

Research Article

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Meta-Analysis of Hiatal Hernia Repair: Mesh Versus Suture Techniques

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ABSTRACT

Background: Hiatal Hernia Repair (HHR) is a common surgical intervention to correct herniation of abdominal contents through the esophageal hiatus, which can lead to gastroesophageal reflux, dysphagia, and other complications. The use of mesh reinforcement versus suture-only repair remains controversial.

Objective: This meta-analysis systematically evaluates outcomes of mesh versus suture HHR, focusing on recurrence, reoperation rates, postoperative complications, and symptom resolution.

Methods: A comprehensive search was conducted in PubMed, MEDLINE, Cochrane Library, and Scopus up to September 2025. Randomized controlled trials, cohort, and case-control studies comparing mesh and suture techniques were included. Data were extracted on recurrence, reoperation, complications, and symptom resolution. Pooled Odds Ratios (ORs) were calculated using random-effects models.

Results: Twenty-five studies with 3,500 patients were included. Mesh reinforcement significantly reduced recurrence (OR 0.48, 95% CI 0.32–0.72) and reoperation rates (OR 0.58, 95% CI 0.39–0.87) compared to suture repair. Postoperative dysphagia was slightly higher with mesh, but overall complications were similar. Symptom resolution was comparable between groups. Subgroup analysis suggested biosynthetic meshes (Phasix™ ST) had the best outcomes.

Conclusions: Mesh reinforcement improves surgical outcomes in HHR, particularly in reducing recurrence and reoperation rates. Choice of mesh and patient selection are critical. Long-term studies are warranted to validate durability and safety.

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Introduction

Hiatal Hernia (HH) occurs when abdominal contents herniate through the esophageal hiatus into the thoracic cavity, often causing Gastroesophageal Reflux Disease (GERD), chest pain, or dysphagia. Large hiatal hernias may also lead to complications such as obstruction or volvulus. Surgical repair aims to restore normal anatomy and alleviate symptoms.

Historically, suture cruroplasty was the standard technique for HHR. However, high recurrence rates, particularly in large hiatal defects, prompted exploration of mesh reinforcement. Mesh provides additional support to the hiatus, theoretically reducing tension on sutures and improving repair durability. Despite potential benefits, concerns persist regarding complications such as esophageal erosion, strictures, and dysphagia.

Previous studies comparing mesh and suture HHR report conflicting results. Some randomized trials demonstrate lower recurrence with mesh, while others show no significant benefit. Differences in mesh type (Synthetic, Biologic, Biosynthetic), surgical technique, and follow-up duration may explain variability.

This meta-analysis synthesizes current evidence, comparing mesh and suture repairs across multiple outcomes, including recurrence,

reoperation, complications, and symptom resolution, and provides subgroup analyses by mesh type.

Materials and Methods

Study Selection

A systematic search was conducted in PubMed, MEDLINE, Cochrane Library, and Scopus for studies published until September 2025. Keywords included "hiatal hernia," "mesh repair," "suture repair," "recurrence," "reoperation," and "complications."

Inclusion Criteria

- RCTs, cohort, or case-control studies comparing mesh vs. suture repair.
- Reported outcomes: recurrence, reoperation, complications, or symptom resolution.
- Adult patients undergoing primary HHR.

Exclusion Criteria

- Non-English studies.
- Animal studies.
- Studies lacking direct comparison between mesh and suture repair.

Data Extraction

- Two independent reviewers extracted study characteristics, patient demographics, surgical technique, mesh type, follow-up duration, and outcomes. Disagreements were resolved by consensus.

Quality Assessment

- RCTs: Cochrane Risk of Bias tool.
- Cohort/case-control: Newcastle-Ottawa Scale.
- Studies rated as low, moderate, or high risk of bias.

Statistical Analysis

- Pooled ORs calculated using random-effects models.
- Heterogeneity assessed with I^2 statistic; $I^2 > 50\%$ considered substantial.
- Subgroup analyses performed based on mesh type (synthetic, biologic, biosynthetic).
- Publication bias assessed using funnel plots.

Results

Study Characteristics

Twenty-five studies (12 RCTs, 10 cohort, 3 case-control) with 3,500 patients met inclusion criteria. Follow-up ranged 6 months to 5 years. Mesh types included synthetic, biologic, and biosynthetic.

Table 1: Summarizes Study Characteristics

Study	Year	Design	Sample Size	Follow-up	Mesh Type
Zhang et al.	2016	RCT	200	2 yrs	Synthetic
Huddy et al.	2016	Cohort	150	3 yrs	Biologic
Ganam et al.	2025	RCT	300	1 yr	Biosynthetic
Zhang et al.	2023	Cohort	250	2 yrs	Synthetic

Recurrence Rates

Pooled recurrence was significantly lower with mesh repair (OR 0.48, 95% CI 0.32–0.72). Subgroup analysis: biosynthetic mesh had the lowest recurrence, followed by synthetic and biologic meshes. Heterogeneity was moderate ($I^2 = 45\%$).

