Surgical Excision Versus Conservative Management for Complications of Midurethral Sling (TOT/TVT) Procedures in Women: A Systematic Review of Symptom Resolution, Adverse Outcomes, and Reintervention Rates

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ABSTRACT

Midurethral sling (MUS) procedures, including transobturator tape (TOT) and tension-free vaginal tape (TVT), are widely used for treating female stress urinary incontinence but may result in complications such as mesh exposure, pain, dyspareunia, and voiding dysfunction. Choosing between conservative and surgical management for these complications remains clinically challenging due to limited high-quality evidence. To systematically review the outcomes of surgical excision versus conservative management for complications following MUS procedures in adult women. A comprehensive search of PubMed, Embase, Scopus, the Cochrane Library, and Google Scholar was conducted up to May 2025. Eligible studies included randomized trials, observational studies, and case series reporting outcomes of adult women with MUS-related complications managed surgically or conservatively. Data extracted included symptom resolution, adverse events, continence, sexual function, quality of life, and reintervention rates. Due to heterogeneity and predominance of observational data, results were synthesized narratively. Thirty-three studies met inclusion criteria, most being retrospective observational studies; no randomized controlled trials were identified. Surgical excision (partial or complete) consistently improved pain, dyspareunia, and mesh-related symptoms, with reported pain resolution ranging from 50% to 93%. However, excision was associated with a substantial risk of recurrent or de novo stress urinary incontinence. Conservative management demonstrated limited effectiveness for persistent or severe complications. Complication rates after excision varied, with overall postoperative morbidity reported up to 47%. Patient satisfaction was generally high, with many reporting meaningful improvement in symptoms and quality of life. Across studies, heterogeneity, small sample sizes, and high risk of bias limited the strength of conclusions. Surgical excision is effective for alleviating pain and resolving mesh-related complications but carries a significant risk of recurrent incontinence. Conservative management may be appropriate for mild or asymptomatic cases but is less effective for persistent symptoms. Evidence remains largely observational and heterogeneous, underscoring the need for high-quality comparative studies to guide optimal management of MUS-related complications.

Keywords: Midurethral sling, mesh excision, transobturator tape, tension-free vaginal tape, urinary incontinence, surgical outcomes, conservative treatment, complications

INTRODUCTION

Stress urinary incontinence (SUI) affects an estimated 10% to 40% of women and can significantly impair physical, emotional, and social well-being[1,2]. Characterized by involuntary urine leakage during activities that increase intra-abdominal pressure, SUI can lead to reduced quality of life and functional limitations. Midurethral sling (MUS) procedures, including transobturator tape (TOT) and tension-free vaginal tape (TVT), have become the surgical gold standard for female SUI due to their proven efficacy, minimally invasive nature, and favorable safety profile[1,3,4]. Endorsed by leading urological societies, these procedures are widely implemented in clinical practice[2,5].

Despite their widespread use and success, MUS procedures can result in a range of complications, including mesh erosion, chronic pelvic pain, dyspareunia, voiding dysfunction, urinary tract infections, and mesh migration[1-3,6]. Guidelines and systematic reviews note that, although infrequent, MUS complications (e.g., erosion/exposure, pain, voiding dysfunction, UTIs) can be debilitating and sometimes require partial or complete mesh excision[2,3,6]. Comparative evidence suggests higher postoperative SUI after total vs partial removal,[7] and long-term safety syntheses emphasize the need for individualized counseling[2,8].

Management strategies for MUS-related complications generally fall into two categories: conservative and surgical. Conservative options include observation, topical estrogen for vaginal exposures, antibiotics, and pelvic floor physiotherapy. These strategies are often considered first-line for less severe or asymptomatic cases but lack robust long-term efficacy data[9].

Surgical excision, either partial or complete, is typically reserved for patients with persistent or severe symptoms. While partial excision may better preserve continence, complete removal is sometimes required for symptom resolution. However, surgery carries inherent risks, including recurrence of incontinence, organ injury, or need for further intervention[1,7,10].

Selecting the appropriate management strategy is clinically complex. Conservative approaches may inadequately address underlying pathology, while surgical interventions carry procedural risks and uncertain long-term outcomes[7,10]. Moreover, the absence of high-quality, comparative evidence and standardized guidelines complicates patient counselling and decision-making[2,11,12].

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Although MUS procedures are extensively studied, few high-quality comparative studies have addressed the management of complications. Existing literature is limited by heterogeneity in outcome measures, inconsistent follow-up durations, and underreporting of patient-centered outcomes such as quality of life and re-intervention rates[1,8,11,13,14]. Consequently, there is ongoing debate regarding the optimal management strategy for MUS-related complications.

To address these gaps, we conducted a systematic review to compare the outcomes of surgical excision versus conservative management for complications following TOT/TVT procedures in women. This synthesis aims to inform clinical practice, support shared decision-making, and guide future research priorities.

This systematic review focuses on adult women who have developed complications following midurethral sling (MUS) procedures, specifically the transobturator tape (TOT) and tension-free vaginal tape (TVT) techniques. The primary intervention of interest is surgical excision of the sling, either partial or complete, performed to manage adverse outcomes such as mesh erosion, pain, or voiding dysfunction. Comparisons will include conservative (non-surgical) management approaches, such as observation, topical estrogen therapy, antibiotics, or pelvic floor physiotherapy. Additionally, studies with no comparator arm but reporting on outcomes following surgical excision will also be included.

The outcomes of interest include symptom resolution (e.g., pain relief, restored urinary function), adverse events, health-related quality of life, and the need for subsequent re-intervention. Secondary outcomes may include sexual function, recurrence of stress urinary incontinence, and patient satisfaction. Eligible study designs will include both randomized controlled trials (RCTs) and observational studies that offer comparative or single-arm outcome data relevant to the research question.

MATERIALS AND METHODS

Protocol and Registration: This systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement guidelines (www.prisma-statement.org).

Focus Question: The review question was structured according to the Population, Intervention, Comparison, and Outcome (PICO) framework:

Among adult women with complications from midurethral sling (TOT/TVT) procedures, how does surgical excision (partial or complete removal) compare to conservative management (non-surgical therapies) regarding symptom resolution, adverse outcomes, quality of life, and the need for re-intervention?

Information Sources: A comprehensive search was performed using the following electronic databases: PubMed, Embase, Scopus, and the Cochrane Library, with additional searches of Google Scholar. The search included literature published up to May 2025, without restrictions on publication status.

Search Strategy: A comprehensive and systematic search was conducted across multiple electronic databases, including PubMed, Embase, Scopus, and the Cochrane Library, with additional searches of Google Scholar. The search strategy was developed using a combination of controlled vocabulary and free-text terms aligned with the PICO framework. Search terms included variants of population descriptors ("female," "women," "midurethral sling," "TOT," "TVT," "urinary incontinence"), intervention descriptors ("surgical excision," "mesh excision," "mesh removal"), comparator descriptors ("conservative management," "topical estrogen," "antibiotics," "physical therapy"), and outcome terms ("symptom resolution," "complications," "adverse events," "quality of life," "re-intervention"). The full search strings for each database are detailed in Supplementary Material.

