



# Laparoscopic hiatal hernia repair: mesh or no mesh? A narrative review

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**Objective:** The objective of this narrative review is to summarize the data supporting or refuting the usage of mesh in laparoscopic hiatal hernia repairs.

**Background:** Laparoscopic hiatal hernia repair was first reported in 1992, and was immediately adopted over open abdominal or thoracic approach due to lower morbidity, blood loss, and ICU stay. The Achilles heel of the laparoscopic repair became apparent in the early 2000's, when studies began to report an up to 50% radiologic recurrence rate. Mesh reinforcement was a natural addition, proposed as a means of reducing tension and improving the recurrence rate, using either biologic or permanent mesh around the hiatal closure.

**Methods:** A variety of studies investigated the impact of mesh on hiatal hernia recurrence, differing in type of mesh, mesh shape and configuration, and method of securing to the diaphragm. This review discusses the available literature on three essential questions for the routine use of mesh in the laparoscopic repair of hiatus hernias: (I) Does mesh reduce long-term recurrence rates? (II) Is the reduction in recurrence rates clinically significant? (III) What is the incidence of mesh-related complications?

**Conclusions:** Overall, the existing data comes from mostly short-term, single-center trials, and suffers in particular from a lack of consistency in definitions (defining a hiatal hernia and defining a recurrence), diagnosis modality, and symptom documentation. The existing literature is insufficient to support the routine use of mesh in laparoscopic hiatal hernia repairs.

**Keywords:** Hiatal hernia; laparoscopic; mesh; review article

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## Introduction

Laparoscopic hiatal hernia repair (LHHR) was first reported by Cuschieri *et al.* in 1992 (1). and even in early comparisons the laparoscopic approach carried a lower morbidity, less blood loss, and reduced ICU stay (2). In the early 2000s, however, longer-term follow-up revealed a recurrence rate of nearly 50% on routine esophagram, compared to only 15% in an open surgery cohort (3). Adding a mesh reinforcement to the suture cruroplasty was a natural response to the problem of high recurrence rates. Carlson *et al.* in 1997 described the first randomized control trial of mesh

reinforcement in laparoscopic hiatal hernia repair, using a PTFE keyhole mesh and showing good early outcomes in a small cohort (4). Similarly, Zehetner *et al.* also published a series, 10 years after their first description of a laparoscopic repair, adding mesh reinforcement and frequent Collis gastroplasty, resulting in a decrease in recurrence rates from 50% to 18% on routine esophagram (5).

The addition of mesh to the laparoscopic hernia repair is intuitive: mesh is routinely used in inguinal and ventral hernias, and a tension-free repair is a basic surgical principle. This is even more compelling at the hiatus, where

the diaphragm is under constant repetitive stress from the mechanics of breathing. Conversely, the idea of wrapping a permanent foreign body around any part of the foregut is concerning for most surgeons. The most notable historical example is the silastic Angelchik prosthesis, introduced in 1979 as an anti-reflux option and eventually taken off the market due to high rates of migration, erosion, and dysphagia (6).

While mesh reinforcement in laparoscopic hiatal hernia repair demonstrated early success at reducing recurrence rates, several limitations emerged. First, the clinical relevance of radiographically diagnosed recurrences is unknown. Most such recurrences are asymptomatic, and many mesh trials do not provide data on symptomatic *vs.* asymptomatic recurrence (7). Second, and more concerning, is the risk of mesh related complications, including erosion, stricture, and dysphagia. The true incidence of such complications is unknown, as many studies provide only short-term data, and limited descriptions of complications (8,9).

Overall, the use of mesh for hiatal hernia repair remains controversial, and practice patterns differ widely. A 2015 survey of European gastrointestinal surgeons showed that 77% of surgeons use mesh selectively, and 15% use mesh routinely in LHHR. Mesh type, configuration, indications, and method of fixation were all highly variable (10). A 2010 survey of SAGES members had similar results, with a high degree of variability in mesh type, fixation, and configuration (11). There are three main questions that determine the utility of mesh for LHHR: (I) Does mesh reduce long-term recurrence rates? (II) Is the reduction in recurrence rates clinically significant? (III) What is the incidence of mesh-related complications?

This paper will review the literature on these three questions to assist surgeons in determining the ideal role for mesh reinforcement during LHHR. Databases searched included MEDLINE (via Ovid: MEDLINE and Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Daily and Versions), Embase (via Elsevier), Scopus, Education Abstracts (via EBSCOhost), and ERIC (via ProQuest).

We present the following article in accordance with the Narrative Review reporting checklist (available at <http://dx.doi.org/10.21037/vats-21-10>).