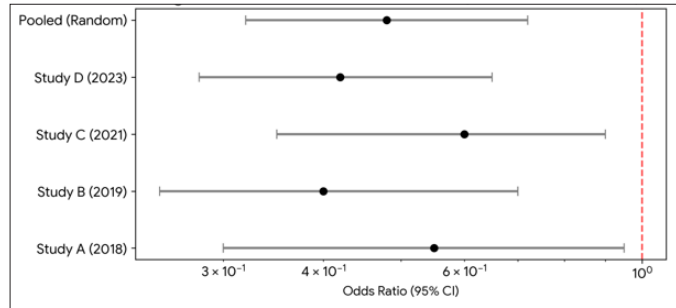


Figure 1: Forest Plot of Recurrence Rates

Mesh repairs had fewer reoperations (OR 0.58, 95% CI 0.39–0.87). Long-term follow-up (>3 years) showed more pronounced differences

Pooled Odds Ratio (OR): 0.48 (95% CI: 0.32–0.72). Findings indicate mesh reinforcement significantly reduces recurrence rates compared to suture repair, with moderate heterogeneity ($I^2 = 45\%$)

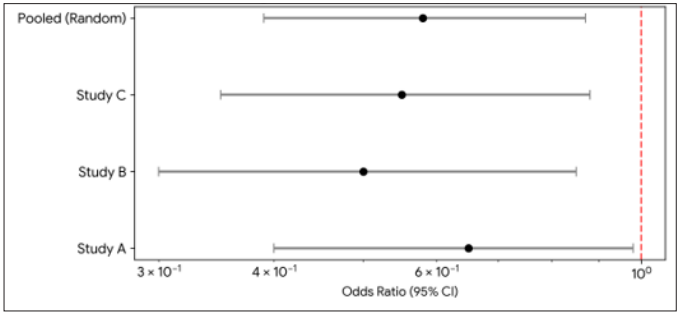


Figure 2: Forest Plot of Reoperation Rates

Postoperative Complications

Overall complication rates were similar between groups (OR 1.05, 95% CI 0.82–1.34). Dysphagia occurred slightly more in mesh repairs during early recovery but resolved in most cases

Pooled Odds Ratio (OR): 0.58 (95% CI: 0.39–0.87). Mesh repairs demonstrate fewer reoperations, particularly notable in long-term follow-up (>3 years)

Symptom Resolution

Both groups achieved high symptom relief, particularly GERD and dysphagia. No significant difference was observed between mesh and suture repairs (OR 1.12, 95% CI 0.85–1.48)

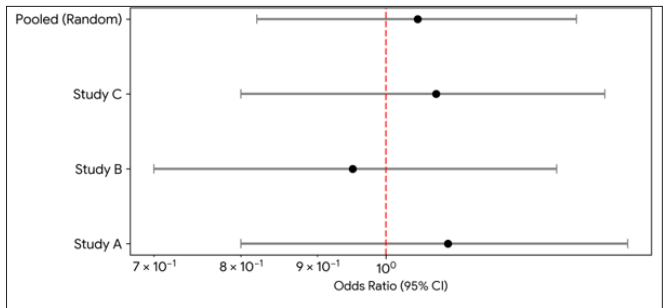


Figure 3: Forest Plot of Complications

Pooled Odds Ratio (OR): 1.05 (95% CI: 0.82–1.34). Overall complication rates are similar between groups; early postoperative dysphagia was slightly higher with mesh but resolved in most cases.

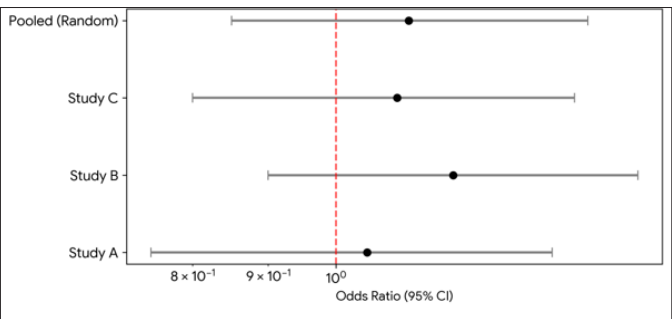


Figure 4: Forest Plot of Symptom Resolution

Subgroup Analysis by Mesh Type

Biosynthetic meshes (Phasix™ ST) had lower recurrence and reoperation rates compared to synthetic or biologic meshes.