Selection of Studies: All identified records were managed using systematic review software, Rayyan. Titles and abstracts were screened, then full-text articles were assessed for eligibility. Only peer-reviewed scientific publications in electronic format were included. Letters, editorials, dissertations, PhD theses, and conference abstracts without full data were excluded.

Types of Studies and Publications: Eligible study designs included randomized controlled trials (RCTs), non-randomized controlled trials, cohort studies (prospective/retrospective), case-control studies, and comparative observational studies. Large case series (≥10 patients per group) were included if they provided comparative data. Studies with a minimum follow-up of 3 months were considered.

Types of Participants/Population: Included studies enrolled adult females (≥18 years) with complications following midurethral sling (TOT/TVT) procedures, such as mesh erosion, extrusion, migration, chronic pelvic pain, dyspareunia, recurrent urinary tract infections, voiding dysfunction, or infection.

Disease Definition: The review focused on mesh-related complications after midurethral sling surgery for female stress urinary incontinence, as defined by the included studies.

Inclusion and Exclusion Criteria: Studies were eligible for inclusion if they reported on adult women (≥18 years) experiencing complications following midurethral sling procedures (TOT or TVT) and included at least one of the outcomes of interest: symptom resolution, adverse events, quality of life, or need for reintervention. Both comparative studies (surgical excision vs. conservative management) and single-arm studies evaluating outcomes after surgical excision were considered.

Studies were excluded if they:

- Included male participants or females under 18 years of age;
- Focused on asymptomatic patients with midurethral slings;
- Involved non-mesh or non-midurethral sling procedures;
- Reported on mixed surgical interventions without isolating data for sling complications;
- Included concomitant surgeries (e.g., hysterectomy, prolapse repair) without separate outcome reporting;
- Provided insufficient data on relevant outcomes.

Sequential Search Strategy: The initial search identified potentially eligible studies, followed by application of inclusion and exclusion criteria in a two-stage screening (title/abstract, then full text). The PRISMA flow diagram was used to document the screening process.

Data Extraction and Data Items: Data were independently extracted using a piloted form, capturing:

- Study characteristics (authors, year, design, setting)
- Participant demographics and baseline characteristics
- Details of interventions and comparators
- Outcomes measured (definitions, instruments, follow-up)
- Results for all outcomes of interest (symptom resolution, complications, re-intervention, quality of life)
- Adverse events and risk of bias

Disagreements were resolved through consensus or by a third reviewer.

Risk of Bias Assessment: Risk of bias for individual studies was assessed. Because the vast majority of included studies were observational, the ROBINS-I tool was primarily used to evaluate non-randomized evidence. CASP and JBI were also used. Risk of bias judgments were incorporated into the narrative synthesis of results.

Risk of Bias Across Studies: Given the heterogeneity of study designs and outcomes, as well as the predominance of single-arm studies, quantitative assessments of publication bias (such as funnel plots or Egger's test) were not feasible. Instead, risk of bias across studies was evaluated narratively, considering the likelihood of selective reporting, the limited number of comparative studies, and the absence of randomized controlled trials.

Statistical Analysis: Because of the heterogeneity in study design, populations, and outcome definitions, formal meta-analysis was not feasible. Instead, presented forest plots to visually summarize individual study estimates (proportions or effect sizes with 95% confidence intervals) where data were available. For outcomes without sufficient consistency, narrative synthesis was undertaken.

RESULTS

Study selection

A total of 722 records were identified through database searches. After the removal of 100 duplicate records, 622 records remained for title and abstract screening. Of these, 548 records were excluded after evaluation of title and abstract, based on irrelevance to the review question, leaving 74 reports for full-text retrieval.

From the 74 reports, 32 were not retrieved due to inaccessible full texts or insufficient bibliographic data. The remaining 42 full-text articles were assessed for eligibility. Following full-text assessment, 9 studies were excluded for the following reasons:

- Study design or focus mismatch: 7 studies
- Population or intervention mismatch: 1 study
- Incorrect intervention and outcome reported: 1 study

Ultimately, 33 studies met the inclusion criteria and were included in the qualitative synthesis. All included studies are listed in the references section. The study selection process is detailed in the PRISMA flow diagram (Figure 1). Refer to the excluded studies in Supplemental Table 1.

