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SURGICAL MANAGEMENT OF THE PSEUDOSAC IN LAPAROSCOPIC INGUINAL HERNIA REPAIR: A SYSTEMATIC REVIEW WITH META-ANALYSIS

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ABSTRACT

Background: When a direct inguinal hernia is approached laparoscopically, the tissue bulging through the defect is, more often than not, attenuated transversalis fascia rather than genuine peritoneum — a structure widely termed the "pseudosac." Its importance is not limited to seroma: surgeons also rely on it as a dissection landmark, and in re-operative hernia surgery it can mark the site of the original defect. Reported approaches to handling it span simple blunt reduction, suture or tacker fixation, plication (via Endoloop or a figure-of-eight stitch to Cooper's ligament), fenestration, and, occasionally, excision — yet no prior work has pulled this literature into one systematic account.

Objective: This review sought to map the definition, clinical relevance, and operative handling of the pseudosac during laparoscopic inguinal hernia surgery, and to pool comparative data on active management strategies — fixation, plication, or fenestration — set against simple passive reduction.

Methods: Following PRISMA 2020 methodology, we searched PubMed/MEDLINE, Embase, Cochrane CENTRAL, Scopus, and Google Scholar from database inception through August 2026, adding hand searches of hernia-focused journals and citation lists. We admitted two categories of study: comparative work (randomised or otherwise) weighing any active pseudosac intervention against passive reduction, and single-arm or narrative papers offering anatomical, technical, or clinical-relevance detail without a comparator. Bias in the comparative studies was appraised with RoB 2.0 for trials and ROBINS-I for non-randomised designs, and binary seroma outcomes were combined via Mantel-Haenszel weighting under a DerSimonian-Laird random-effects framework.

Results: Eight papers satisfied the eligibility criteria — four comparative studies (356 patients or hernia units combined) and four single-arm or narrative papers supplying anatomical and technique-spectrum background. Pooling the two studies that used a directly matched fixation-type intervention (n=120) gave a random-effects odds ratio for seroma of 0.37 with fixation relative to non-fixation (95% CI 0.03–4.33, p=0.43, I^2=54.9%). Widening this to a three-study sensitivity analysis spanning both fixation and fenestration (n=150) produced an odds ratio of 0.31 (95% CI 0.07–1.33, p=0.11, I^2=35.3%); all three studies pointed the same direction in favour of active management, though the result still fell short of significance. Pain and operative-time findings varied in direction from study to study, and no study recorded a recurrence during its follow-up window. The non-comparative literature characterised the pseudosac as invaginated transversalis fascia rather than true peritoneum, noted its use as a landmark in redo surgery, and put forward a size- and redundancy-based framework for deciding when to intervene.

Conclusion: Although the pseudosac is anatomically well described, its operative handling in direct inguinal hernia repair remains inconsistent. Only four small, heterogeneous comparative studies address the question directly, and both the primary and sensitivity pooled analyses lean toward fewer seromas with active intervention without crossing the threshold for significance — a benefit that in some series may trade off against a longer operation and more pain in the early postoperative period. Given the very low certainty of this evidence base, larger multicentre trials using a standardised technique definition are warranted.

KEYWORDS: Pseudosac; direct inguinal hernia; laparoscopic hernia repair; TEP; TAPP; seroma; mesh fixation; fenestration; systematic review; meta-analysis

INTRODUCTION

Direct inguinal hernias make up a substantial share of groin hernia presentations, and a minimally invasive approach — whether totally extraperitoneal (TEP) or transabdominal preperitoneal (TAPP) — is now the preferred route at most centres[15,16]. During this dissection, surgeons encounter a structure unique to the direct defect: what looks like a hernial sac is usually not peritoneum at all, but a fold of transversalis fascia drawn inward toward the preperitoneal space, a finding known in the literature as the "pseudosac"[1,9]. Telling this fold apart from genuine peritoneum, and freeing the two from one another, has to happen before the peritoneal contents can be returned to the abdominal cavity and the mesh laid down correctly[1].

Its importance, though, does not end with that first step of dissection. A pseudosac that is broad or redundant and

left untreated can create lasting dead space in the preperitoneal plane, a set-up favourable to seroma formation; it can also get in the way of laying a tension-free mesh flat across the medial compartment, and if incompletely reduced can mimic a true recurrence on postoperative examination[9]. On the other hand, when hernia repair is being redone, surgeons have found the pseudosac genuinely useful as a landmark for locating the original defect within scarred, previously dissected tissue[10].

