

Laparoscopic management of recurrent symptomatic hiatal hernia with and without mesh repair: a comparative prospective study

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Background

Recurrence after primary hiatal hernia repair is common and ranges between 15 and 60%. Symptomatic patients who are actually in need of redosurgery are ~5%. Resurgery after the primary repair is usually not easy and is challenging. The reputation of mesh migration and erosion into gastroesophageal junction makes most of the surgeons avoid the use of mesh in hiatal hernia repair.

Aim

This prospective study aims to compare the efficacy of redolaparoscopic Nissen fundoplication with and without mesh repair for treatment of recurrent hiatus hernia after failed primary repair, regarding improvement of recurrent symptoms, rate of recurrence of hernia after secondary repair, and postoperative patients' satisfaction.

Patients and methods

This prospective randomized study was conducted on 25 patients who underwent redolaparoscopic Nissen fundoplication for the treatment of recurrent hiatus hernia after a failed primary repair between January 2017 and January 2020 with at least 1-year follow-up at Ain Shams University Hospitals. A total of 12 patients underwent redolaparoscopic Nissen fundoplication (group A), whereas 13 patients underwent the same technique with mesh reinforcement (group B). The outcomes of both techniques were compared regarding the postoperative improvement of recurrent symptoms, postoperative recurrence, and postoperative patients' satisfaction.

Results

Significant differences in postoperative reflux-associated symptoms were observed in both groups than preoperatively, but with a significant higher score for dysphagia noticed in group B than group A. Anatomical recurrence occurred in three (25%) patients in group A after 12 months with relatively higher regurgitation, heartburn scores, and pH monitoring. Overall, 83.3% of patients in group A and 92.3% in group B were satisfied with their postoperative improved symptoms.

Conclusion

Mesh reinforcement is associated with less recurrence rate in comparison with redolaparoscopic Nissen fundoplication alone during short-term follow-up, but it is associated with higher incidence of postoperative dysphagia. However, some patients had recurrence after redolaparoscopic Nissen fundoplication without mesh, but their postoperative symptoms were much less compared with the preoperative ones.

Keywords:

hiatus hernia, mesh repair, recurrent hiatus hernia, redo-Nissen fundoplication

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Introduction

Surgery for the treatment of hiatal hernias is a challenge for most of the surgeons and necessitates good experience of the anatomy of the gastroesophageal junction and the esophageal hiatus. Laparoscopic repair became the optimal technique. Many factors may play a role in the recurrence of hiatus hernia including the size of the primary hernia, patients' general condition, the antireflux operation used, inadequate dissection of the esophagus at the time of primary repair, incomplete

reduction of the hernial sac, inadequate closure with low hiatal pressure, and the surgeon's experience [1,2].

The incidence of recurrence of hiatal hernia after failed primary repair in patients with gastroesophageal reflux is very variable among different studies and ranges

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between 15 and 60%, which may be owing to inclusion of radiologically asymptomatic recurrences. On the contrary, the incidence of clinically symptomatic patients after the primary repair is ~5% [3–5].

Surgical intervention for recurrent hiatal hernia is composite, so it is preserved for only significantly symptomatic patients with intractable gastroesophageal reflux, dysphagia, regurgitation, and pain. Despite the increased risk of morbidity during surgery including esophageal and gastric perforation that may lead to esophagectomies, there is increased patient satisfaction with postoperative improvement of symptoms [6,7].

To diminish the recurrence after redosurgery, different techniques were used including mesh placement, anterior crural closure, gastropexy, gastrostomy, relaxing incision, and redofundoplication, as well as a Collis esophageal lengthening procedure [4,8,9].

Many types of meshes had been used such as polypropylene, polyester, and polytetrafluoroethylene. Biological meshes, and different types of dual meshes became more commonly used to prevent recurrence and to reinforce the esophageal hiatus and at the same time to decrease complications that may be associated with synthetic meshes such as esophageal erosions and esophageal stenosis [10–12].

Although mesh reinforcement is associated with decreased incidences of recurrence, it has not been proven definitively that the mesh repair is superior to the primary repair [13]. In our study, we present the outcomes of redolaparoscopic Nissen's fundoplication with and without mesh repair for recurrent symptomatic hiatal hernia after a failed primary repair with short-term follow-up.