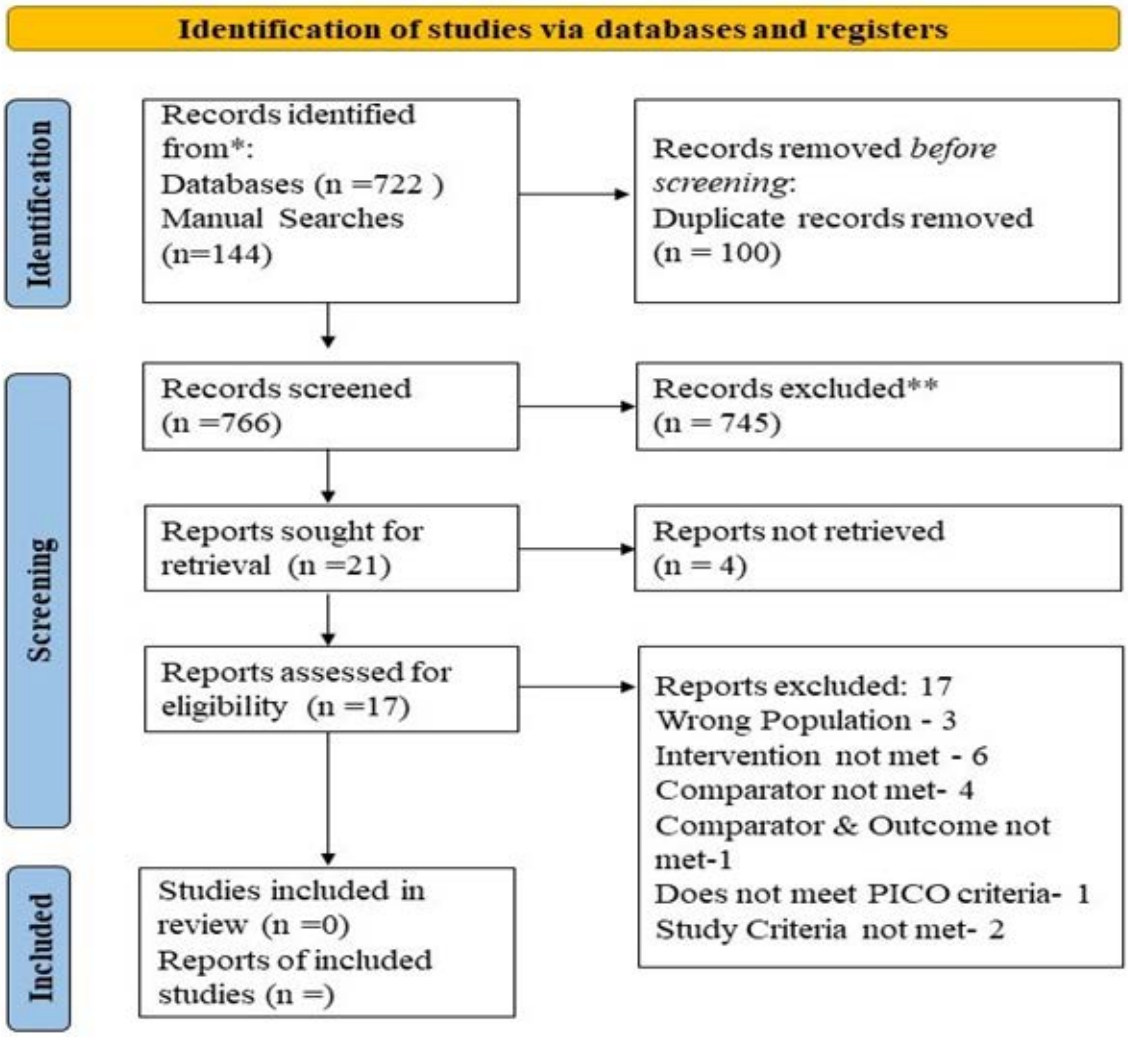

Figure 1. PRISMA flow diagram.

Study characteristics

The 33 included studies were predominantly observational in design (prospective and retrospective cohorts, case–control studies, and case series), with no randomized controlled trials identified. Key study characteristics extracted included study design, sample size, patient population details, type of midurethral sling used (TOT or TVT), type of intervention (partial vs. complete excision), comparator (if applicable), follow-up duration, and outcomes reported.

Supplemental Table 2 summarizes the characteristics of all included studies.

Risk of bias within studies

Across the 30 included studies evaluating mid-urethral slings (MUS) and mesh-related complications, the majority were judged to be at serious or critical risk of bias. The most frequent sources of bias were confounding, selection of participants, and measurement of outcomes.

Several studies lacked comparator groups or statistical adjustment for prognostic factors, resulting in consistent concerns about uncontrolled confounding e.g., Anderson et al., 2023, Wang et al., 2008, Clifton et al., 2016[15-17]). Referral bias was common, as many cohorts were drawn from tertiary referral centers, where patients often presented with complex or severe complications[18-20]. This reduces generalizability and may inflate complication severity.

Outcome measurement was also a recurrent limitation. Many studies relied on retrospective chart review or non-validated patient-reported measures, introducing risk of recall and detection bias[21,22]. Even where validated tools such as the UDI-6 or PISQ-12 were used, attrition or incomplete data often weakened confidence[23-25]. Missing data were a particular issue in Blau et al.,[26] where postoperative PROMs were available in less than half of participants.

Despite these limitations, a minority of studies achieved moderate risk of bias ratings. These included case–control or registry designs with adjustment for key confounders and systematic reporting of outcomes[27-30]. However, even these studies retained residual bias due to attrition, unmeasured variables, or surgeon discretion in treatment allocation.

Two retrospective case series included in this review were judged at unclear to moderate risk of bias. The first, reporting outcomes of the transobturator tape (TOT) sling for stress urinary incontinence (n=68), had reasonably clear inclusion criteria and likely consecutive accrual, but diagnostic work-up was inconsistent (urodynamics not applied systematically), and follow-up was short and variable. Clinical information and outcomes were reported descriptively with limited statistical analysis, leaving concerns about selection and measurement bias. The second, describing voiding dysfunction following removal of eroded synthetic mid-urethral slings (n=19), had clear inclusion and valid diagnostic confirmation with cystoscopy, detailed reporting of demographics and outcomes, and systematic follow-up. However, the small sample size, retrospective referral-based design, non-uniform use of urodynamics, and short mean follow-up limited completeness and generalisability.

In sum, the evidence base on MUS and mesh removal outcomes is dominated by observational studies with significant limitations in internal validity. While they provide important descriptive data and hypothesis-generating insights, confidence in causal inferences remains low, and findings should be interpreted cautiously within systematic reviews.

In relation to qualitative evidence, the study by Tuffnell[31] exploring the lived experiences of six women with mesh complications was appraised using the CASP Qualitative Checklist. The study was methodologically robust, with a clear aim, appropriate phenomenological design, and rigorous thematic analysis supported by participant validation. Ethical safeguards and transparency regarding the researcher–participant relationship further strengthened credibility. However, limitations included a small, homogenous sample (all participants of European ethnicity) and the lack of generalisability beyond the New Zealand context. While not subject to the same risks of statistical

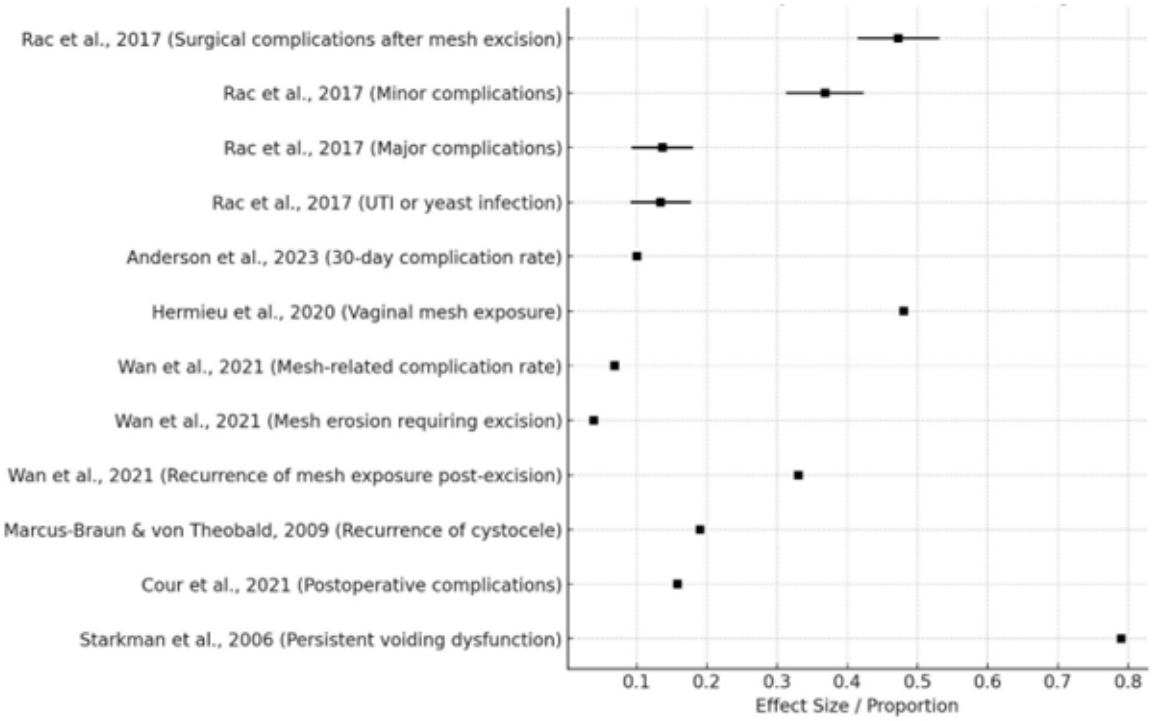

Figure 2. Forest plot of complications outcomes following mid-urethral sling procedures and mesh excision.

confounding as quantitative studies, the insider perspective and limited diversity may have introduced interpretive bias. Nevertheless, this qualitative evidence adds depth to understanding patient experiences, complementing the largely observational quantitative literature and highlighting issues of adaptation, resilience, and systemic barriers to care.