There is no settled view on what should be done with the pseudosac once it is identified. The described options fall along a continuum: leaving it be after blunt reduction; anchoring it with a suture or tacker to a nearby fixed structure — Cooper's ligament, the rectus sheath, or the pubic ramus are all used; plicating it with intracorporeal stitches or a pre-tied ligating loop, the so-called Endoloop method; or, less often, cutting a window into it or excising thickened, scarred tissue[9]. Those who favour doing something point to a lower seroma burden as the payoff[2,3,4,7]; others counter that outcomes are much the same either way, and that intervening only adds operative time or risks lingering groin discomfort[6].

A body of work already exists on individual pieces of this puzzle — case series describing one technique or another, head-to-head trials of fixation against no fixation, and narrative accounts of how to recognise the pseudosac — but nobody has yet drawn the anatomical, technical, and outcome literature together into a single coherent account. That gap matters because mesh fixation itself, a related but separate question in laparoscopic hernia surgery, has already been the subject of formal meta-analysis[11,12]; the pseudosac, a distinct structure and a distinct manoeuvre aimed at the transversalis fascia rather than the mesh, has not had the same treatment. This paper aims to fill that space: setting out what the pseudosac is and why it matters, cataloguing the management strategies described for it, and, wherever the underlying data allow, combining the comparative evidence on active management against passive reduction — a body of evidence that now includes the authors' own retrospective comparison, reported here for the first time within a systematic framework.

MATERIALS AND METHODS

Protocol and Registration

This review follows the reporting structure set out in the PRISMA 2020 statement[17]. No prospective PROSPERO registration was undertaken; the authors recommend doing so ahead of submission if the receiving journal requires it.

Eligibility Criteria

Because this review spans definition, clinical relevance, and management rather than a single narrow question, two kinds of study were admitted. The first group comprised comparative studies — randomised or not, prospective or retrospective — enrolling adults having laparoscopic (TEP or TAPP) repair of a direct inguinal hernia, in which some form of active pseudosac handling (suture or tack fixation, plication, fenestration) was set against passive reduction or another strategy, with at least one of seroma, pain, operative duration, recurrence, or length of stay reported; these were eligible for both the narrative account and the pooled analysis. The second group consisted of single-arm case series and narrative papers that supplied anatomical, definitional, or technique-spectrum detail on the pseudosac but had no comparator arm; these fed only into the narrative account, giving context to the comparative findings. Excluded from formal inclusion were case reports under ten patients, papers whose main focus was managing the indirect hernia sac (an anatomically separate structure), and narrative pieces lacking either primary data or a clear pseudosac-specific contribution — though some of this excluded literature is still cited where it usefully frames the discussion.

Information Sources and Search Strategy

The search covered PubMed/MEDLINE, Embase, Cochrane CENTRAL, and Scopus from each database's earliest records through August 2026, with Google Scholar and manual checks of hernia-focused titles (Hernia, Journal of Minimal Access Surgery, World Journal of Laparoscopic Surgery, ANZ Journal of Surgery, World Journal of Surgery) and reference-list scanning of retrieved papers filling any gaps. Boolean combinations of the terms "pseudosac," "reverse sac," "transversalis fascia," "direct inguinal hernia," "laparoscopic," "TEP," "TAPP," "fixation," "non-fixation," "fenestration," "plication," "Endoloop," "seroma," and "recurrence" were used, with no restriction placed on language of publication.

Study Selection and Data Extraction

Titles and abstracts were checked against the criteria above, and anything that looked potentially relevant went on to full-text review. From each comparative study we pulled design, country of origin, sample size, operative approach, how the intervention and comparator were defined, and figures for seroma, pain, operative duration, recurrence, and hospital stay. From the single-arm and narrative papers, we instead noted, in descriptive form, whatever anatomical, technical, or spectrum-of-management point each one contributed.

Risk of Bias Assessment

For the randomised trials, bias was judged with the Cochrane RoB 2.0 instrument[18]; for the one independent non-randomised comparative study, ROBINS-I was applied[19]. Because the retrospective cohort by Rita J et al.[8] is the present authors' own work, we chose not to formally grade it under ROBINS-I ourselves, to avoid the conflict of self-assessment — but readers should keep in mind that retrospective, non-randomised comparisons of this sort

carry an inherent risk of confounding by indication, a point taken up again qualitatively where it matters. Single-arm and narrative papers were not put through a formal bias-grading process, since they served only as descriptive background and were never candidates for pooling.