### The impact of mesh on long-term recurrence rates

The initial proposed benefit of mesh at the hiatus is the

same as the benefit of mesh in any hernia: a tension-free repair with lower recurrence rates. While published recurrence rates vary, several studies have reported a greater than 50% recurrence after LHRR (12-14). Prophylactic mesh placement has been shown to decrease this rate considerably. Frantzides *et al.* showed a decrease in recurrence from 22% with suture repair alone, to 0% with PTFE reinforcement after 2.5 years of follow up (15). Oelschlager *et al.* randomized 108 patients to suture repair or biologic mesh, and at 6 months found a 24% recurrence rate in the suture group compared to a 9% rate in the mesh reinforced group ( $P=0.04$ ). Granderath *et al.* randomized 100 patients and found recurrence in 26% of suture-alone and 8% with polypropylene mesh reinforcement at one year ( $P<0.001$ ) (16).

Unfortunately, the differences in recurrence rates seem to vanish with longer term follow-up. Oelschlager *et al.* published a follow up study in 2011, showing that the previously seen difference in recurrence disappeared at 5 years (17). Similarly, Jones *et al.* published a retrospective analysis of 209 patients undergoing mesh reinforced repair. They found a recurrence rate of 16% at 1 year, but by 5 years, recurrence increased to 39%, matching the published rates for non-mesh repair (18). Moreover, while most studies show a lower short-term recurrence, some do not show a difference. Watson *et al.* randomized 126 patients with >50% intrathoracic stomach in 2015 to suture alone, absorbable mesh, or non-absorbable mesh; they found no significant difference in recurrence rates (19). Oor *et al.* in 2018 had similar outcomes, with no difference in recurrence between suture and mesh for patients with large (>5 cm) hernias (20).

Two meta-analyses have tried to combine the data from the various randomized trials on mesh placement to reinforce sutures at the hiatus. Stavros *et al.* in 2012 found only 3 trials and a total of 267 patients that met their inclusion criteria; in pooled data of these three trials the recurrence after primary repair was 24.3% compared to 5.8% after mesh reinforcement ( $P=0.001$ ). No study had follow-up beyond a year. Memon *et al.* published a meta-analysis of 4 trials in 2016; while they also found a reduction in overall recurrence rates, they concluded that any recommendations were hindered by several limitations, including: poor methodologic quality, varying definitions of “recurrence,” incomplete data on mesh complications, short follow-up, and incomplete data on symptomatic *vs.* asymptomatic recurrences. The authors concluded that mesh and suture repair produce “comparable results” (21).

## The clinical significance of hiatal hernia recurrence

Importantly, the initial concern with high recurrence rates after laparoscopic hiatal hernia repair emerged from studies that performed routine imaging at a set time after repair. Many of these studies did not include a comparison of symptoms between the groups with and without radiographic recurrence, leading to questions about the clinical relevance of the finding.

Oelschlager *et al.*, who documented that recurrence rates equalized by 5 years of follow-up, is also one of the only groups to investigate symptomatic recurrences. They found that while over 50% of patients had a recurrence on imaging, there was minimal impact on heartburn related quality of life or symptoms. A large recurrence carried a slight increase in heartburn risk, but overall quality of life as measured by the SF36 did not differ between patients with and without recurrence at 5 years follow-up (22). Dallemagne *et al.* did a retrospective review of 85 patients; while 66% had recurrence on imaging, there was no relationship between radiographic recurrence and quality of life. Two patients (3%) required reoperation, one non-mesh patient for dysphagia and one mesh patient for symptomatic recurrence (12). Hietaniemi *et al.* performed routine CT after 165 repairs for giant hiatal hernia; while the majority were non-mesh repair, they found a 30% recurrence rate and no correlation between recurrence and health-related quality of life. Only 4% of patients had what they qualified as a “major” recurrence, with a greater than five centimeter hernia on follow up imaging (23). Overall, there is no evidence that radiographic recurrence correlates with need for reoperation, quality of life, or symptoms. The studies differ, however, in the definition of recurrence and the quality of symptom data.

Importantly, the high rate of asymptomatic, radiologically-determined hernias raises the question of how recurrence should be defined. The radiologic definition is itself in debate. Various authors have defined a recurrence as any amount of gastric tissue above the diaphragm (24); others have used 2 cm (25,26) or 3 cm (12) as specific cut-offs for defining a recurrence. Braghetto *et al.* proposed a classification score combining endoscopic and radiologic findings with postoperative symptoms to define what a symptomatic or “true” recurrence (13).

## Mesh-related complications

Finally, the use of mesh requires an evaluation of mesh-

related complications. These include inflammation, esophageal stricture, bleeding, and erosion of the mesh into the esophagus (27). Fixation of the mesh also carries risks, including case reports of cardiac tamponade from tack fixation into the diaphragm (28,29). Unfortunately complications related to mesh placement are often not included in the trials, and the follow-up period is likely too short to establish a realistic complication rate. A 2009 case series of 28 patients with mesh complications is the largest publication to date, and includes six patients requiring esophagectomy as a result of erosion or stenosis (30). This series included both synthetic and biologic mesh complications. Not all studies include measurements of dysphagia, although Granderath *et al.* found a higher rate in patients with mesh compared to the suture-alone group (16).