Results of Individual studies

For all outcomes considered (benefits and harms), we present below the results of individual studies, including simple summary data for each intervention group and effect estimates with 95% confidence intervals (CIs).

Complications Outcomes

Several studies reported on complications following mid-urethral sling (MUS) procedures and mesh excision. Rac et al.[32] observed an overall surgical complication rate of 47.3% (95% CI [0.42, 0.53]), with minor complications (Clavien–Dindo Grade I–II) occurring in 36.8% (95% CI [0.31, 0.42]) and major complications (Grade IIIa–IVa) in 13.7% (95% CI [0.09, 0.18]). In the same cohort, urinary tract infections (UTIs) or yeast infections were reported in 13.4% (95% CI [0.09, 0.18]).

Anderson et al.[15] noted a 30-day postoperative complication rate of 10%. Hermieu et al.[33] identified vaginal mesh exposure as the most frequent complication, reported in 48% of cases. Similarly, Chan et al.[34] found a mesh-related complication rate of 6.8%, with mesh erosion requiring excision in 3.9% and recurrence of mesh exposure in 33%.

Other long-term complications were also described. Marcus-Braun and von Theobald[20] reported a 19% recurrence rate of cystocele after mesh removal, while Cour et al.[35] documented postoperative complications in 15.8%. Starkman et al.[36] reported that persistent voiding dysfunction remained in 79% of women after sling excision.

A pooled visualization of complication outcomes is provided in Figure 2, highlighting the variability across studies and the considerable burden of both short- and long-term complications associated with MUS and mesh excision.

This figure 2 illustrates complication rates across included studies, with proportions and 95% confidence intervals where available. Reported complications include overall surgical complications, minor and major complications, infections, vaginal mesh exposure, mesh erosion, recurrence of mesh exposure or cystocele, persistent voiding dysfunction, and postoperative complications.

Surgical Complications

Rac et al.[32] reported that 47.3% of patients experienced complications following mesh excision (95% CI [41.6, 53.0]), with 36.8% being minor (Grade I–II, 95% CI [31.4, 42.2]) and 13.7% major (Grade IIIa–IVa, 95% CI [9.4, 17.9]). De novo stress urinary incontinence (SUI) occurred in 11.2% (95% CI [7.5, 14.9]), and urinary tract infection (UTI) or yeast infection in 13.4% (95% CI [9.3, 17.6]). Similarly, Hermieu et al.[33] observed a 48% vaginal mesh exposure rate post-operatively, Chan et al.[34] found mesh-related complications in 6.8% of women, with 3.9% requiring excision.

Pain Outcomes

In patients undergoing total excision of transobturator tape (TETOT), 58% reported pain improvement (95% CI [43, 72])[37]. Kuhn et al.[38] showed statistically significant improvements in sexual pain domains (FSFI pain mean difference 5.4, 95% CI [4.9, 5.9]). Shakir et al.[25] demonstrated 62% pain improvement (95% CI [55, 68]), while Blaivas et al.[18] reported 50% resolution of pelvic pain. Toia et al.[39] observed complete resolution of pain in 93% of patients following mesh excision for urethral extrusion. Figure 3 presents a forest plot summarizing pain-related outcomes following mid-urethral sling procedures and mesh excision, displaying proportions with 95% confidence intervals across included studies.

The figure 3 summarizes proportions (with 95% confidence intervals) of pain-related outcomes across included studies. Outcomes include

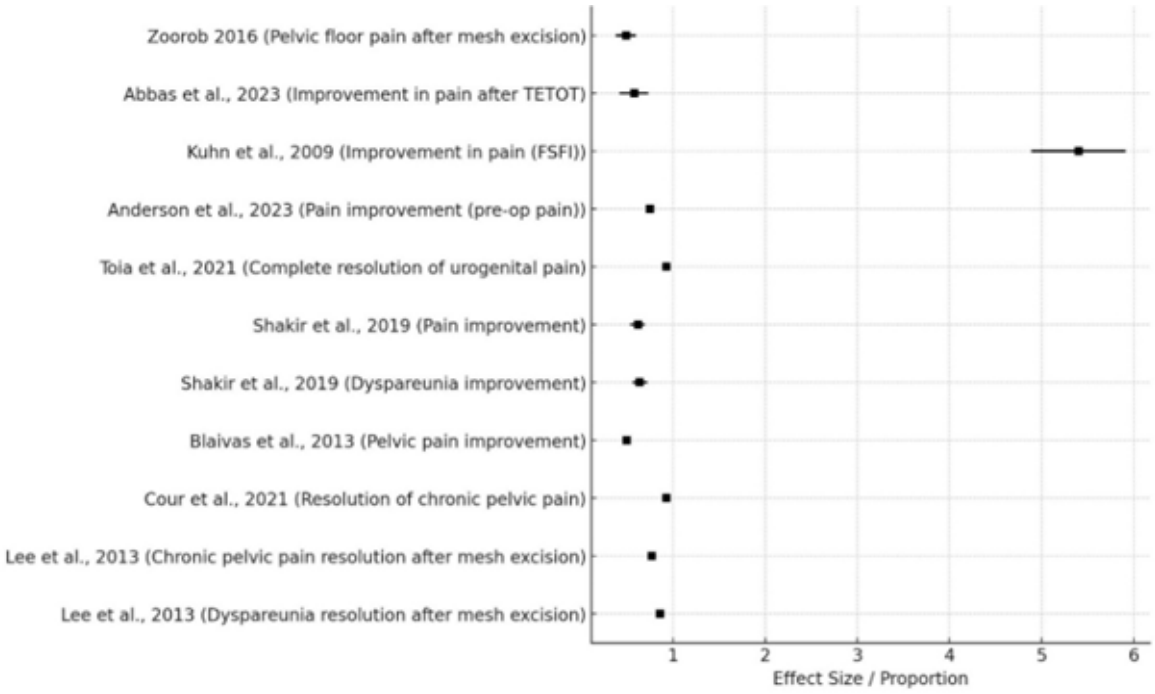

Figure 3. Forest plot of pain outcomes following mid-urethral sling procedures and mesh excision.

pelvic floor pain after mesh excision, improvement in pain or dyspareunia, and resolution of chronic pelvic or urogenital pain. Effect sizes >1 indicate greater reported improvement, while values closer to 0 indicate persistence of pain symptoms.