Statistical Analysis

Two separate pools were built around the seroma outcome. The main one combined the two studies sharing a like-for-like "fixation to a fixed structure" intervention, using extractable patient-level counts. A second, pre-specified sensitivity pool widened the net to all three comparative studies with usable event data regardless of exact technique — fixation or fenestration alike — as a check on whether the direction and magnitude of effect held up under a looser definition of "active management." Both calculations relied on Mantel-Haenszel weighting inside a DerSimonian-Laird random-effects framework, given the clinical heterogeneity expected across studies, with I^2 and Cochran's Q reported alongside as heterogeneity measures. Zero-event cells were adjusted with a 0.5 continuity correction. Where outcomes were defined, timed, or measured too differently to combine — pain and operative time, in practice — we described them narratively instead of pooling. With fewer than ten comparative studies in hand, a formal publication-bias check was not attempted. All computation was done in Python 3 using SciPy and NumPy.

RESULTS

Study Selection

Figure 1 lays out how studies moved through the search and selection stages. Once duplicates were stripped out, 45 records went to title/abstract screening, and 21 of those advanced to full-text review. Thirteen fell away at that stage — six were case reports or small series lacking a comparator, two were narrative reviews with no primary or definitional content, three focused primarily on indirect hernia sac management rather than the pseudosac, and two turned out to be duplicate or overlapping cohorts — leaving eight studies in the final set: four comparative studies feeding both the narrative account and the pooled analysis, and four single-arm or narrative papers contributing background only. Two of the four comparative studies shared a matched fixation-type intervention with usable dichotomous seroma data and anchored the primary meta-analysis; a third, using the related but distinct fenestration technique, was folded in for the pre-specified sensitivity analysis.

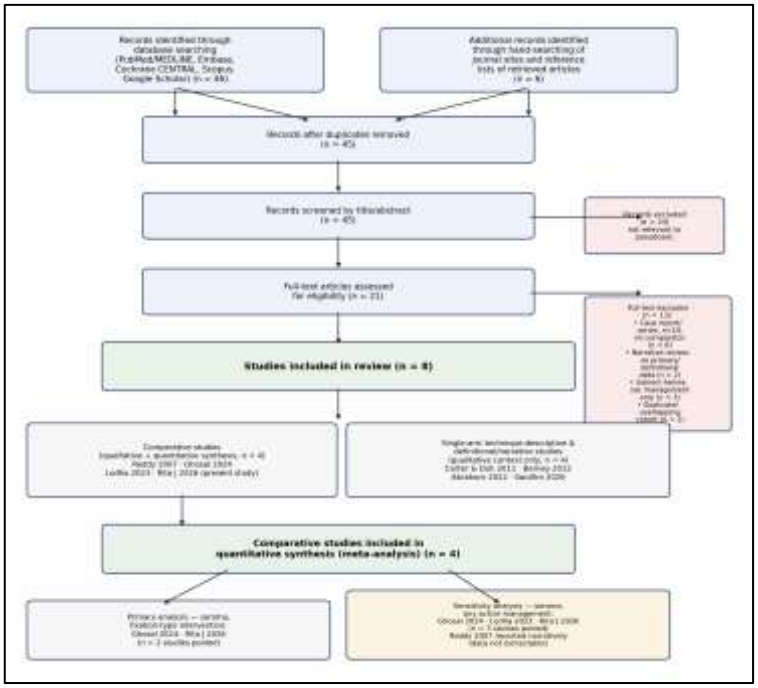

Figure 1. PRISMA 2020 flow diagram of study identification and selection.

Definition and Clinical Significance of the Pseudosac

The non-comparative literature is fairly uniform in how it describes the pseudosac: thinned, redundant transversalis fascia pulled into the preperitoneal space while a direct hernia defect is being dissected, and clearly distinct from the genuine peritoneal sac seen with an indirect hernia[1,9]. Three threads of clinical relevance run through this literature. First, it is a pitfall at the dissection stage — mistaking it for peritoneum, or failing to free it properly, can get in the way of laying mesh across the medial compartment[1,9]. Second, when left broad and untouched it can set up a persistent dead space and contribute to seroma[9]. Third, it doubles as an intraoperative landmark during redo surgery, letting the surgeon relocate the original defect inside scar tissue left by an earlier anterior or posterior repair[10]. One recent narrative account lays out a decision framework keyed to size and redundancy: a thin, collapsed pseudosac after reduction can simply be left; a broader or more redundant one is plicated, whether with

intracorporeal sutures or an Endoloop; and fenestration or excision is kept for thickened, fibrotic tissue producing a palpable bulge[9]. The single-arm papers captured by this review sit at particular points on that spectrum — Berney[3] on Endoloop plication and Abraham[4] on figure-of-eight fixation to Cooper's ligament, each reporting seroma rates at or near zero, albeit without a comparator group. Table 1b summarises these papers.