Patients and methods

A prospective randomized study was done on 25 patients who presented to Ain Shams University hospitals in the outpatient clinics diagnosed with symptomatic recurrent hiatus hernia after failed primary repair in the period from January 2017 to January 2020 with 12 months of follow-up. The outcomes of redolaparoscopic Nissen fundoplication without mesh (group A) and the same technique with the use of mesh (group B) were compared. Patients were randomized simply according to the closed envelope method.

A comprehensive assessment program was carefully structured so that a disciplined routine was followed in each patient. All patients were preoperatively and

postoperatively evaluated. Ethical approval was taken from Ain Shams University Ethical Committee, and a written consent was taken from every patient after explanation of all details of the operation, advantages, disadvantages, realistic expectations, and with the possibility of conversion to open surgery and all the possible intraoperative, early, and late postoperative complications. Surgeries were done by the same surgical team throughout the study.

Inclusion criteria

The study included all adult patients experiencing recurrent hiatus hernia with chronic intractable reflux resistant to medical treatment after failed primary repair that interfered with their lifestyle after exclusion of any other cause of their symptoms, and who continued follow-up for 12 months.

Exclusion criteria

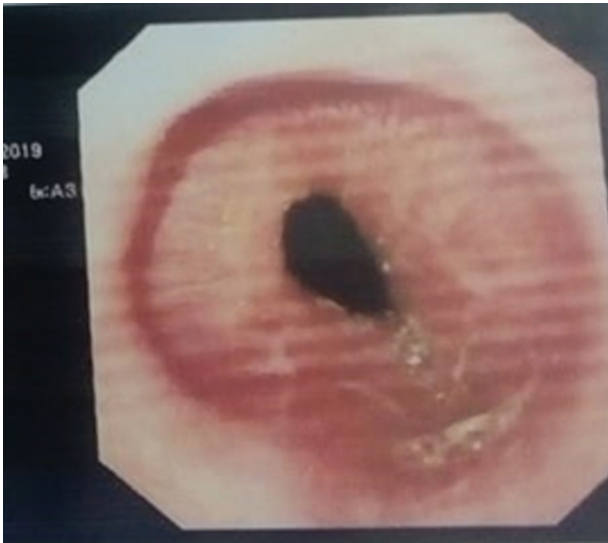
Patients who were unfit for general anesthesia, patients with previous major upper abdominal surgeries or midline exploratory surgeries, and pregnant women were excluded.

As the symptoms of recurrent hiatus hernia may be deceiving and similar to other symptoms of related diseases, a full detailed history was taken, and an examination was done for every patient. All perioperative circumstances regarding primary repair were asked about, including first, type of previous antireflux operation either laparoscopic or conventional open surgery, and any previous investigations had been done preoperatively; second, time of recurrence of symptoms after primary repair; third, history of persistent smoking, hypertension, diabetes, and excess weight gain; fourth, history of proton pump inhibitor intake and doses; fifth, DeMeester score for dysphagia, regurgitation, and heartburn was obtained from every patient; and sixth, respiratory complications (nocturnal cough and aspiration) and upper respiratory symptoms such as laryngitis were asked about.

Investigations were done for all patients, including first, upper gastrointestinal (GI) endoscopy: comments on esophageal peristalsis, lower esophageal sphincter (LES), esophagitis and Barrett's esophagus, size of recurrent hiatus hernia, and length of the intra-abdominal esophagus, and a biopsy was taken for histopathology (Fig. 1); second, barium study: to detect reflux, the size and shape of hiatal hernia, and type of recurrence (Fig. 2); third, Esophageal high resolution manometry (HRM): it was used for evaluation of lower esophageal sphincteric pressure, esophageal

peristalsis, and effective clearance; fourth, 24-h esophageal pH monitoring and DeMeester pH score calculation with parameters that establish the score, which are total number of episodes of reflux, % total time esophageal pH less than 4, % upright time esophageal pH less than 4, supine time esophageal pH less than 4, number of reflux episodes greater than or equal to 5 min, and longest reflux episode (min); and (5) echocardiography, cardiac enzymes, and respiratory function tests were done to exclude cardiac and respiratory causes that may be the cause of patients' symptoms and for preoperative assessment.