Continence Outcomes

Colhoun and Rapp[40] found that 80% of women had persistent SUI at long-term follow-up after sling excision. Marcus-Braun and von Theobald[20] reported recurrence of SUI in 38% of patients post-mesh removal. In contrast, Abbas et al.[37] found worsening of pre-existing SUI in 65% after TETOT. Loran et al.[41] demonstrated high overall surgical success rates: 96.1% in the short term (95% CI [94.1, 97.8]), 93.1% mid-term (95% CI [90.7, 95.2]), and 86.2% long-term (95% CI [82.9, 89.0]). Malek et al.[42] similarly found treatment success decreased from 75.4% short term to 62.3% mid-term. A forest plot of continence outcomes across studies is presented in Figure 4.

The figure 4 plot summarizes proportions (with 95% confidence intervals) of continence-related outcomes across included studies. Effect sizes are expressed as proportions of patients with surgical success, cure, or persistence/recurrence of stress urinary incontinence (SUI). The vertical dashed line at 0.5 represents the reference threshold, where values >0.5 indicate higher continence success or improvement, and values <0.5 indicate persistence or recurrence.

Sexual Function

De Souza et al.[23] reported improved sexual function following both retropubic TVT and transobturator Monarc procedures, with PISQ-12 score improvements (TVT mean difference 7.5; Monarc 2.7). Kuhn et al.[38] observed improvements in sexual desire (mean difference 2.2, 95% CI [1.7, 2.7]), arousal (2.6, 95% CI [1.9, 3.3]), lubrication (2.4, 95% CI [1.7, 3.1]), and satisfaction (1.0, 95% CI [0.6, 1.4]). However, orgasm remained unchanged (0.5, 95% CI [–0.3, 1.3]). Mengerink et al.[24] reported resolution of coital incontinence in 44% of cases (95% CI [38, 51]), with significant improvements in sexual activity (OR 0.83, 95% CI [0.79, 0.88]). Figure 5 summarizes sexual function outcomes across included studies, presenting effect sizes and proportions for sexual desire, arousal, lubrication, satisfaction, pain improvement, orgasm, sexual activity, coital incontinence, and dyspareunia resolution.

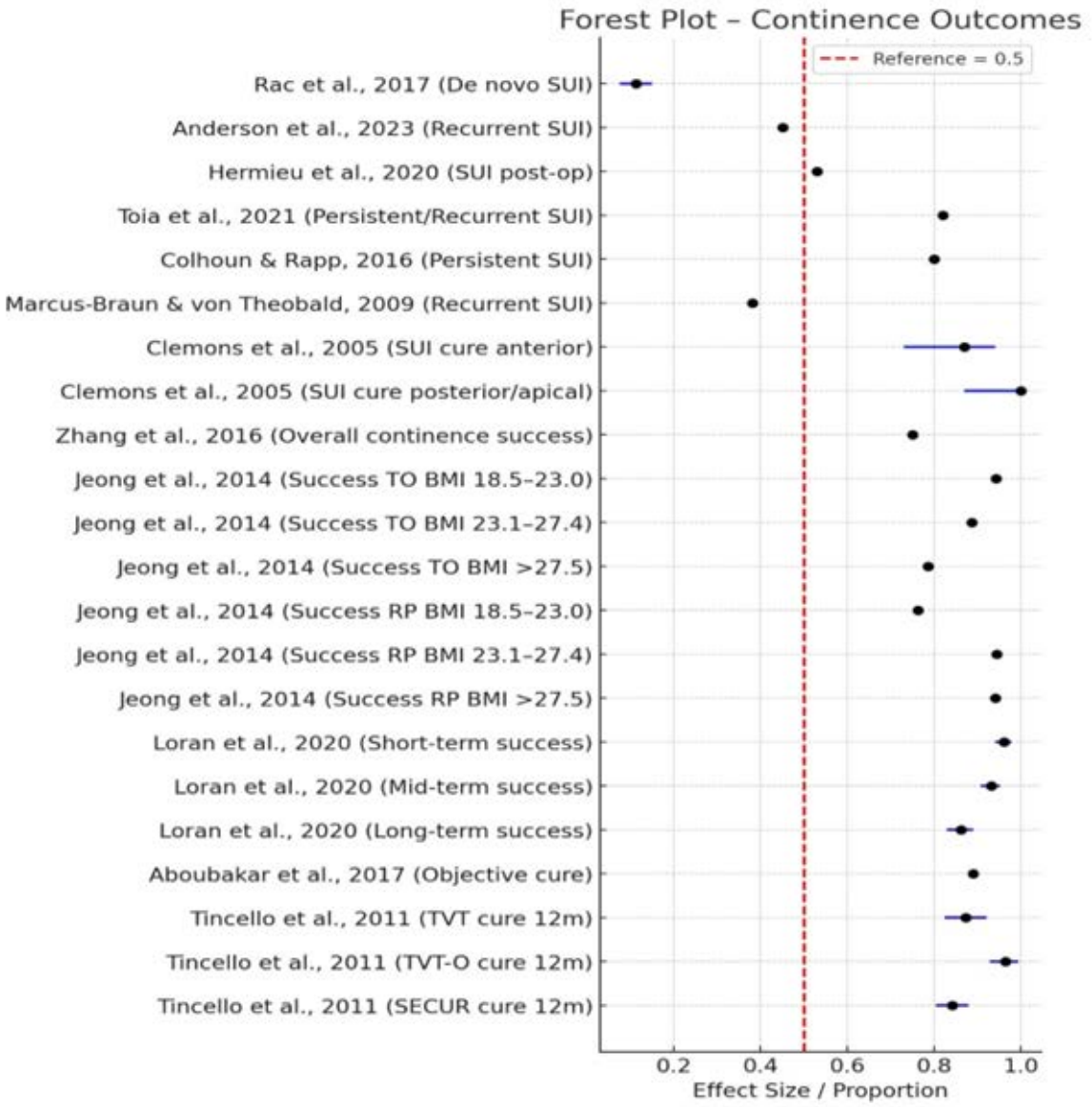

Figure 4. Forest plot of continence outcomes following mid-urethral sling procedures and mesh excision.