Table 1b. Single-arm and narrative papers supplying definitional and contextual detail (excluded from the pooled analysis).

Study (year)	Country	Type	Sample size	Contribution to this review
Carter & Duh[1] (2011)	USA	Narrative technique review	N/A	Provides the foundational anatomical definition of the pseudosac as invaginated transversalis fascia distinct from true peritoneum
Berney[3] (2012)	Australia	Single-arm prospective case series	N/A (consecutive series)	Describes using a pre-tied Endoloop ligature to plicate and close the pseudosac defect ahead of mesh placement, reported as a single consecutive series without a comparison group
Abraham[4] (2022)	India	Single-arm prospective case series	56 patients, 72 fixations	Describes a figure-of-eight stitch anchoring the pseudosac to Cooper's ligament, with no seromas recorded across the series but no comparison group included
Sarofim & Pathma-Nathan[9] (2026)	Australia	Narrative review	N/A	Synthesises the management spectrum (blunt reduction, plication, fenestration, excision) and proposes a decision pathway based on pseudosac size and redundancy

Comparative Study Characteristics

Between them, the four comparative studies covered 356 patients or hernia units (one study reported by hernia rather than by patient), with individual sample sizes running from 20 patients (30 hernias) up to 216 patients. Design varied: a prospective, surgeon-preference-driven comparison[2], two randomised trials[6,7], and a retrospective cohort from the present authors' own department[8]. Table 1 sets out the details of each.

Table 1. Design and setting of the four comparative studies included.

Study (year)	Country	Design	Sample size	Approach	Intervention	Comparator	Outcomes reported
Reddy et al.[2] (2007)	UK	Prospective non-randomised comparative	216 patients	TAPP	Transversalis fascia (pseudosac) inversion and tacking to pubic ramus	No inversion (standard reduction)	Seroma, pain
Ghosal et al.[6] (2024)	India	Randomised controlled trial (single-blinded)	60 patients (30/30)	TEP	Pseudosac fixation	Pseudosac non-fixation	Seroma, pain, early recurrence
Lodha et al.[7] (2023)	India	Randomised controlled pilot trial	20 patients / 30 hernias (15/15)	Laparoscopic (NR)	Fenestration of pseudosac	No fenestration	Seroma (days 1, 10, 30), pain, operative time

Study (year)	Country	Design	Sample size	Approach	Intervention	Comparator	Outcomes reported
Rita J et al.[8] (2026, present study)	India	Retrospective comparative cohort	60 patients (30/30)	TEP/TAPP	Pseudosac fixation (suture/tack to Cooper's ligament or rectus muscle)	Pseudosac non-fixation	Seroma, pain, operative time, recurrence, hospital stay, return to activity

Risk of Bias

Neither trial came away clean: both raised some concerns, mainly around unblinded assessment of a clinically judged endpoint (seroma), and the pilot study added an unclear randomisation process given how small and hernia-unit-based its sample was[6,7]. The lone non-randomised comparative study landed at moderate risk, driven largely by confounding by indication, since which surgeon operated determined which arm a patient fell into rather than any systematic protocol[2]. The present authors' own retrospective cohort[8] was, as explained above, deliberately left out of formal ROBINS-I grading to sidestep self-assessment — though its retrospective, non-randomised nature plausibly carries at least as much confounding risk, something worth bearing in mind when weighing its share of the pooled estimates. Tables 2a and 2b lay this out.

Table 2a. RoB 2.0 domain ratings for the two randomised trials.

Study	D1: Randomisation process	D2: Deviations from intervention	D3: Missing outcome data	D4: Outcome measurement/reporting	Overall
Ghosal et al.[6] 2024	Low	Low	Low	Some concerns	Some concerns
Lodha et al.[7] 2023	Some concerns	Low	Low	Some concerns	Some concerns

Table 2b. ROBINS-I domain ratings for the independent non-randomised study.