Figure 1



Endoscopic and radiological findings of huge recurrent hiatal hernia with severe esophagitis.

Figure 2



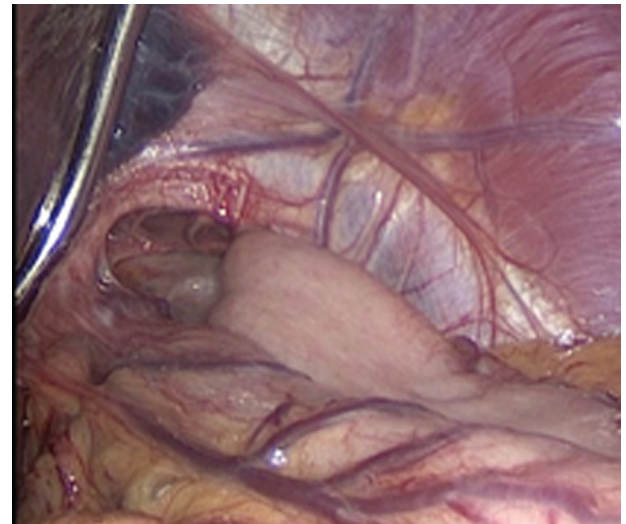
Endoscopic and radiological findings of huge recurrent hiatal hernia with severe esophagitis.

Operative steps

Redo-Nissen's fundoplication

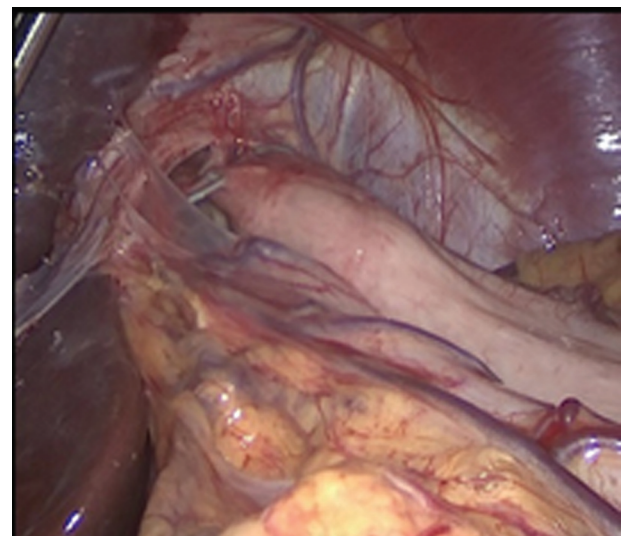
The patient was placed in the supine 45° anti-Trendelenburg, semilithotomy position. Pneumoperitoneum was obtained by Veress needle from Palmer's point followed by ports introduction. A 10-mm port for the 30° lens camera was placed under direct vision 3 fingers above the umbilicus, a 5-mm liver retractor port was placed slightly to the left of midline 1 finger below the xiphoid process, a 5-mm working port was placed in the right midclavicular line mid-way between the camera and the costal margin, another 10-mm working port was placed at the same point on the left side, and a second 5-mm assistant port was placed in the left anterior axillary line (Figs 3 and 4).

Figure 3



Recurrent hiatal hernia with widened hiatus.

Figure 4



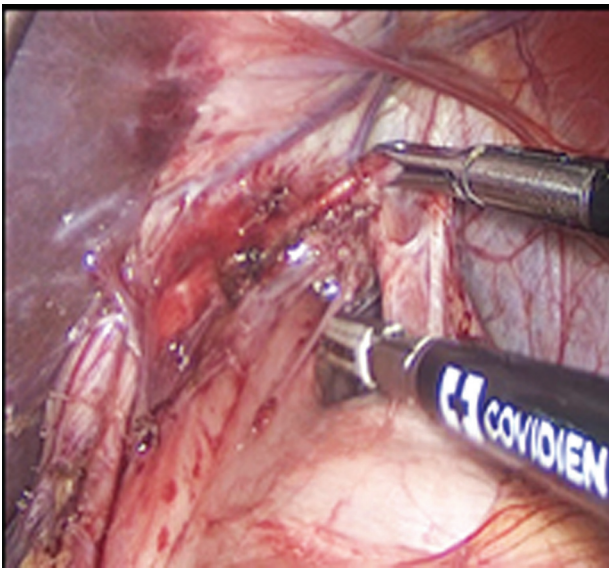
Recurrent hiatal hernia with widened hiatus.