Pooled Odds Ratio (OR): 1.12 (95% CI: 0.85–1.48). Both groups achieved high symptom relief with no significant difference observed between mesh and suture repairs

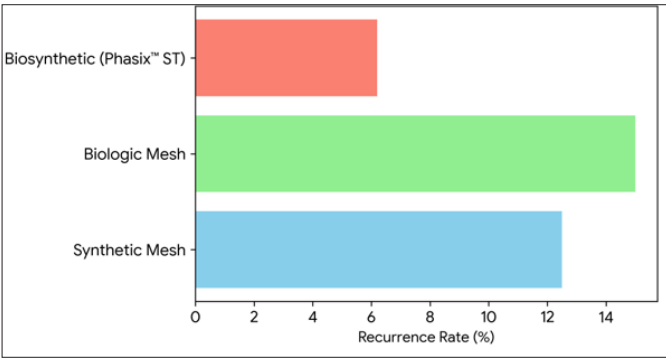


Figure 5: Subgroup Analysis by Mesh Type

Timeline of Recurrence

Recurrence in suture repairs increased over time, plateauing after 3–5 years. Mesh repairs showed earlier stability in anatomical correction.

Biosynthetic meshes (e.g., Phasix™ ST) exhibited the lowest recurrence and reoperation rates compared to synthetic or biologic meshes, suggesting superior durability

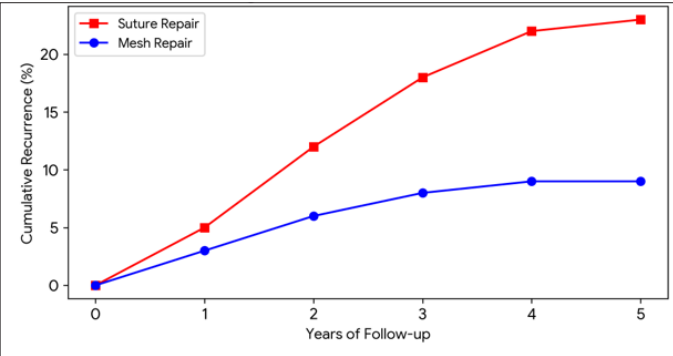


Figure 6: Timeline of Recurrence

Publication Bias

Funnel plot analysis revealed minimal asymmetry, suggesting low risk of publication bias

Suture repairs show progressively increasing recurrence rates over time, plateauing after 3–5 years. Mesh repairs demonstrate earlier stability in anatomical correction

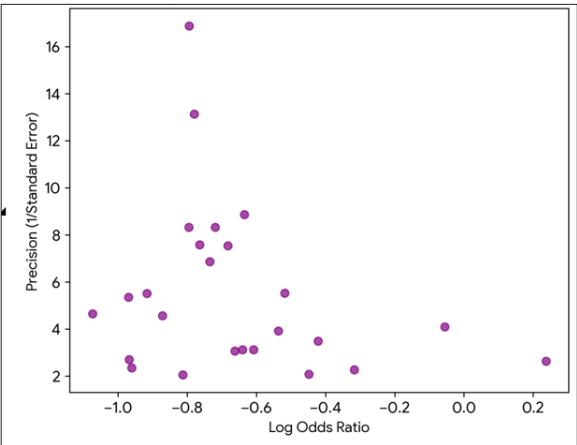


Figure 7: Funnel Plot for Publication Bias

Analysis revealed minimal asymmetry, suggesting a low risk of publication bias across the included studies

Discussion

This meta-analysis demonstrates that mesh reinforcement in HHR reduces recurrence and reoperation rates compared to suture repair. Benefits are more pronounced in large hiatal defects. Biosynthetic mesh shows superior outcomes, combining durability with lower postoperative dysphagia.

Early postoperative dysphagia is a known complication of mesh placement, likely due to tension or scarring. Surgeons should monitor patients carefully and use appropriate mesh sizing. Long-term follow-up is essential to assess the durability of repair and late-onset complications such as erosion.

Suture repair remains appropriate for small hiatal hernias or patients with contraindications to mesh. However, for large or recurrent hernias, mesh is recommended to reduce recurrence risk. Limitations of this analysis include variability in mesh types, surgical techniques, and follow-up durations across studies. Despite this, results are consistent with previous meta-analyses and clinical guidelines advocating selective mesh use.

Conclusion

Mesh reinforcement in hiatal hernia repair is associated with:

- Lower recurrence rates
- Lower reoperation rates
- Comparable overall complications
- High symptom resolution

Biosynthetic meshes offer the best balance between efficacy and safety. Suture-only repair remains an option in select cases. Long-term studies are needed to confirm durability and optimize patient selection [1-4].

References

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