SCIENTIFIC PAPER JSLS

Biologic Keyhole Mesh in Hiatal Hernia Repair

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ABSTRACT

Background and Objectives: Laparoscopic paraesophageal hernia repair (LPEHR) is the new standard, but the use of mesh is still debated. Biologic mesh has shown great promise, but only the U-shaped onlay has been extensively studied. Postoperative dysphagia has historically been a concern with the use of synthetic keyhole mesh and subsequently slowed its adoption. The purpose of our study was to identify the incidence of postoperative dysphagia in a series of patients who underwent laparoscopic paraesophageal hernia repair with novel placement of keyhole biologic mesh.

Methods: Thirty consecutive patients who underwent hernia repair with primary suture cruroplasty and human acellular dermal matrix keyhole mesh reinforcement were reviewed over a 2-year period. All procedures were performed at a single institution. Postoperative symptoms were retrospectively identified. Any postoperative hernia on imaging was defined as radiographic recurrence.

Results: Of the 30 consecutive patients who underwent hernia repair, 3 (10%) had mild preoperative dysphagia. The number remained unchanged after LPEHR with keyhole mesh. Return of mild reflux symptoms occurred in 6 (20%) patients. Repeat imaging was performed in 11 patients (37%) at an average of 8 months with 2 slight recurrences. All hernias were classified on preoperative imaging as large hiatal hernias. There were no postoperative complications.

Conclusion: Laparoscopic paraesophageal hernia repair with biologic keyhole mesh reinforcement has a low recurrence rate and no increase in postoperative dysphagia. The traditional belief that keyhole mesh has a higher incidence of dysphagia was not evident in this series.

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Disclosures: none reported.

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DOI: 10.4293/JSLS.2017.00086

Key Words: Dysphagia, Hiatal hernia, Laparoscopy, Surgical mesh.

INTRODUCTION

The transition from open hiatal hernia repair to a laparoscopic approach has improved patient outcomes in multiple areas, including hospital length of stay, decreased morbidity, and earlier postoperative mobility.[1] This evolution toward minimally invasive techniques has improved outcomes, but the basic surgical principles of hiatal hernia repair has remained unchanged. The stomach is reduced from the mediastinum, the hernia sac is resected, and primary cruroplasty and abdominal wall pexy are performed. Although the fundamentals required for successful repair are generally agreed on, there are disagreements related to the operative approach.[2,3]

One of the ongoing discussions is the use of mesh to bolster the posterior cruroplasty. Initial laparoscopic approaches with primary cruroplasty alone resulted in unacceptably high recurrence rates.[4,5] In the largest randomized control trial to date looking at the use of mesh in the repair of hiatal hernia, Oelschlager et al[6,7] reported improvement in short-term recurrence rate but found no advantage in the use of mesh repair at long-term follow-up. Other studies, however, have shown long-term benefit of the use of mesh.[8,9] The earliest techniques called for synthetic mesh but its safety profile is unclear with complications including dysphagia, erosion, and stricture.[10,11] Biologic mesh was soon adopted and became the most common material in hiatal hernia repair.[2,12]

In addition to the material used, the configuration may play an important role in the success of hernia repair. Early use of synthetic circular mesh brought reports of dysphagia and erosion, and the U-shaped onlay patch became the preferred configuration.[6,13,14] With the advent and widespread adoption of biological mesh and its improved safety profile,[15,16] we thought it worth revisiting the idea of using mesh to encircle the hiatus.

At our institution, we began using a novel technique consisting of human acellular dermal matrix in a keyhole

configuration (16 × 9 cm rectangular mesh with a circular defect; **Figure 1**) with favorable results. Published techniques involve a variety of configurations including U-shaped or circular onlay with synthetic or biologic meshes. The use of a keyhole-shaped onlay mesh composed of biologic material, however, has not been described heretofore in the literature. Because concerns of dysphagia with synthetic materials have limited the adoption of keyhole mesh in laparoscopic hiatal hernia repair (LPEHR), we sought to identify the incidence of dysphagia in our patients who underwent LPEHR in the modern era.

METHODS

A series of 30 consecutive patients who underwent paraesophageal hernia repair from January 2012 through December 2013 at our institution were identified and included in our retrospective review. Institutional Review Board approval was obtained, and a retrospective database was created. Patient demographics were obtained and included in the database. Preoperative symptoms including dysphagia were recorded along with diagnostic procedures and imaging. Operative details were obtained from detailed operative notes.

