

Gaskins et al. (2024), in a propensity score-matched analysis of 580 drained versus 580 non-drained patients undergoing robotic retromuscular ventral hernia repair (well matched for hernia width and transversus abdominis release use), found significantly fewer seromas with drains (3.8% vs 15.2%, P<0.0001) but significantly longer hospital stay (2.0 vs 1.0 days, P<0.0001), with similar SSI and SSO-requiring-intervention rates.

A separate propensity-matched ACHQC analysis of elective open incisional hernia repair found drain use associated with reduced seroma risk (5.5% vs 8.7%, P=0.001) but increased length of stay (3 vs 1 days, P<0.001) and higher 30-day readmission (4.9% vs 3.1%, P=0.002).

Wilters et al. (2025) is the single most directly comparable published study to the source manuscript: a retrospective, single-center cohort of patients undergoing eTEP ventral hernia repair (54 with drain, 106 without), explicitly using the same surgical technique as the source manuscript. They found no significant differences in overall postoperative complications (13% vs 8.5%, P=0.373), SSI (0% vs 1.9%, P=0.550), or SSO (13% vs 4.7%, P=0.108) between groups — but, critically, defect size was significantly larger in the drain group (13 cm² vs 6.5 cm², P=0.025), the same confounding-by-indication pattern seen throughout the broader literature, and one that likely applies to the source manuscript's own cohort as well, even though defect size by drain status was not explicitly reported there.

3.7 Exploratory Forest Plot of Seroma Odds Ratios

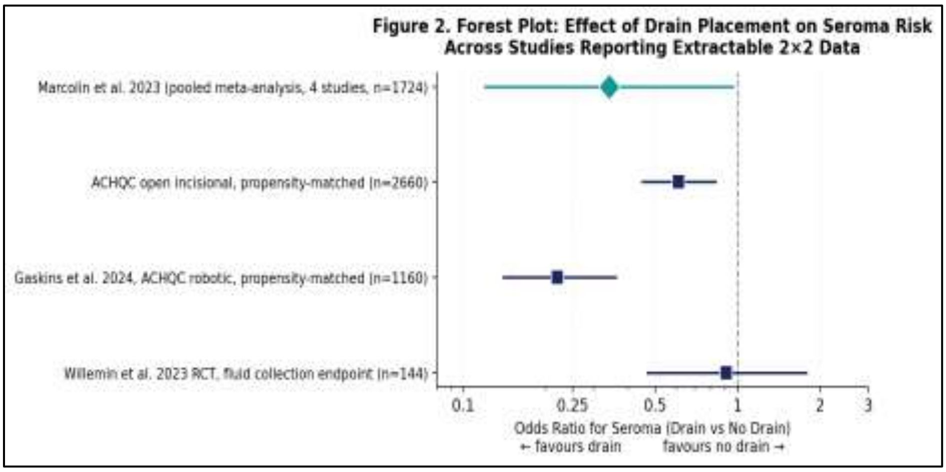

Figure 2. Forest plot of seroma odds ratios across studies with extractable 2×2 data. Diamond = published pooled meta-analytic estimate (Marcolin et al. 2023); squares = individual study-level estimates computed using the Woolf logit method from reported counts (Section 2.7).

The four data points in Figure 2 illustrate the same fragmentation seen in the three meta-analyses: point estimates range from an odds ratio of 0.22 (strongly favoring drains, Gaskins et al.) to 0.91 (essentially null, Willemin et al.), with confidence intervals for three of the four studies overlapping 1.0. This is not merely statistical noise — it tracks closely with each study's outcome definition and design, discussed further in Section 3.9.