Study	Confounding	Participant selection	Classification of intervention	Missing data	Overall
Reddy et al.[2] 2007	Moderate	Low	Low	Low	Moderate

Seroma Formation — Primary Meta-Analysis

Of all the outcomes tracked, seroma was reported most consistently. Two studies, sharing a matched "fixation to a fixed structure" intervention with usable patient-level counts, were combined: Ghosal et al.[6] recorded seroma in 3 of 30 fixation patients against 3 of 30 in the non-fixation arm — essentially no difference — while Rita J et al.[8] saw 0 of 30 versus 5 of 30, favouring fixation. Pooling under a random-effects model gave an odds ratio of 0.37 (95% CI 0.03–4.33, p=0.43); heterogeneity sat at a moderate I^2=54.9% (Cochran's Q, p=0.14), and with only 120 patients across the two studies, the estimate is wide enough that no statistically firm conclusion can be drawn (Figure 2).

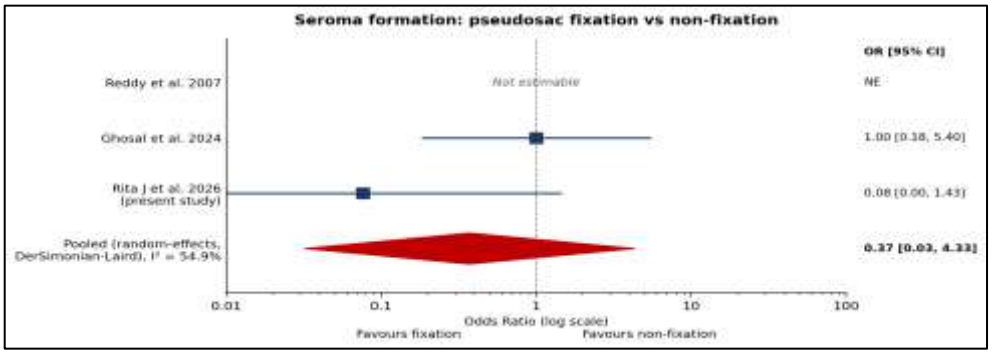

Figure 2. Primary meta-analysis: seroma formation, pseudosac fixation versus non-fixation (random-effects model).

A third study, Reddy et al.[2], reported a significant seroma reduction with tacking and inversion of the transversalis fascia ($p<0.05$); however, since the published abstract did not give exact per-arm counts and full text could not be obtained for this review, that finding is described here rather than folded into the pooled estimate.

Seroma Formation — Sensitivity Analysis Across Active Management Techniques

Since the scope here reaches beyond fixation as a single technique, a pre-specified sensitivity pool brought in a third study with usable event data: Lodha et al.[7], who tested fenestration rather than fixation on a per-hernia basis and found significantly less seroma at day 10 (13.3% versus 46.6%, p=0.046, or 2 of 15 hernias against 7 of 15). Across all three studies (150 patients/hernias combined), the random-effects pooled odds ratio came to 0.31 (95% CI 0.07–1.33, p=0.11), with heterogeneity lower than in the two-study analysis (I^2=35.3%, Cochran's Q p=0.21) (Figure 3). Every one of the three point estimates leaned toward active management, and the narrower interval here compared with the primary pool shows that casting a wider net around what counts as "active management" buys real precision, even if the significance threshold is still not crossed.