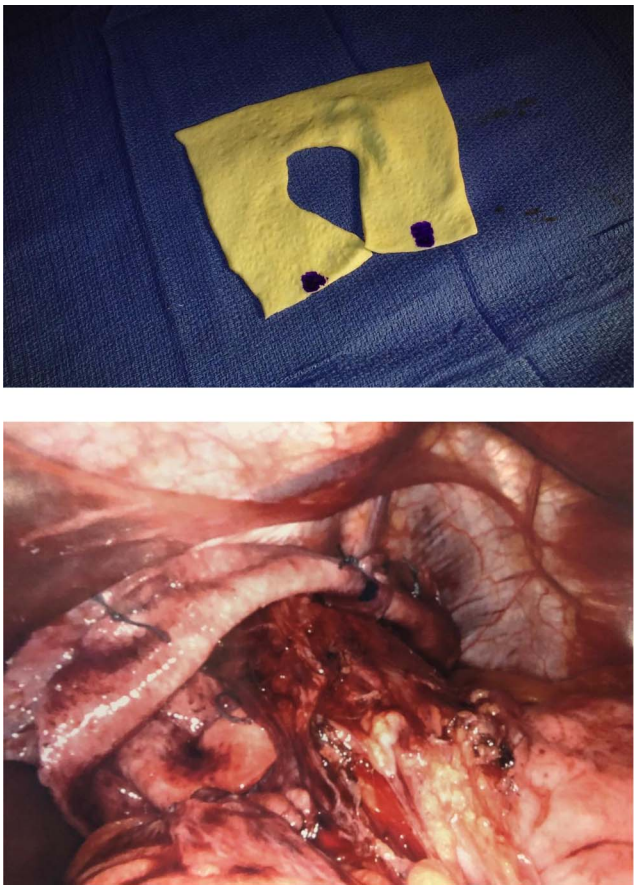

Figure 1. Acellular human dermal mesh prepared in a keyhole configuration and in vivo placement.

All patients underwent LPEHR. Hiatal dissection was performed with reduction of the hernia and resection of the sac. Primary cruroplasty with nonabsorbable interrupted suture was performed. A 16 × 9-cm rectangular human acellular dermis (Alloderm; Allergan [formerly Lifecell Corporation], Dublin, Ireland) mesh was prepared in a keyhole configuration. The mesh was then placed around the hiatus with 3-point suture fixation with permanent braided sutures. All patients underwent placement of mesh. Fundoplication was then performed, except in 3 of the 30 cases. A percutaneous endoscopic gastrostomy tube was routinely placed for anterior abdominal wall fixation. All patients were admitted to a surgical unit, and an upper gastrointestinal swallow study was performed on postoperative day 1. A standardized clinical pathway was used in all patients in regard to diet and discharge. Early recurrence, postoperative morbidity, and mortality were noted.

Follow-up encounters were identified in the patients' charts. Routine follow-up was at 2 weeks and then as needed to evaluate symptomatic patients. Any symptoms or events relating to the procedure, including dysphagia, reflux, symptomatic recurrence, and reoperation, were recorded. All postoperative follow-up encounters were reviewed and time to last clinical visit was noted. All postprocedure diagnostic studies, including endoscopy and computed tomography, were reviewed. Symptomatic recurrence was defined as patient reports of symptoms similar to those experienced before operative intervention. Radiographic recurrence was defined as any evidence of hiatal hernia on any radiographic study. Long-term repeat imaging was not routinely obtained. Only patients with clinical concern for recurrence or those with other medical indications were imaged after surgery.

RESULTS

Patient Demographics

Over a 2-year period from January 2012 through December 2013, 30 patients underwent LPEHR with placement of a keyhole biologic mesh. The average age of the patients was 64 (range, 31–83) years. Twenty-two were women (73%) and 8 were men (27%). The average body mass index (BMI) was 30 (range, 23–39) (**Table 1**).

Table 1.
Patient Characteristics

Characteristic	Data
Mean age, years (range)	64 (31–83)
Females	22/30 (73)
Mean BMI (range)	30 (23–39)
Previous hiatal surgery	4/30 (13)
Large hernia size	30/30 (100)
Use of biologic mesh	30/30 (100)
Fundoplication	27/30 (90)
Placement of gastrostomy tube	27/30 (90)
Conversion to open procedure	0/30 (30)

Unless otherwise noted, data are expressed as the number affected/total number of the group (percentage of the total group).

Operative Data

The mean operative time for all cases was 144 ± 31 (range, 116–247) minutes. All 30 of the hernias were classified as large (type 2 or greater, larger than 5 cm, and involving more than one third of the stomach). Four of the patients (13%) had undergone previous hiatal surgery. All hernia repairs were performed with placement of human acellular dermis mesh. A fundoplication was performed in 27 (90%) of the patients, with an anterior Dor fundoplication being the most common (77%). A gastrostomy tube was placed in 27 (90%) patients. This was performed for anterior wall gastropexy, to administer gravity feedings until oral feeding was tolerated, and to avoid postoperative nausea. All gastrostomy tubes were removed after a 6-week follow-up without complication. None of the operations required conversion to an open procedure.