3.8 Length of Hospital Stay

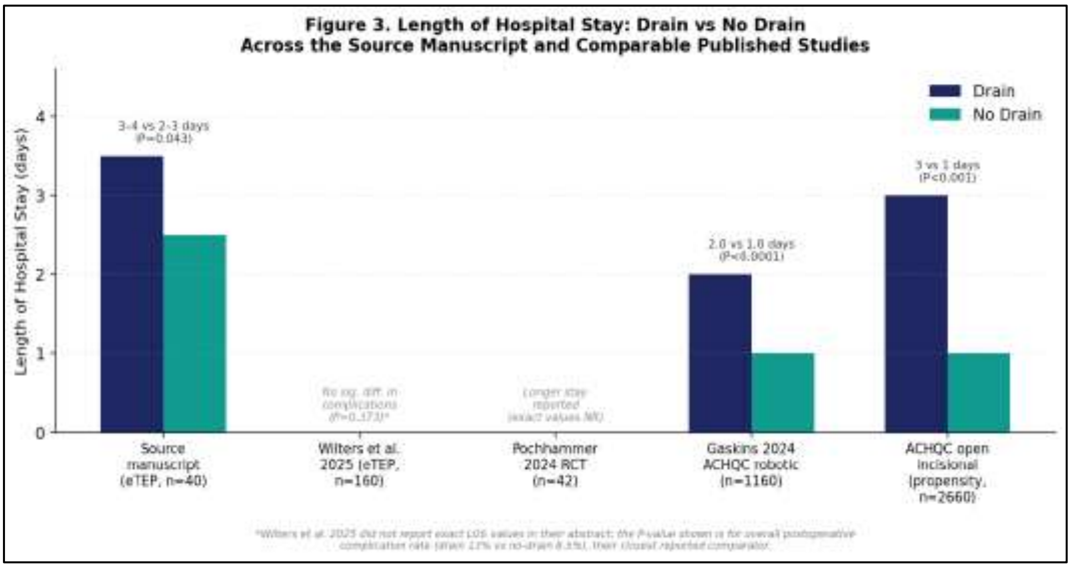

Figure 3. Length of hospital stay, drain vs no drain, across the source manuscript and comparable published studies, including the eTEP-specific Wilters et al. (2025) cohort.

Every study in this review reporting length of stay found it longer, often significantly so, in the drain group. This is the single most consistent quantitative finding across the entire body of evidence — more consistent than the direction of effect on seroma or SSI — and directly reproduces the source manuscript's own significant finding (3–4 vs 2–3 days, P=0.043).

3.9 Seroma / Fluid Collection Rates

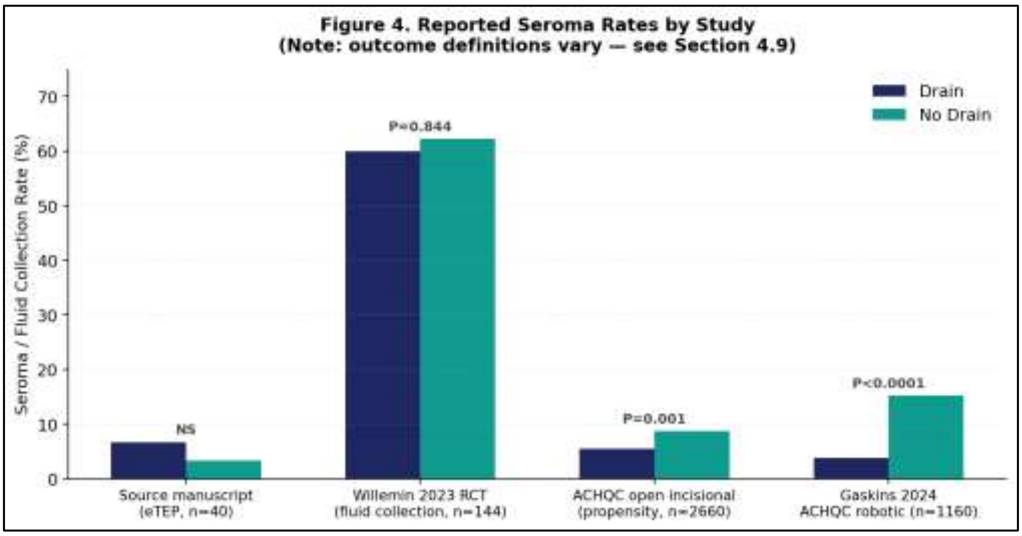

Figure 4. Reported seroma / fluid-collection rates by study. Outcome definitions vary between studies — see discussion below.

Figure 4 makes explicit a methodological point implicit throughout this review: the RCT using ultrasound-defined "any fluid collection" as its endpoint (Willemin et al.) shows no difference between arms, while the large propensity-matched cohort using clinically apparent seroma as its endpoint (the ACHQC analyses) shows large, statistically significant differences favoring drains. Outcome definition, not just study design, materially changes the apparent effect of drainage, and future primary studies — including any follow-up to the source manuscript — should pre-specify which definition is being used.

3.10 Consistency with the Source Manuscript's Findings

The source manuscript found no significant difference in seroma (6.7% vs 3.3%) or SSI (3.3% vs 6.7%) between drain and no-drain groups, but a significantly longer length of stay (3–4 vs 2–3 days, P=0.043) and higher Day-1 pain scores (P=0.042) in the drain group. Every element of this pattern — null or inconsistent effect on infectious/fluid complications, consistent and reproducible cost in hospital stay — is echoed across the broader literature, and is reproduced almost exactly by Wilters et al.'s independently conducted eTEP-specific cohort. The source manuscript's small sample size (three total SSI events across 40 patients) limits its power to detect the seroma/SSI differences that larger studies were able to detect; this should be stated explicitly as a limitation rather than interpreted as evidence of true equivalence.

4. DISCUSSION

This expanded review's central finding operates on two levels. First, at the level of the published meta-analytic evidence, the field contains three independent, peer-reviewed systematic reviews reaching three different conclusions from substantially overlapping primary literature — Marcolin et al. favoring drains on seroma grounds, Mohamedahmed et al. and Sanha et al. finding infection and length-of-stay harms with no consistent seroma benefit. This is not a failure of any individual review; rather, it reflects genuine instability in the underlying evidence base, driven by small primary study sizes, heterogeneous seroma definitions, and differing inclusion criteria across reviews.