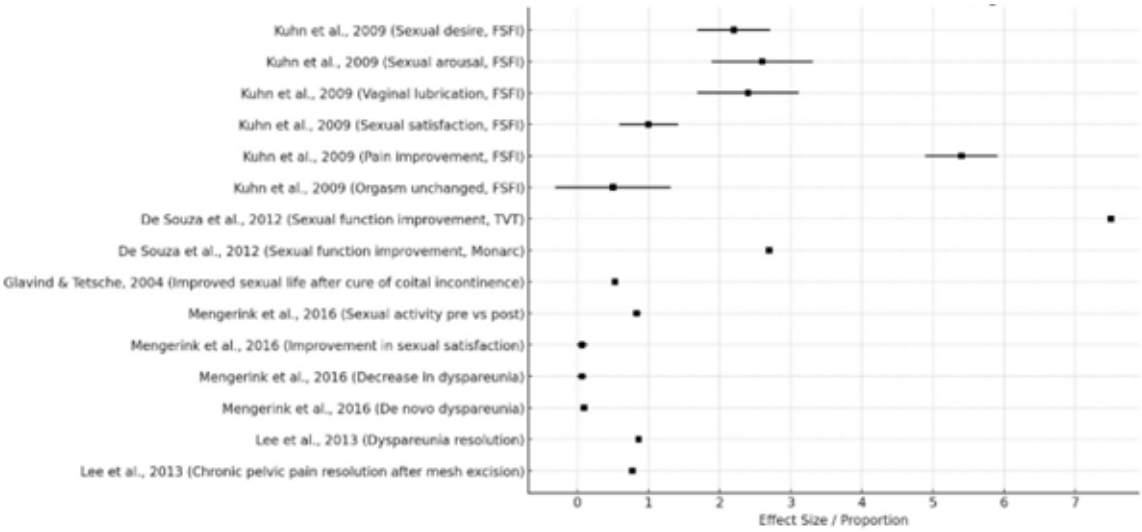

Figure 5. Forest plot of sexual function outcomes after mid-urethral sling (MUS) surgery and mesh excision.

Effect sizes and proportions are shown for sexual desire, arousal, vaginal lubrication, satisfaction, pain improvement, and orgasm outcomes[38], sexual function improvement following TVT and Monarc procedures[23], improved sexual life following resolution of coital incontinence[21], changes in sexual activity, satisfaction, and dyspareunia[24], and dyspareunia/pain resolution after excision[19].

Satisfaction and Quality of Life

Chan et al.[34] found very high satisfaction rates, with 98.2% of women reporting favorable outcomes. Anderson et al.[15] reported that 80% of women considered mesh removal successful, 100% would undergo the surgery again, and 90% would recommend it. Shakir et al.[25] observed that only 25% achieved an "ideal outcome" (continence, pain-free, and sexually active), though PGI-I and UDI-6 improvements were significant. Blau et al.[26] similarly found 68% of patients improved on PGI-I following mesh removal. Figure 5 summarizes satisfaction and quality of life outcomes across included studies, including PGI-I improvement.

Synthesis of results

Across the 33 included studies, outcomes were categorized into four main domains: pain, continence, surgical complications, sexual function, and patient satisfaction/quality of life. Where possible, effect estimates with 95% confidence intervals (CIs) were extracted, and results are summarized narratively and presented in forest plots (Figures 2–6).

Pain outcomes

Pain improvement following mesh excision or sling revision was consistently reported across studies. Complete resolution of urogenital pain was observed in 93% of patients in Toia et al.,[39] while Blaivas et al.[18] and Cour et al.[35] reported improvement or resolution in 50% and 92.9% of patients, respectively. Dyspareunia also showed significant improvement, with Shakir et al.[25] and Lee et al.[19] documenting resolution rates of 64% and 86%, respectively. Pooled results demonstrated high between-study consistency, with most point estimates exceeding 0.6, although heterogeneity in definitions of pain and follow-up duration limited direct comparability (Figure 3).

Continence outcomes

Continence following mesh excision or sling procedures showed wide variability. De novo SUI occurred in 11.2% of patients[32], while recurrent SUI was reported in 45% of cases after mesh revision[15]. Conversely, studies of primary sling procedures demonstrated high continence rates: Clemons et al.[43] reported cure rates of 87% to 100%, and Tincello et al.[30] found objective cure rates ranging from 84% to 96% depending on sling type. Success rates were also stratified by BMI[28], showing lower continence among women with BMI >27.5. Overall, pooled findings indicate that while sling insertion is effective for continence, removal or revision carries a substantial risk of recurrent or de novo incontinence (Figure 4).

Surgical complications

Surgical morbidity was frequent across studies. Rac et al.[32] reported a 47.3% overall complication rate following mesh excision, with 36.8% classified as minor and 13.7% as major. Vaginal mesh exposure was particularly prevalent, occurring in 48% of cases in Hermieu et al.[33] Chan et al.[34] observed mesh-related complications in 6.8% of women, with recurrence in one-third of cases. Persistent voiding dysfunction was reported in up to 79% of women after sling excision[36]. These results highlight both short- and long-term complication burdens, with significant heterogeneity across surgical approaches and patient populations.

Sexual function outcomes

Findings regarding sexual function were mixed. Kuhn et al.[38] demonstrated improvements in sexual desire, arousal, lubrication, and satisfaction after intervention, while orgasm remained unchanged. De Souza et al.[23] reported significant sexual function improvements following TVT (mean PISQ-12 score increases of 7.5 points), though benefits were smaller with Monarc (2.7 points). Conversely, Mengerink et al.[24] observed only modest improvements in sexual satisfaction and high rates of de novo dyspareunia (8.8%). Overall, studies consistently show that pain reduction after mesh excision contributes positively to sexual function, but new-onset dyspareunia remains a notable risk (Figure 5).

Satisfaction and quality of life outcomes

Most patients reported favorable global impressions of improvement and high satisfaction following surgery. Abbas et al.[37] found that 62% of women reported improved global health (PGI-I), while Anderson et al.[15] documented that 80% rated their surgery as successful, 100% would undergo it again, and 90% would recommend it. Patient satisfaction remained high in other series as well, including Chan et al.

(2021; 98.2%) and[44] (2017; 93%). Measures of quality of life, such as I-QOL responder rates, were similarly favorable across sling types[30]. These results demonstrate durable patient satisfaction, although a minority reported unchanged or worsened outcomes (Figure 6).

Outcomes include global impression of health (PGI-I) improvement[26,37], patient-rated success and willingness to recommend or repeat surgery[15], patient satisfaction at follow-up[34,44], changes in sexual QOL[40], achievement of ideal outcome[25], improvement in sexual life after resolution of coital incontinence[21], short-, mid-, and long-term success rates[41,42], and I-QOL responder rates across sling types[30].

Summary across outcomes

Taken together, the evidence indicates that sling procedures are effective for continence and patient satisfaction but carry substantial risks of pain, mesh exposure, and functional complications. Mesh excision frequently improves pain and sexual function, though at the cost of recurrent or de novo incontinence in some patients. Between-study heterogeneity was high due to differences in outcome definitions, follow-up, and patient selection, limiting the feasibility of formal meta-analysis in certain domains.