Dissection of the adhesions was done using a ligasure energy device (Medtronic, USA) followed by hiatal dissection (Figs 5–7 and 11) and reduction of the migrated wrap from the mediastinum taking into consideration to reduce the maximum possible length of the esophagus back intra-abdominally (at least 3 cm) and to avoid pleural injury (Fig. 8). The pervious tailored wrap was dissected (Fig. 6). Repair of the crura was done using nonabsorbable polyfilamented braided sutures (Ethibond 2/0; Ethicon, USA) (Fig. 8). A new wrap was reconstructed over a 36-Fr bougie using the same suture material and fixing the new wrap to the lower esophagus (Fig. 12). Application

of 18-Fr tube drain was done, followed by ports closure after the evacuation of the pneumoperitoneum (Figs 9–12).

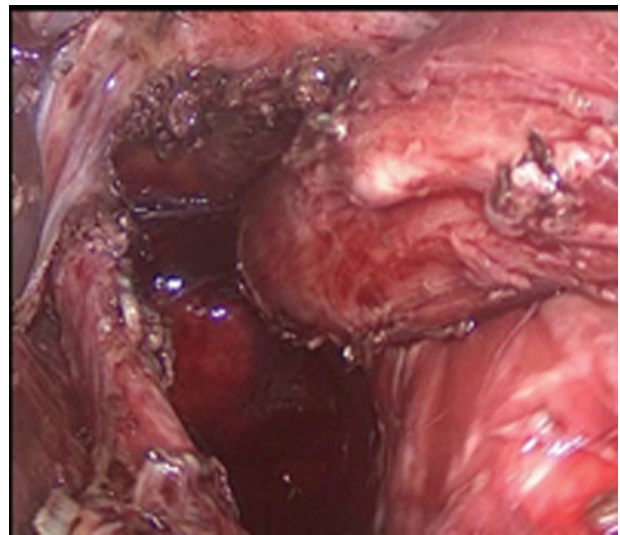
For redo-Nissen's fundoplication with mesh reinforcement, a tailored 'U' shaped 10×6 cm double face ventralight mesh (BARD, USA) was used before fashioning the new wrap. It was introduced to cover the repaired part of the hiatus. The mesh was secured to the diaphragm and its crura using absorbable tackers (autosuture; Medtronic) or Capsure covered tacks (BARD), taking into consideration not to fire any tacks at the central tendon of the diaphragm (Fig. 9).

Figure 5



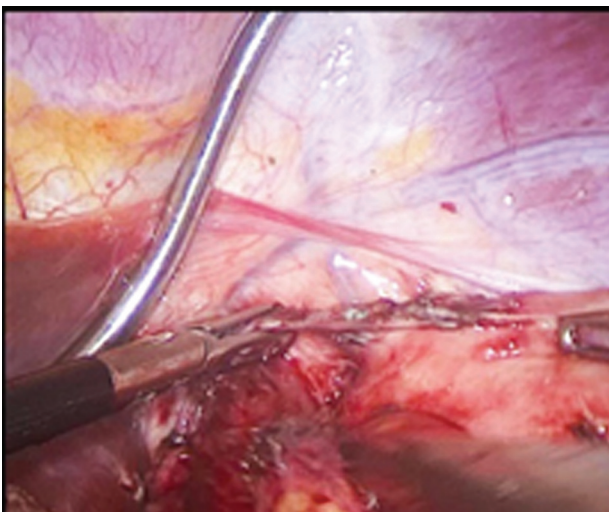
Hiatal dissection.