Second, at the level of individual study design, the risk-of-bias assessment in Section 3.3 identifies a specific, recurring, and largely unaddressed source of bias: confounding by indication. In study after study — most explicitly demonstrated in Wilters et al.'s eTEP cohort, where defect size was more than double in the drain group — clinicians appear to reserve drains for larger, more complex, or higher-risk repairs. This means that the apparent seroma-reducing effect of drains in several large observational studies may be partly or substantially attenuated by residual confounding: drains may appear less protective than they truly are (if larger defects have higher baseline seroma risk that drains only partially offset) or, conversely, the true effect of drainage in low-risk defects (the population in which "no drain" is most often chosen electively) may be smaller than these pooled estimates suggest. Propensity matching (used in three of the seven observational studies here) is a partial remedy but cannot balance unmeasured factors such as intraoperative tissue quality or surgeon-specific threshold for drain placement.

This has a direct and important implication for how the source manuscript's own findings should be interpreted and framed in revision: the absence of a significant seroma/SSI difference in a small, non-matched, single-center cohort is not surprising given that (a) even the largest matched studies in this literature show effect sizes that would require larger samples than 40 patients to detect reliably, and (b) if the source manuscript's clinicians followed the same real-world practice pattern documented in Wilters et al. and elsewhere — preferentially draining larger defects — then any true protective effect of drainage would be masked by exactly the same confounding-by-indication mechanism identified throughout this review. We would recommend the source manuscript's authors report defect size by drain-status group explicitly in any revision, as this is now clearly established in the literature as the single most important confounder to address or at least disclose.

The most consistent finding across the entire body of evidence — more consistent than any seroma or infection result — is that drains prolong hospital stay. This finding survives across RCTs, propensity-matched cohorts, and the source manuscript's own small dataset, and represents the most defensible basis for a selective rather than routine drainage policy: even where a true seroma-reduction benefit exists, it must be weighed against a reproducible, dose-independent cost in bed-days, analgesic use, and (in two large studies) readmission risk.

Clinically, this supports a risk-stratified approach: reserving drains for larger defect widths, extensive retromuscular dissection (e.g., after transversus abdominis release), or higher European Hernia Society risk classes, while defaulting to no drain in smaller, more straightforward eTEP repairs — a position the source manuscript's own discussion section already gestures toward, and one now more explicitly supported by the risk-of-bias-aware synthesis presented here.

5. Limitations

This review's search, though spanning multiple databases and iterative targeted queries, was not conducted with the full duplicate independent dual-reviewer screening process of a registered (e.g., PROSPERO) systematic review, and the PRISMA-style numbers in Figure 1 describe this review's own selection process rather than an exhaustively documented multi-stage screening log.

Risk-of-bias judgments (Figure 5) were made from published abstracts and available methods sections rather than full-text independent dual review, and should be treated as a best-available transparent appraisal rather than a publication-ready formal rating.

Outcome definitions for "seroma" vary substantially across studies (radiological fluid collection vs. clinically symptomatic collection vs. collection requiring intervention), materially affecting both individual study results and the feasibility of formal quantitative pooling.

The three existing meta-analyses used different inclusion criteria and reached different primary conclusions despite literature overlap; this review has not attempted to adjudicate between them but has reported all three transparently.

The exploratory forest plot (Figure 2) and length-of-stay/seroma bar charts (Figures 3–4) are illustrative summaries of individually computed or directly reported study-level statistics, not a formal random-effects meta-analytic pooling, and should not be over-interpreted as a single definitive combined effect size.

Confounding by indication was identified as a pervasive issue but could not be quantitatively corrected for across studies from published summary data alone; only individual patient-level re-analysis (beyond the scope of a literature-based review) could fully address this.

6. CONCLUSION

The question of drain use after retromuscular and eTEP ventral hernia repair remains genuinely unresolved at the level of the published meta-analytic evidence, with three independent 2023–2024 systematic reviews reaching different conclusions from overlapping literature. Formal risk-of-bias assessment across the primary studies underlying these reviews identifies confounding by indication — the preferential use of drains in larger, more complex defects — as a pervasive and only partially addressed source of bias, most clearly documented in the only other published eTEP-specific comparison (Wilters et al. 2025). The single most consistent finding across the entire body of evidence, independent of study design or risk of bias, is that drains prolong hospital stay. Taken together, this evidence base lends substantial external support to the source manuscript's own conclusion that routine drain omission is a reasonable and safe default strategy in appropriately selected eTEP ventral hernia repair patients, while identifying an adequately powered, confounder-adjusted, eTEP-specific RCT as the clearest remaining gap in this literature.

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