Hospitalization

The mean length of hospital stay was 3.3 ± 2.2 (range, 2–7) days. None of the patients required admission to the intensive care unit during their stay. All patients underwent routine video esophagram on the first postoperative day. There were no instances of early recurrence, need for reoperation, or perioperative complications.

Long-Term Follow-up

The average length of clinical follow-up was 7 (SD 7.2; range, 2–27) months. The mean length of time to the last radiographic follow-up was 8 (range, 1–27) months. No patient required reoperation (**Table 2**).

Table 2.
Patient Follow-up

Postoperative Events	Data
Last clinical follow-up, months (range)	7 (2–27)
Last repeat imaging, months (range)	8 (1–27)
Reoperation	0/30 (0)
Symptomatic recurrence	6/30 (20)
Radiographic recurrence	2/11 (18)

Unless otherwise noted, data are expressed as the number affected/total number of the affected group (percentage of the total group).

Recurrence

Eleven patients underwent additional follow-up radiographic imaging. Five of the 11 patients underwent additional imaging for other reasons (i.e., trauma or other disease states). The remaining 6 patients underwent imaging for recurrence of symptoms. Two of the patients with a clinical picture of recurrence had radiographic evidence (<2-cm defects) and were successfully treated without operative intervention. None of the imaging in our asymptomatic patients demonstrated radiographic evidence of recurrence.

Dysphagia

Seven patients endorsed symptoms of preoperative dysphagia (**Table 3**). Four of them were relieved of dysphagia after surgery. The remaining 3 had persistent, but not worsening, postoperative dysphagia. Two of the patients had evidence of a small recurrent hernia on imaging, and another had a preoperative diagnosis of an esophageal motility disorder. Of the 23 patients who had no preoperative dysphagia, none had symptoms of new-onset postoperative dysphagia (**Figure 2**).

Table 3.
Postoperative Dysphagia

Occurrence of Dysphagia	Data, n (%)
Preoperative dysphagia	7/30 (23)
Postoperative dysphagia	
New onset	0/23 (0)
Pre-existing	3/30 (10)

Data are expressed as the number affected/total number of the group (percentage of the total group).

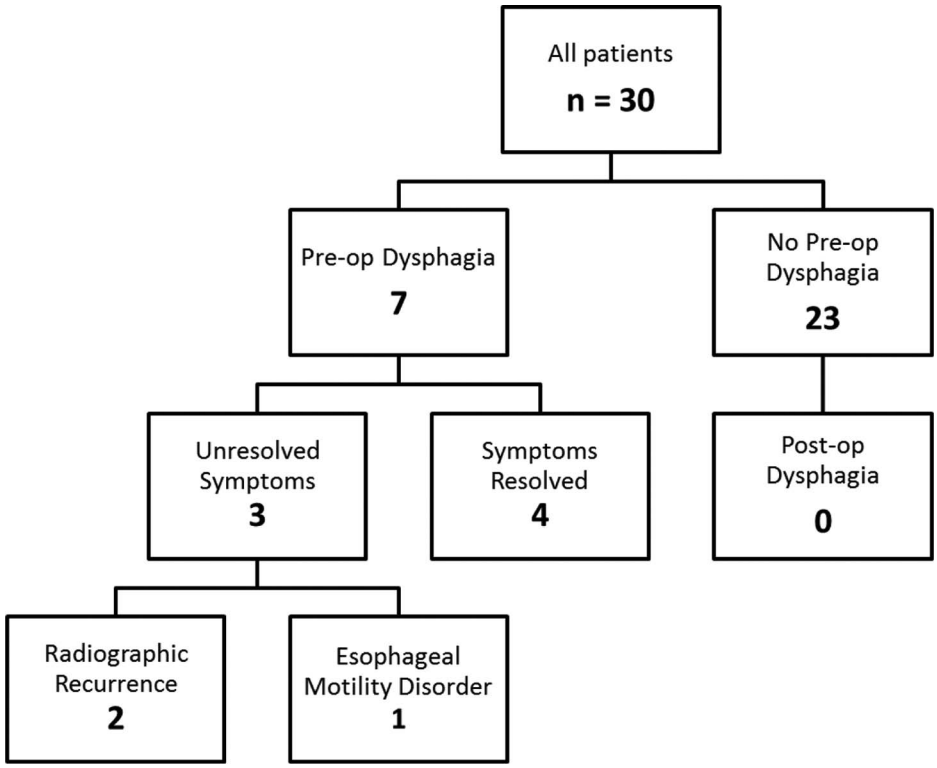

Figure 2. Rates of pre- and postoperative dysphagia.

