The surgical treatment of paraesophageal hernias

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The surgical treatment of paraesopageal hernia

Paraesophageal hernias account for about 5 to 10% of all hiatal hernias. The surgical approach to these hernias has radically changed over the last 15 years, as mostly patients who are symptomatic are operated on nowadays, and preferably by a laparoscopic approach rather than by laparotomy or thoracotomy. We reviewed the surgical repair of paraesophageal hernias, focusing particularly on the operative approach and technique.

KEY WORDS: Esophagus, Laparoscopy, Paraesophageal hernia, Stomach, Surgery, Surgical mesh

Introduction

Paraesophageal hernias are uncommon type of hiatal hernias accounting for about 5 to 10% of all such hernias. By definition, a hiatal hernia occurs when elements of the abdominal cavity herniate through the esophageal hiatus of the diaphragm. The most complete classification of hiatal hernias comprises four different anatomic types: 1) Sliding hiatal hernia (Type I) in which a portion of the gastric cardia herniates through a widened esophageal hiatus into the posterior mediastinum; 2) "True" paraesophageal hernia (Type II), subsequent to a localized defect in the phrenoesophageal membrane and characterized by the gastroesophageal junction (GEJ) remaining fixed into the abdomen whereas the gastric fundus is dislocated in the chest alongside the esophagus (i.e., paraesophageal); 3) Mixed sliding and paraesophageal hernia (Type III) that has elements of both type I and II as the GEJ slides above the diaphragm together with a paraesophageal component; and 4) Type IV hernia that is essentially a large type III in which a huge defect allows other organs besides the stomach (e.g., colon, spleen) to migrate upward into the chest. Types II, III, and IV are varieties of paraesophageal hernias, all characterized by a true hernia sac and by the presence of a paraesophagel portion of the stomach. Among them, the type III prevails and likely represent the progression of a sliding hernia. Most patients with a paraesophageal hernia are asymptomatic or have only vague, intermittent symptoms (e.g., chest pain, heartburn, epigastric pain, postprandial fullness, nausea, and vomiting). However, serious complications may occur in such patients as consequence of a mechanical problem caused by the hernia, such as gastric volvulus, gastric outlet obstruction, hemorrhage, gangrene with perforation, and respiratory distress leading to an emergent repair. In asymptomatic patients, paraesophageal hernias are usual-

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ABBREVIATIONS

GEJ	Gastroesophageal junction
GERD	Gastroesophageal reflux disease
SF-36	Short Form 36
GDSS	Glasgow Dyspepsia Severity Score
GIQLI	Gastrointestinal Quality of Life Index

ly diagnosed incidentally on the basis of a chest x-ray, while in the presence of symptoms the hernia is generally detected by upper endoscopy or barium swallow.
This review addresses the surgical repair of paraesophageal hernias, focusing particularly on the operative approach and technique.

Indications for surgical treatment and preoperative work-up

Historically, surgical repair was advocated for the treatment of patients with paraesophageal hernias regardless of whether they had related symptoms. This approach stem from retrospective reports showing 30% to 45% incidence of complications and mortality rates up to 50% among patients left untreated [1,2]. More recently, however, several authors have questioned the need for repair in truly asymptomatic patients [3]. Stylopoulos and Collegues from the Massachussetts General Hospital developed a Markov Monte Carlo decision analytic model to investigate elective laparoscopic paraesophageal hernia repair as opposed to a watchful waiting strategy in patients with asymptomatic or minimally symptomatic type II or III hiatal hernia. Interestingly, they found that the published studies overestimated the mortality of emergency surgery when compared to the 1997 Nationwide Inpatient Sample database of the Healthcare Cost and Utilization Project (17% vs. 5.4%). The mortality rate of the elective laparoscopic repair pooled from 20 published studies was 1.4%. The annual probability of developing acute symptoms requiring an emergency operation in patients who were only observed was 1.16% per year (range, 0.69%-1.93%). The lifetime risk of developing acute symptoms for a 65-year-old patient was 18% and decreased exponentially from there on. Of note, for patients 65 years of age, the elective laparoscopic repair was reduced of 0.13 quality-adjusted life-years as compared with watchful waiting (10.78 vs. 10.65). The difference in the quality-adjusted life expectancy was more pronounced as the age of the patient increased, and only 1 out of 10 85-year-old patients would benefit from the laparoscopic repair. Finally, the model predicted that observation was the optimal treatment strategy in 83% of patients with asymptomatic or minimally symptomatic paraesophageal hernia, while laparoscopic repair would benefit the remaining 17% [3]. According to these data, the majority of patients affected by paraesophageal hernia, who are elderly with minimal or no symptoms, should be treated expectantly. By contrast, in younger and fit patients who have a long life expectancy, since in specialized centers the burden of the procedure is not as severe as was thought in the past, a surgical repair could be considered to prevent symptoms or acute complications. Finally, patients who experience symptoms due to the paraesophageal hernia (i.e., GERD, incarceration, or obstruction) should be operated on.
Paraesophageal hernias are best evaluated by a barium swallow that can precisely define esophageal and gastric anatomy as well as the location of the GEJ. In addition, in the setting of acute strangulation the examination may help to determine the presence of organoaxial or mesoaxial rotation of the stomach. An upper endoscopy should always be performed preoperatively to identify the presence of inflammation, stricture, or Barrett's esophagus. Esophageal manometry and ambulatory 24-hour pH-monitoring are not mandatory as a fundoplication is nowadays considered a routine part of the surgical repair. However, if fundoplication is used selectively the presence of gastroesophageal reflux disease (GERD) should be objectively evaluated by esophageal function tests.