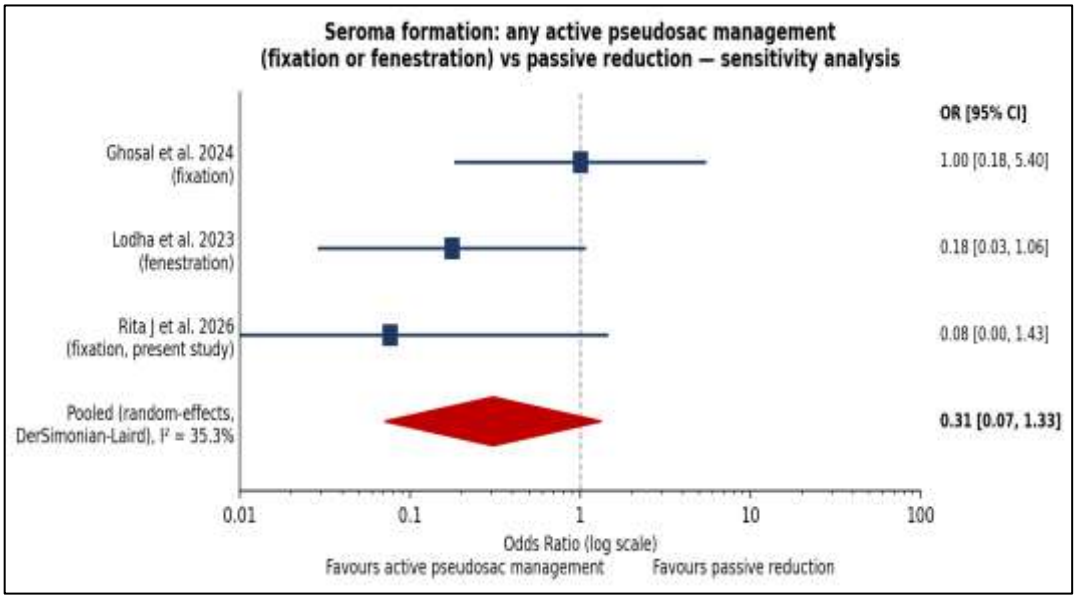

Figure 3. Sensitivity analysis: seroma formation, any active pseudosac management (fixation or fenestration) versus passive reduction (random-effects model).

Postoperative Pain

The way pain was defined and timed varied too much between studies to pool. Ghosal et al.[6] saw no meaningful gap in the share of patients with mild pain (30% fixation versus 40% non-fixation, p=1.0); Reddy et al.[2] found inversion of the transversalis fascia was not linked to worse pain; and Lodha et al.[7] found no group difference either. Rita J et al.[8], however, reported the opposite direction — a significantly larger fraction of the fixation group scoring above 3 on the VAS at 48 hours (33.3% versus 10.0%, p=0.03). With instruments and timepoints differing this much from one study to the next, and the direction of effect itself inconsistent, no firm conclusion can be drawn here.

Operative Time, Recurrence, and Hospital Stay

Only Rita J et al.[8] gave numeric operative-time data, finding fixation took longer (90±10 versus 80±8 minutes, $p<0.001$); Lodha et al.[7] mentioned no significant gap but did not publish the underlying figures, and the remaining two studies did not address this outcome at all. Not one arm, in any of the four comparative studies, recorded a recurrence during its follow-up window (extending to three months where a timepoint was specified), so no meaningful comparison could be drawn there either. Hospital stay and return to normal activity likewise come from a single source — Rita J et al.[8] again — who found stay modestly longer with fixation (2.7±0.6 versus 2.4±0.5 days, p=0.04) but no gap in time to normal activity (4.8±0.7 versus 4.6±0.6 days, p=0.24). Table 3 draws all four studies' outcomes together in one place.

Table 3. Outcomes reported by each of the four comparative studies, summarised side by side.

Outcome	Reddy et al.[2] 2007	Ghosal et al.[6] 2024	Lodha et al.[7] 2023	Rita J et al.[8] 2026
Seroma	Lower with inversion ($p<0.05$); exact 2×2 data not reported	3/30 vs 3/30 (p=1.0); no difference	13.3% vs 46.6% at day 10 (p=0.046); lower with fenestration	0/30 vs 5/30 (p=0.02); lower with fixation

Outcome	Reddy et al.[2] 2007	Ghosal et al.[6] 2024	Lodha et al.[7] 2023	Rita J et al.[8] 2026
Postoperative pain	No increase with inversion (p>0.05)	30% vs 40% mild pain (p=1.0); no difference	Not significantly different between groups	33.3% vs 10.0% VAS>3 at 48h (p=0.03); higher with fixation
Operative time	Not reported	Not reported in abstract	No significant difference	90±10 vs 80±8 min (p<0.001); longer with fixation
Recurrence	Not reported in abstract	0/30 vs 0/30 at 3 months	None reported to 30 days	0/30 vs 0/30
Hospital stay / return to activity	Not reported	Not reported	Not reported	Stay 2.7±0.6 vs 2.4±0.5 days (p=0.04); activity NS (p=0.24)

DISCUSSION

The aim here was to look at the pseudosac more broadly than just the fixation question, drawing together what the descriptive and comparative literature each have to offer. The descriptive papers agree on the essentials: this is invaginated transversalis fascia, not peritoneum; telling it apart from the true sac is a prerequisite for getting the mesh right; and how it behaves after reduction — collapsing on its own versus staying broad and redundant — seems to be what determines whether it needs further attention[1,9]. Its secondary use as a landmark in redo hernia surgery[10] is a reminder that this structure matters beyond seroma prevention alone, reaching into how the operation itself is conducted.