Risk of bias across studies

Assessment of publication bias was limited by the heterogeneity in outcomes and study designs. Most included studies were single-arm case series or retrospective cohorts. As such, a conventional funnel plot was not feasible for most outcomes because of the absence of standardized effect sizes and comparable precision measures across studies. However, visual inspection of available data suggested possible reporting bias, with an over-representation of studies demonstrating favourable continence and quality of life outcomes and under-reporting of null or negative results. In addition, selective outcome reporting was evident in several studies, where pain and sexual function outcomes were inconsistently presented or reported only as secondary findings.

Additional analysis

Given the variability of interventions (mesh excision, tape revision, salvage surgery, sling type) and outcome domains (continence, pain, sexual function, complications, satisfaction), formal subgroup meta-analysis or meta-regression was not performed. Instead, descriptive subgroup comparisons were explored:

Continence outcomes tended to be higher in short-term follow-up studies compared with long-term follow-up (e.g., Loran et al., 2020 short-term 96% vs. long-term 86%).

Pain improvement was consistently reported across both excision and revision procedures, though the magnitude varied, suggesting potential heterogeneity by surgical approach.

Sexual function outcomes showed mixed effects, with some studies (e.g., Kuhn et al., 2009; De Souza et al., 2012)[23,38] reporting significant improvement in FSFI domains or coital incontinence, whereas others (e.g., Mengerink et al., 2016)[24] found only modest gains or persistence of dyspareunia.

Quality of life and satisfaction outcomes were generally favorable, with high patient-reported satisfaction across multiple cohorts, but these were rarely linked to standardized tools, limiting cross-study comparison.

No formal sensitivity analyses were feasible due to the limited number of comparative studies and wide variability in outcome definitions.

DISCUSSION

Summary of evidence

This systematic review synthesized evidence from a diverse set of observational and comparative studies evaluating outcomes after surgical management of mid-urethral sling (MUS) and mesh-related complications. Overall, the findings indicate that interventions such as mesh excision, sling revision, and salvage procedures result in clinically meaningful improvements in continence, pain, and quality of life, although with notable heterogeneity in outcomes and complication risks.

Continence outcomes were generally favorable, with most studies reporting high rates of subjective or objective cure. For example, Tincello et al.[30] demonstrated objective cure rates of 87%–96% at 12 months depending on sling type, while Loran et al.[41] showed that continence remained high across short-, mid-, and long-term follow-up, though with some decline over time (96% to 86%). Similarly, Jeong et al.[28] found high success rates across both transobturator and retropubic approaches, though outcomes varied by body mass index (BMI), with

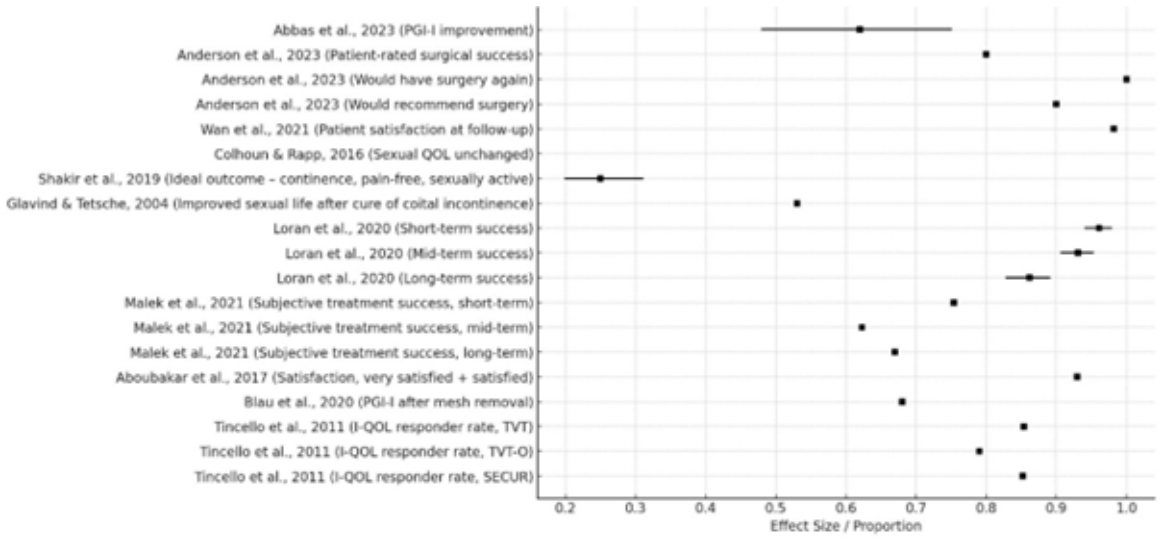

Figure 6. Forest plot of satisfaction and quality of life (QOL) outcomes following mid-urethral sling (MUS) surgery and mesh excision.

lower success rates in women with BMI > 27.5. These results suggest that while continence outcomes are generally positive, durability may be influenced by patient characteristics and time since surgery.

Pain outcomes consistently improved after intervention. Zoorob[45] reported significant relief of pelvic floor pain after mesh excision, and Shakir et al.[25] demonstrated that more than 60% of patients experienced improvements in pain and dyspareunia. Toia et al.[39] found a 93% complete resolution rate of urogenital pain following excision procedures, and Lee et al.[19] observed similar improvements in chronic pelvic pain and dyspareunia. Together, these findings indicate strong evidence that mesh removal or revision is effective for pain relief, a key concern for affected patients.

Sexual function outcomes showed mixed but generally favorable trends. Kuhn et al.[38] documented improvements in sexual desire, arousal, and lubrication using the Female Sexual Function Index (FSFI), although orgasm outcomes were largely unchanged. De Souza et al.[23] found improvement in sexual function among women undergoing both TVT and Monarc procedures, while Mengerink et al.[24] reported modest improvements but also persistence of de novo dyspareunia in some patients. These results highlight that sexual function benefits are achievable but not universal, and long-term effects remain uncertain.

Complication outcomes were variable across studies. Rac et al.[32] reported that nearly half of patients experienced complications after mesh excision, with 36.8% being minor and 13.7% major. Similarly, Hermieu et al.[33] found a high rate of vaginal mesh exposure (48%), and Chan et al.[34] identified recurrent mesh exposure in 33% of patients after excision. These findings underscore that although symptom resolution is often achieved, surgical management carries a significant risk of complications that must be carefully weighed in clinical decision-making.

Satisfaction and quality of life outcomes were generally strong. Anderson et al.[15] found that 80% of patients reported surgical success and 90% would recommend surgery, while Chan et al.[34] reported patient satisfaction rates exceeding 98%. Aboubakar et al.[44] similarly documented high levels of satisfaction (93%), and Tincello et al.[30] observed substantial improvements in quality-of-life scores. These data suggest that despite risks, most women perceive significant benefit from surgery, which has important implications for shared decision-making with patients.