Although mesh placement has not been shown to decrease the need for reoperation, there is concern it may make reoperation more challenging. While a case-control study in 2016 found no increased risk of 30-day major morbidity or mortality with prior hiatal mesh (31), a 2010 retrospective study found mesh placement at the initial operation was associated with a 6.8-fold increased risk of major resection at reoperation (32).

## Discussion

Mesh reinforcement is the standard of care for hernia repair in almost any part of the abdomen. At the hiatus, laparoscopic hernia repair is accompanied by high tension, constant repetitive motion, and an extremely high recurrence rate on follow-up imaging. This makes a strong case for the routine placement of mesh. Currently, the exact role of mesh for LHHR, including indications, shape, type, and fixation method are all controversial. This review evaluates the three crucial questions for surgeons deciding on when or if mesh is indicated at the hiatus.

Recurrence rates are decreased in short- and mid-term follow up with mesh in almost all studies. However, in the few studies that follow patients to 5 years, this difference disappears. Additionally, the clinical significance of the radiologic recurrence is debatable. In many studies, recurrence has no relationship to health-related or general quality of life scales, symptom descriptions, or need for reoperation. Because not all studies distinguish between asymptomatic and symptomatic recurrences, it is difficult to know if a correlation would exist in the subset who have a recurrence detected due to symptoms. Finally, the incidence of mesh related complications is unknown. While these

complications are in the literature mainly as case reports, they can be very severe, up to and including the need for esophagectomy. The true incidence is unknown, and likely underreported.

More data is needed to overcome significant limitations in the literature, including relatively small sample sizes, varied definitions of “large” hernia, short follow-up, lack of symptom documentation, lack of descriptions of surgeon experience, and varied definitions of recurrence. While LHHR has major advantages over open surgery and remains the operation of choice, it carries a high recurrence rate. Mesh reinforcement does, in most studies, reduce the short-term incidence of radiologic recurrence, but there is little evidence to suggest it reduces the risk of symptomatic recurrence or the need for reoperation. Mesh complications are serious, and their incidence is unknown. While there may be situations where mesh is indicated, including recurrence after primary repair or giant hernia with inability to close the diaphragm, the data does not support routine use of mesh reinforcement for hiatus closure in LHHR.

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## References

1. Cuschieri A, Shimi S, Nathanson LK. Laparoscopic reduction, crural repair, and fundoplication of large hiatal hernia. *Am J Surg* 1992;163:425-30.
2. Schauer PR, Ikramuddin S, McLaughlin RH, et al. Comparison of laparoscopic versus open repair of paraesophageal hernia. *Am J Surg* 1998;176:659-65.
3. Hashemi M, Peters JH, DeMeester TR, et al. Laparoscopic repair of large type III hiatal hernia: Objective followup reveals high recurrence rate. *J Am Coll Surg* 2000;190:553-60.
4. Carlson MA, Richards CG, Frantzides CT. Laparoscopic prosthetic reinforcement of hiatal herniorrhaphy. *Dig Surg* 1999;16:407-10.
5. Zehetner J, DeMeester SR, Ayazi S, et al. Laparoscopic versus open repair of paraesophageal hernia: The second decade. *J Am Coll Surg* 2011;212:813-20.
6. Crookes PF, DeMeester TR. The Angelchik prosthesis: What have we learned in fifteen years? *Ann Thorac Surg* 1994;57:1385-6.
7. Tam V, Winger DG, Nason KS. A systematic review and meta-analysis of mesh vs suture cruroplasty in laparoscopic large hiatal hernia repair. *Am J Surg* 2016;211:226-38.
8. Furnée E, Hazebroek E. Mesh in laparoscopic large hiatal hernia repair: A systematic review of the literature. *Surg Endosc* 2013;27:3998-4008.
9. Li J, Cheng T. Mesh erosion after hiatal hernia repair: the tip of the iceberg? *Hernia* 2019;23:1243-52.
10. Furnée EJ, Smith CD, Hazebroek EJ. The Use of Mesh in Laparoscopic Large Hiatal Hernia Repair: A Survey of European Surgeons. *Surg Laparosc Endosc Percutan Tech* 2015;25:307-11.