DISCUSSION

In our study, the use of a biologic mesh in a keyhole configuration had minimal deleterious effects on postoperative dysphagia and was associated with an acceptable short-term recurrence rate. This experience adds to the literature, in that it helps to establish the safety of biologic mesh with in a circumferential configuration.

Much has been written concerning the use of mesh in repairing hiatal hernias, but there is still a lack of consensus regarding the types of materials and the details of their orientation. The transition from open to minimally invasive repair has been the subject of intense study. In the modern era, minimally invasive techniques are considered the accepted first-line approach in repair of hiatal hernias.[17] It is accepted that closure of the crus with primary cruroplasty is needed in PEH repair,[18] but the ideal method of buttressing the repair and even the necessity of such repair remain less clear.

Countless varieties of mesh are available to use in PEH repair. In addition, the mesh is placed in multiple configurations. Synthetic mesh was the first to be extensively studied and its use followed the basic tenets of tension-free inguinal hernia repair. Although some studies have shown successful results,[19,20] others have demonstrated unacceptable rates of erosion, stricture, and other untoward complications.[10,11]

Recently, biologic mesh has gained traction in hiatal hernia repair. Given the potential for tissue ingrowth rather than encapsulation and inflammation, biologic mesh is the most common material used for reinforcement of the hiatus.[17] The advantages of a biologic mesh include reduction of long-term risks that were initially seen with synthetic mesh, which includes erosion into the esophagus or stomach, mesh migration, and stenosis. In contrast, long-term studies have shown decreased risk when pliable biomaterials are used.[7,21] Several newer biomaterials are available, each with advantages and disadvantages. In this study, human acellular dermal matrix was used, despite a possible higher cost than other biomaterials, because its use at the hiatus has been studied extensively, and favorable outcomes have been reported.[13,22] Human acellular dermis provides a strong extracellular collagen matrix that allows for a bolstering of the hiatal repair in addition to improved intra-abdominal handling compared to other materials.[23] Shrinkage and contraction of synthetic mesh has been reported in animal models,[21] but no

such properties have been described with the use of human acellular dermis.[21]

In addition to mesh composition, the configuration of mesh placement may play a significant role in a successful long-term PEH repair. Most studies of primary repair versus mesh cruroplasty have involved use of a U-shaped configuration to cover the posterior crus, leaving the anterior diaphragmatic component largely exposed. This U-shaped configuration has persisted in part because of fears of the complications related to a circular or keyhole-shaped mesh.[11] With the advent of improved biologic mesh materials, complications involving erosion and stricture have become significantly less prevalent.[24] Anatomically, the diaphragmatic hiatus is a circular structure, and it seems that any portion of the circle left exposed could increase the risk of recurrence. Extrapolating from hernia repair experience in other parts of the body, the principles of tissue coverage and tension-free repair can be applied at the hiatus.

Varela and Jacks[25] published a report in 2009 in which they used acellular human dermis in a manner similar to that in our study. They fashioned a slit, however, rather than a keyhole configuration. The keyhole configuration may further reduce the risk of erosion and stenosis when used in a circumferential repair. The use of sutures for mesh fixation is preferred, as pledgets and tacks may have deleterious consequences in this sensitive anatomic location.[26,27] In addition, a gastrostomy tube rather than a suture pexy is regularly placed to improve fixation and to assist in management of possible postoperative symptoms, given the large size of hernias in this patient population, and its use may contribute to a lower overall recurrence rate.[28]

The primary goal in looking at the use of mesh in this configuration was to identify its effect on postoperative dysphagia. The usage of a Dor fundoplication in most of this patient group is a deliberate choice made to minimize potential dysphagia of a 360° circumferential wrap in this vulnerable population, while still providing an adequate antireflux barrier in the form of a fundoplication.[29] No routine manometry was performed, as its utility is questionable in patients with large PEH.[30] Of the 3 patients with continued dysphagia, one was found to have an unidentified preoperative esophageal motility disorder. Radiographic imaging was obtained in the other two and a small type I PEH recurrence was identified in each. The postoperative dysphagia was directly related to either recurrence or a motility disorder, and therefore not to the mesh placement.

The study was retrospective and conducted in a single institution. Long-term data are currently being collected to identify recurrence rates and dysphagia. The goal is to introduce this technique and present its safety and efficacy within a reasonable postoperative period rather than prove superiority over other methods. Longer postoperative follow-up, in addition to objective symptomatic dysphagia scores and routine radiographic imaging, can help inform this important clinical sequela.

CONCLUSION

LPEHR with biologic keyhole mesh reinforcement has an acceptable recurrence rate, with no discernible effect on postoperative dysphagia. Although there are many more questions to be answered, the data suggest that this method of repair is a safe and effective technique. The traditional belief that keyhole mesh has a higher incidence of dysphagia should be less of a concern with the new generation of biologic mesh. Keyhole biological mesh seems to be safe in patients with large PEH.

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