Operative technique

The goal of the surgical repair of paraesophageal hernias is to achieve a tension-free reduction of all the herniated viscera into the abdomen. To that end, a few critical steps must be accomplished [4,5]: 1) extensive dissection and excision of the hernia sac as well as adequate mobilization of the esophagus to allow complete reduction of the hernia with no tension; 2) closure of the diaphragmatic hiatus; and 3) effective anchoring of the stomach beneath the diaphragm (i.e., fundoplication).

Dissection of the hernia sac and mobilization of the esophagus

The herniated stomach should be gently pulled out of the posterior mediastinum down into the abdomen. In order to reduce the risk of injuring a replaced or accessory left hepatic artery, a "left crus" approach may be elected by dividing initially the short gastric vessels and then reach the left pillar of the crus before opening the gastro-hepatic ligament [5]. Subsequently, the hernia sac can be opened at the junction with the left crus to start the mobilization of the esophagus and to facilitate that, a Penrose drain may be early placed around it for traction. Ideally the entire sac should be dissected and resected; however, when it extends high in the mediastinum, it can be transect at the level of the esophageal hiatus with no risk of postoperative mediastinal fluid collection [6]. The

esophagus should be extensively dissected proximally in the posterior mediastinum in order to have 3 to 4 cm of its length below the diaphragm. However, if the GEJ goes back above the diaphragm as soon as traction is removed (i.e., short esophagus), a lengthening procedure (i.e., Collis gastroplasty) is deemed necessary to avoid recurrences due to a shortened esophagus [4]. Among the different techniques available, a wedge gastroplasty achieved with a linear stapler and tailored by placing a bougie inside the esophagus to avoid narrowing of the lumen is certainly very straightforward [7-9]. Although a small gastric pouch is left above the wrap with some acid-producing parietal cells, this can be easily controlled by proton pump inhibitors.

Closure of the esophageal hiatus

Patients with paraesophageal hernia who are operated on are generally elderly with a large symptomatic hernia, consequently the hiatus is sizable with thin pillars, and therefore it may be difficult to achieve closure of the hiatus behind the esophagus with no tension, particularly with a laparoscopic approach. For this reason, the use of pledgets or mesh has been advocated under those circumstances [10,11]. However, with laparoscopic repair, the closure of the hiatus can be simplified overcoming the tension by positioning an extracorporeal jamming knot 1 cm behind the esophagus and then placing intra-corporeal stitches below it [4]. Occasionally, one or two extra stitches may be necessary anterior to the esophagus to close the hiatus properly.

Fundoplication

The rationale for a fundoplication is two-fold: 1) to control reflux in patients who either had GERD preoperatively or could develop it postoperatively due to the extensive dissection; and 2) to perform a gastropexy to anchor the stomach below the diaphragm [12]. A total fundoplication secured by additional stitches to the pillars and the crus can fulfill such purpose [4,13].