11. Frantzides CT, Carlson MA, Loizides S, et al. Hiatal hernia repair with mesh: A survey of SAGES members. *Surg Endosc* 2010;24:1017-24.
12. Dallemagne B, Kohnen L, Perretta S, et al. Laparoscopic repair of paraesophageal hernia: Long-term follow-up reveals good clinical outcome despite high radiological recurrence rate. *Ann Surg* 2011;253:291-6.
13. Braghetto I, Lanzarini E, Musleh M, et al. Thinking about hiatal hernia recurrence after laparoscopic repair: When should it be considered a true recurrence? A different point of view. *Int Surg* 2018;103:105-15.
14. Sathasivam R, Bussa G, Viswanath Y, et al. 'Mesh hiatal hernioplasty' versus 'suture cruroplasty' in laparoscopic para-oesophageal hernia surgery; a systematic review and meta-analysis. *Asian J Surg* 2019;42:53-60.
15. Frantzides CT, Madan AK, Carlson MA, et al. A prospective, randomized trial of laparoscopic polytetrafluoroethylene (PTFE) patch repair vs simple cruroplasty for large hiatal hernia. *Arch Surg* 2002;137:649-52.
16. Granderath FA, Schweiger UM, Kamolz T, et al. Laparoscopic Nissen fundoplication with prosthetic hiatal closure reduces postoperative intrathoracic wrap herniation: Preliminary results of a prospective randomized functional and clinical study. *Arch Surg* 2005;140:40-8.
17. Oelschlager BK, Pellegrini CA, Hunter JG, et al. Biologic prosthesis to prevent recurrence after laparoscopic paraesophageal hernia repair: Long-term follow-up from a multicenter, prospective, randomized trial. *J Am Coll Surg* 2011;213:461-8.
18. Jones R, Simorov A, Lomelin D, et al. Long-term outcomes of radiologic recurrence after paraesophageal hernia repair with mesh. *Surg Endosc* 2015;29:425-30.
19. Watson DI, Thompson SK, Devitt PG, et al. Laparoscopic repair of very large hiatus hernia with sutures versus absorbable mesh versus nonabsorbable mesh a randomized controlled trial. *Ann Surg* 2015;261:282-9.
20. Oor JE, Roks DJ, Koetje JH, et al. Randomized clinical trial comparing laparoscopic hiatal hernia repair using sutures versus sutures reinforced with non-absorbable mesh. *Surg Endosc* 2018;32:4579-89.
21. Memon MA, Memon B, Yunus RM, et al. Suture Cruroplasty Versus Prosthetic Hiatal Herniorrhaphy for Large Hiatal Hernia: A Meta-analysis and Systematic Review of Randomized Controlled Trials. *Ann Surg* 2016;263:258-66.
22. Oelschlager BK, Petersen RP, Brunt LM, et al. Laparoscopic Paraesophageal Hernia Repair: Defining Long-Term Clinical and Anatomic Outcomes. *J Gastrointest Surg* 2012;16:453-9.
23. Hietaniemi H, Ilonen I, Järvinen T, et al. Health-related quality of life after laparoscopic repair of giant paraesophageal hernia: How does recurrence in CT scan compare to clinical success? *BMC Surg* 2020;20:109.
24. Mittal SK, Bikhchandani J, Gurney O, et al. Outcomes after repair of the intrathoracic stomach: Objective follow-up of up to 5 years. *Surg Endosc* 2011;25:556-66.
25. Lidor AO, Kawaji Q, Stem M, et al. Defining recurrence after paraesophageal hernia repair: Correlating symptoms and radiographic findings. *Surgery* 2013;154:171-8.
26. Oelschlager BK, Pellegrini CA, Hunter J, et al. Biologic prosthesis reduces recurrence after laparoscopic paraesophageal hernia repair: A multicenter, prospective, randomized trial. *Ann Surg* 2006;244:481-90.
27. Dehn T. Mesh Repairs in Hiatal Surgery. *Surg Endosc* 2003;17:1372-5.
28. Köckerling F, Schug-Pass C, Bittner R. A word of caution: never use tacks for mesh fixation to the diaphragm! *Surg Endosc* 2018;32:3295-302.
29. Vidrio Duarte R, Vidrio Duarte E, Gutierrez Ochoa J, et al. Cardiac Tamponade by Tack Fixation of a Hiatal Mesh. Should Tacks Still Be Used in the Diaphragm? *Cureus* 2020;12:e8416.
30. Stadlhuber RJ, Sherif A El, Mittal SK, et al. Mesh complications after prosthetic reinforcement of hiatal closure: A 28-case series. *Surg Endosc* 2009;23:1219-26.
31. Higgins RM, Bosler ME, Schumm M, et al. Mesh at the hiatus in revisional surgery for failed fundoplication: A case-control evaluation. *J Laparoendosc Adv Surg Tech A* 2017;27:997-1001.
32. Parker M, Bowers SP, Bray JM, et al. Hiatal mesh is associated with major resection at revisional operation. *Surg Endosc* 2010;24:3095-101.

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