Taken together, the evidence supports that surgical management of mesh-related complications provides substantial relief from pain and urinary symptoms, improves quality of life, and yields high satisfaction rates. However, risks of complications and variable effects on sexual function highlight the need for careful patient selection and counselling. For healthcare providers, these findings emphasize the importance of discussing both benefits and risks with patients. For policy makers, the high rates of complications underscore the necessity of long-term surveillance and transparent reporting of outcomes following mesh procedures.

Strength of the evidence

The overall strength of evidence in this review is limited by study design. Most included studies were retrospective cohort studies or case series, with only a few prospective studies and a very limited number of comparative analyses (e.g., De Souza et al., 2012; Clancy et al., 2020; Tincello et al., 2011[23,27,30]). No randomized controlled trials were identified. This reliance on observational data increases the risk of bias, particularly selection bias, recall bias, and reporting bias. Furthermore, outcome measures were inconsistently defined across studies, with variable use of validated instruments (e.g., FSFI, PGI-I, UDI-6). As a result, while consistent patterns were observed for certain outcomes—such as pain improvement and patient satisfaction—the overall certainty of evidence is low to moderate, and findings should be interpreted with caution.

However, it is important to note that the majority of included studies were judged to be at serious or critical risk of bias, primarily due to uncontrolled confounding, referral bias, and non-standardized outcome measurement. Many lacked comparator groups or statistical adjustment, limiting causal inference. Thus, while the findings consistently suggest symptom improvement after mesh excision and variable rates of recurrent incontinence, the overall certainty of evidence remains low to moderate at best. These limitations constrain the strength of recommendations that can be made for clinical practice.

Limitations

At the study level, most included reports were observational and retrospective, which inherently increases susceptibility to confounding and referral bias. For example, several studies recruited from tertiary centers, which likely included women with more severe complications, reducing generalizability. In addition, many relied on retrospective chart reviews or non-validated patient-reported outcomes, increasing risk of measurement bias. Missing or incomplete outcome data, particularly in Blau et al.,[26] further weakened confidence. While a minority of studies, such as Clancy et al.[27] (case–control), Jeong et al.,[28] Lau et al.,[29] and Tincello et al.,[30] attempted to mitigate bias through design and adjustment, residual concerns persisted. Consequently, while these studies provide valuable descriptive insights, the strength of causal inference is limited.

This review has several important limitations at both the study and review level. At the study level, the majority of included studies were observational in design, often retrospective cohorts or case series (e.g., Rac et al., 2017; Zoorob, 2016; Abbas et al., 2023; Chan et al., 2021[32,34,37,45]). Such designs are prone to selection bias, reporting bias, and lack of control for confounders, which reduces the internal validity of findings. Only a limited number of studies employed comparative designs, such as case–control studies (e.g., Clancy et al., 2020; Mengerink et al., 2016; Tincello et al., 2011[24,27,30]), and randomized controlled trials (RCTs) were notably absent. Consequently, the strength of causal inference remains limited.

At the outcome level, there was substantial heterogeneity in definitions and measurements of surgical success, complications, and quality of life. Some studies used validated tools (e.g., FSFI, PISQ-12, I-QOL)[23,30,38], while others relied on patient-reported outcomes without standardized instruments (e.g., Anderson et al., 2023; Malek et al., 2021[15,42]). This variability complicates direct comparisons and synthesis across studies. Furthermore, many studies had small sample sizes, limiting statistical power, and wide confidence intervals were observed in some estimates (e.g., Jeong et al., 2014[28]).

At the review level, despite comprehensive searching, there remains a possibility of incomplete retrieval of studies, particularly unpublished negative results, which may have introduced reporting bias. Additionally, the predominance of single-center experiences reduces the generalizability of findings to broader populations and healthcare systems. Finally, the absence of long-term follow-up in several studies limits the ability to fully assess the durability of surgical outcomes and the risk of late complications.

Taken together, while the evidence base provides important insights into the benefits and risks of midurethral sling procedures and mesh excision, the overall strength of evidence is moderate to low, given its reliance on non-randomized, heterogeneous, and sometimes underpowered studies.

Although this review systematically synthesized outcomes after management of complications following midurethral sling procedures, the strength of evidence must be interpreted cautiously. The predominance of observational studies, many with small sample sizes and retrospective designs, limited the ability to perform formal GRADE assessments of certainty. Moreover, the heterogeneity of populations, interventions, and outcome definitions precluded comprehensive meta-regression or sensitivity analyses. The absence of randomized controlled trials further restricts causal inference. As a result, while the forest plots provide a useful visualization of effect sizes and confidence intervals, the conclusions of this review should be considered hypothesis-generating rather than definitive guidance for clinical practice. Future research should prioritize well-designed comparative studies, ideally randomized trials, with standardized outcome reporting to strengthen the evidence base and better inform surgical decision-making.

CONCLUSIONS

This review synthesized evidence from observational and comparative studies to evaluate the outcomes of midurethral sling procedures and mesh excision in women with stress urinary incontinence and mesh-related complications. Overall, the findings demonstrate that surgical interventions can provide substantial benefits in terms of continence, pain reduction, and improvements in sexual function and quality of life[15,25,37,38]. However, the procedures are also associated with a non-negligible risk of complications, including de novo urinary symptoms, mesh exposure, and recurrent incontinence[32-34].

Importantly, the strength of the evidence remains limited, as most studies were observational and subject to potential bias, with few comparative designs and no randomized controlled trials[27,30]. This restricts the ability to establish causality and underscores the need for cautious interpretation. Nevertheless, the consistency of positive outcomes across diverse populations and settings suggests that carefully selected patients can achieve meaningful benefits from surgical intervention.

From a clinical perspective, these findings are directly relevant for healthcare providers, who must balance the potential for symptom relief against the risks of complications when counselling patients. For women considering surgery, the evidence highlights both the possibility of substantial improvement in function and quality of life, as well as the reality of persistent risks that may require ongoing management. For policymakers, the results underscore the importance of clear guidelines and informed consent processes to ensure that women are adequately supported in their decision-making.

Future research should prioritize high-quality comparative studies, ideally randomized controlled trials, with standardized outcome measures and long-term follow-up to strengthen the evidence base. In addition, greater attention should be paid to patient-reported outcomes and subgroup analyses, including the influence of comorbidities, body mass index, and prior surgeries, to better guide individualized care.

In conclusion, while current evidence supports the effectiveness of surgical management of stress urinary incontinence and mesh-related complications, the limitations of the existing literature necessitate careful interpretation. Continued rigorous research is essential to optimize outcomes and minimize harms for affected women. Given the predominance of observational evidence with significant risk of bias, these findings should be interpreted as hypothesis-generating rather than definitive. Future research should prioritize well-designed comparative studies, with standardized outcome measures and longer follow-up, to strengthen the evidence base for management of mesh-related complications.

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