Laparoscopic *versus* open repair

Traditionally, paraesophageal hernias have been treated by thoracotomy or laparotomy [1,2,14,15]. In the early Nineties, repair by laparoscopic techniques has been described and progressively employed since then [16,17].
Draaisma and collaborators from the Netherlands reviewed a total of 32 publications comparing conventional and laparoscopic repair of paraesophageal hernias [18]. Unfortunately, no randomized controlled trials could be retrieved, nineteen of the publications analyzed were retrospective series, and therefore most of the studies showed a level of evidence II-c or lower. Patients operated on laparoscopically had a shorter median hospital stay (3 days vs. 10 days) as well as less postoperative complications such as pneumonia, thrombosis, hemorrhage, and urinary and wound tract infections (4.3 % vs. 16.2%) as opposed to those who underwent an open repair. However, most articles on open repair were published beforehand which may have somewhat reflected historical changes in hospital stay policy. Recurrence rates were higher in patients operated on conventionally (median 9.1% vs. 7.0%), although follow up was longer for conventional as opposed to laparoscopic surgery (median 45 months vs. 17.5 months). In addition, only seven studies assessed objectively (i.e., barium swallow) in a high percentage of patients the anatomic recurrence rate which is a critical aspect as recurrence of the hernia does not necessarily implicate return of complaints [18]. For instance, the DeMeester's group performed a barium swallow in about three-fourth of patients undergoing paraesophageal hernia repair and reported an anatomical recurrence rate of 42% at a median of 17 months after laparoscopic approach as opposed to 15% at a median of 35 months after conventional repair [19]. These data were confirmed by Zaninotto and collaborators from Italy in a retrospective study with long term objective follow up at a median of 64 months [20]. Finally, Rathore et al. in a meta-analysis of 13 retrospective case series of patients undergoing laparoscopic paraesophageal hernia repair (N= 965 patients) noted a recurrence rate of 14% [21]. However, when only patients followed up by barium swallow were considered the recurrence rate raised to 25.5% [21].
The patient satisfaction with the laparoscopic repair of paraesophageal hernia has also been investigated [22,23]. Velanovich and Karmy-Jones evaluated patients undergoing elective repair of paraesophageal hernia by the Short Form 36 (SF-36) in a nonrandomized trial [22]. Patients treated laparoscopically had superior quality of life scores than those treated by open surgery in the domains of physical functioning (90 vs. 65), role-physical (100 vs. 0), role-emotional (100 vs. 66.7), vitality (80 vs. 55), and social functioning (100 vs. 75) [22]. Moreover, Targarona and collaborators from Spain prospectively evaluated the correlation between anatomic and/or symptomatic recurrences and the patient's quality of life after laparoscopic paraesophageal or large hiatal hernia repair [23]. According to the SF-36 and Glasgow Dyspepsia Severity Score (GDSS), the patients' postoperative quality of life did not differ significantly from the matched Spanish population. In addition, successfully operated patients reached a Gastrointestinal Quality of Life Index (GIQLI) value comparable to the standard population but, not surprisingly, symptomatic patients had significantly lower GIQLI scores than the asymptomatic counterpart [23].
In conclusion, the laparoscopic repair offers a shorter hospital stay and reduced morbidity over the open repair as well as high postoperative quality of life. However, the laparoscopic approach seems associated with a higher incidence of hiatal hernia recurrence.

Mesh repair

After the initial enthusiasm with the laparoscopic repair of paraesophageal hernias due to clear-cut short term advantages over the open repair, it became evident that the former approach could be associated with a higher incidence of hernia recurrence [19,20]. One of the main causes of failure after antireflux operation is herniation of the fundoplication through the hiatus due to breakdown of the hiatal closure [24]. Thus, the use of mesh was suggested in paraesophageal hernia repair to reinforce the hiatal closure, thereby reducing the rate of reherniation [25]. The basic idea was to accomplish a tension-free repair, applying the same principles introduced to mesh repair of inguinal and ventral hernias [26]. In the late Nineties, Frantzides and collaborators randomized 72 patients with a large hernia defect (i.e., ≥8 cm) undergoing Nissen fundoplication to simple cruroplasty or cruroplasty and polytetrafluoroethylene (PTFE) mesh [10]. The recurrence rate in the PTFE group was 22% as opposed to 0% in the control group ($p<0.006$) at a median follow up of 2.5 years (range, 0.5-6 years) [10]. These results were confirmed by other authors and led to the conclusion that the use of prosthetic materials for hiatal repair was supported in the repair of large paraesophageal hernias [20,27]. However, placing non-absorbable material next to the esophagus, may create serious complications due to intraluminal mesh erosion, dense fibrosis with esophageal stenosis possibly leading to morbid operations such as esophagectomies, gastrectomies, or esophageal stent placement [28]. In the attempt to reduce all such complications, the concept of hiatal repair by mesh composed of biologic materials was introduced [29]. The biologic mesh creates a scaffold containing extracellular collagen which serves as a temporary matrix, avoiding the complications related to erosion and fibrosis associated to the use of permanent prosthetic material placed in proximity of the esophagus. In a multicenter randomized trial, 108 patients undergoing laparoscopic repair of a paraesophageal hernia at 4 institutions were randomized to primary repair or primary repair buttressed with a small intestinal submucosa (SIS) biologic prosthesis [30]. Of note, the evidence of recurrent hernia (i.e., ≥2 cm, primary outcome measure) was evaluated on barium swallow by a blinded radiologist. At 6-month follow up, patients in the SIS group had significantly fewer recurrences compared to controls (9 vs. 24%) and there were neither operations for recurrent hernia nor mesh-related complications [30]. Recently, the second phase of this trial which was aimed to determine the long-term durability of the biologic mesh-buttressed repair was reported [31]. Again, two radiologists blinded to treatment received evaluated hiatal hernia recurrence defined as the maximum vertical height of the stomach >2 cm above the diaphragm. At median follow up of 58 months (range, 42-78 months), 54% of patients in the SIS group had a recurrent hiatal hernia opposed to 59% among control patients ($p \leq 0.7$). There was no statistically significant difference in symptom questionnaire or SF-36 in between the study groups. Finally, there were no strictures, erosions, dysphagia, or other complications related to the use of SIS mesh [31].