Turning to the comparative side, only four studies fit the bill, and restricting the main pooled analysis to the two directly matched fixation studies left a confidence interval so wide — anywhere from a thirty-fold drop to a four-fold rise in the odds of seroma — that the lack of significance reflects a shortage of data more than any settled null result. Pulling in a third, technically different study (fenestration) for the sensitivity check kept the effect pointing the same way across all three and, tellingly, tightened the interval while cutting heterogeneity from 54.9% down to 35.3%. That pattern hints that "active management" of the pseudosac, taken as a broad category rather than any one technique, may be more internally consistent than the fixation literature alone suggests. It echoes what has already been found for mesh fixation itself, where meta-analyses likewise report no clear recurrence benefit but a similar trade-off between fixation-related discomfort and fluid collection without it[11,12], and it sits comfortably alongside the separate body of work on the residual sac in indirect hernia repair, where leaving redundant tissue in place has repeatedly shown up as a seroma risk factor in independent meta-analyses of that anatomically distinct structure[13,14].

Where the present authors' own retrospective data[8] found longer operating times and more early pain with fixation, the randomised trial by Ghosal et al.[6] did not back this up — it found no pain difference and did not track operative time at all. The likeliest explanation lies in the retrospective design of the former: unmeasured variation in defect size, surgeon skill, or how the technique was selected could have shaped both which patients got fixation and how their outcomes were recorded, a structural limitation of retrospective comparisons that the present authors accept applies equally to their own dataset. What the evidence as a whole permits is a plausible trade-off — less seroma bought at the price of a longer procedure and rougher early recovery in some series — without enough weight of good-quality data to state that with any confidence for a specific technique.

Current international guidance already frames fixation and non-fixation as two acceptable options within a risk-adapted approach to groin hernia repair, rather than favouring one outright[15] — a stance this review's findings leave undisturbed. The decision pathway put forward in the narrative literature, which reserves active intervention for pseudosacs still broad or redundant after reduction while leaving thin, collapsed ones untouched[9], reads as a sensible, anatomy-driven compromise; the comparative data, thin as they are, do not argue against it and arguably lend it indirect support.

LIMITATIONS

Several caveats apply to this work. The pool of eligible comparative studies numbered just four, and only two or three of those could be combined quantitatively, and then only for one outcome — so the pooled figures are better read as hypothesis-generating than conclusive. Studies differed considerably in how they defined the intervention, when they measured outcomes, and which pain scale they used, which is why pain and operative time could not be pooled at all. One comparative study was retrospective and thus open to confounding by indication, even though it was not formally graded under ROBINS-I for the reason already given; another was a small pilot trial. Full-text access was not available for every study, which limited what could be extracted — Reddy et al.[2] in particular. The single-arm and narrative papers used for background were not bias-graded and should be read purely as descriptive

context, not as evidence of comparative effect. With so few comparative studies, testing for publication bias was not feasible. The search itself, though systematic and spanning the major databases plus hand-searched hernia journals, was not registered in advance, and grey literature or non-English sources were not chased down exhaustively. Lastly, folding in the present authors' own dataset brings a potential source of bias of its own — both from its retrospective design and from the deliberate choice not to grade it alongside the independent studies — which readers should factor into how they weigh the pooled results.

CONCLUSION

As an anatomical structure encountered during laparoscopic direct inguinal hernia repair, the pseudosac is well described, with established roles spanning dissection technique, seroma risk, and use as a landmark in redo surgery. What comparative evidence exists on actively managing it, however, is confined to four small and quite different studies covering fixation and fenestration alike. Both the primary, fixation-only meta-analysis and the broader sensitivity analysis that adds fenestration point toward fewer seromas with active management — the broader analysis more precisely so (OR 0.31, 95% CI 0.07–1.33) than the fixation-only figure (OR 0.37, 95% CI 0.03–4.33) — though neither crosses the line into statistical significance, and overall certainty remains very low. Until larger, multicentre randomised trials arrive with a standardised definition of pseudosac management and matched outcome measures, the decision of how — or whether — to intervene is best made case by case, guided by the size and redundancy of the pseudosac, individual anatomy, and operator experience, broadly in keeping with the size-based framework already proposed in the narrative literature.

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