In conclusion, although the use of biologic mesh does not increase the rate of complications or side effects, its benefit in reducing reherniation diminishes over time.

Based on these data, mesh at the hiatus should be used selectively according to the status of the crura; in other words, when weak muscle are encountered, regardless the size of the hernia, mesh should be considered as disruption of the crural fibers may well occur. Our preference under those circumstances is for a U shaped polypropylene mesh leaving at least 0.5 cm between the border of the mesh and the esophagus [32]. By doing so, total encircling of the esophagus is avoided to prevent obstruction of the esophagus in consequence of mesh shrinkage. Covering the mesh with a detached flaps of the hernia sac has also been suggested to prevent mesh-related complications [33,34].

Conclusions

The surgical approach to paraesophageal hernias has radically changed over the last 15 years, as mostly patients who are symptomatic are operated on nowadays, and preferably by a laparoscopic approach rather than by laparotomy or thoracotomy. Although the laparoscopic paraesophageal hernia repair offers definite short term benefits over the open approach (e.g., shorter hospital stay and reduced morbidity) and elevated postoperative quality of life, it seems associated with a higher incidence of hiatal hernia recurrence. The use of mesh reduces the incidence of hernia recurrence but may cause severe complications leading to morbid reoperations. By contrast, biologic mesh does not increase the rate of complications but it does not reduce hernia recurrence over time. Thus, mesh at the hiatus should be probably used selectively by experienced foregut surgeons according to the status of the crural fibers, and further research will be needed to establish the ideal type of mesh as well as the better technique for its implantation.

Riassunto

Le ernie paraesofagee costituiscono dal 5 al 10% di tutte le ernie iatali. L'approccio chirurgico al trattamento di tali ernie è radicalmente cambiato negli ultimi 15 anni poiché molti pazienti asintomatici vengono operati al giorno d'oggi, preferibilmente per via laparoscopica piuttosto che laparotomica o toracotomica. Abbiamo rivisto la riparazione chirurgica delle ernie pareaesofagee, focalizzando la nostra attenzione in particolare sull'approccio e la tecnica chirurgica.

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Commento - Commentary

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È la sintesi di una ricerca clinica originale, condotta a random e valutazione con metodo statistici, che diventerà di assoluto rilievo con l'incremento numerico dei casi, come preannunciato dagli stessi Autori; soprattutto se lo studio si estenderà ad un accurato follow-up dei pazienti operati allo scopo di stabilire un link tra eventuale recidiva ed alterazioni ultrastrutturali "severe" dei pilastri diaframmatici, con o senza la variabile rappresentatat dal grado di esofagite preoperatoria.
L'impiego di *pledgets* di rinforzo (e non *meshes*), peraltro diffusosi fra i cultori della chirurgia esofagea, potrebbe diventare tassativo, considerato che l'incidenza di complicanze è praticamente nulla, a fronte di una migliore tenuta delle suture

* * *

The article is a synthesis of an original clinical research, carried out at random and evaluated using statistical methods, which will becomes highly significant with the increasing number of cases, as announced by the same Authors. Especially if the study will be extended to an accurare follow-up of patients operated. For the purpose of establishing a limnk between any recurrence and severe ultrastructural alterations of the diaphragm' s pillar, with or without the variable represented by the degree of preoperative esophagitis.
The use of pledgets as reinforcement (and not meshes), moreover well spread among surgeons practicing esophageal surgery, could become a must, considering that the incidence of complications is practically absent, in front of a better tightness of the sutures.