Figure 7



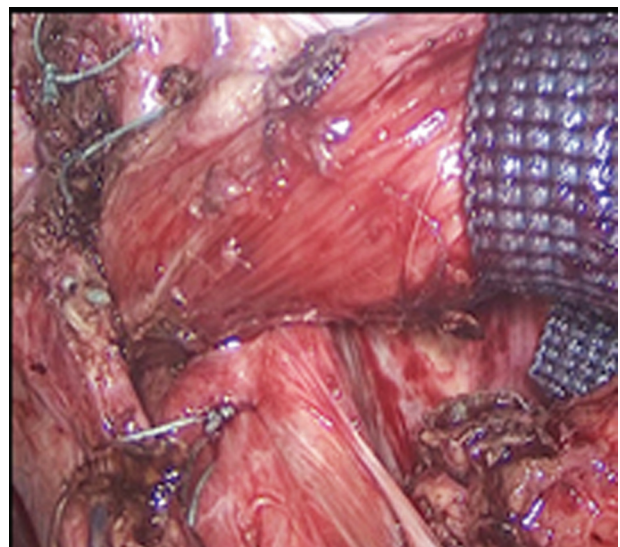
Hiatal window after dissection of the hernia.

Figure 6



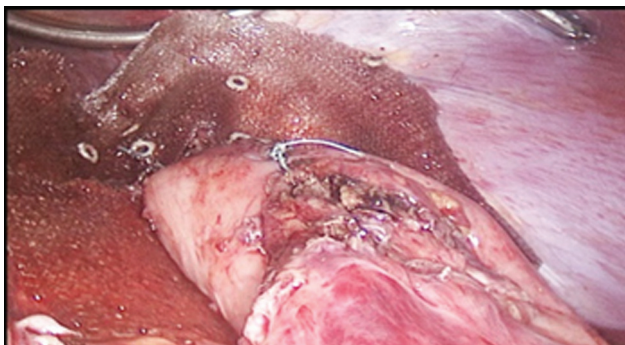
Dissection of old wrap.

Figure 8



Hiatal repair with the restoration of the abdominal esophagus.

Figure 9



Fixation of mesh around the esophagus.

Figure 10

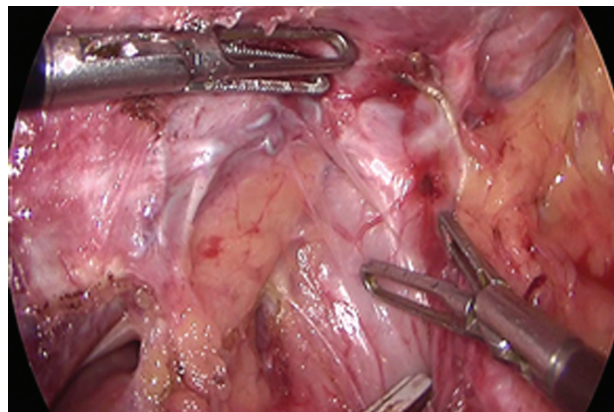


Postoperative barium study.

Outcome measures

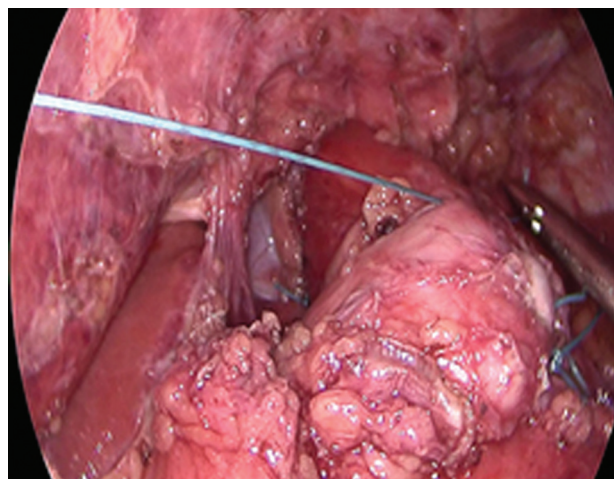
Clinical evaluation was carried out at baseline and 1, 3, 6, and 12 months postoperatively, using a modified DeMeester symptom scoring system (Table 1), in which each patient was evaluated according to the presence of three symptoms: dysphagia, regurgitation, and heartburn. For each symptom, a score from 0 to 3 was attributed, depending on its severity. Then, for each patient, a clinical global score equal to the sum of these symptoms scores was finally assessed, and the reduction of each symptom severity after the surgery was then investigated. Esophagogastric barium study was done before discharge to confirm the free passage of dye from the esophagus to the stomach and for detection of any early postoperative complications and was repeated in patients with suspected recurrence at the end of follow-up. Follow-up endoscopy was done at the sixth and 12th months, whereas LES pressure and pH monitoring were assessed at the 12th month. We defined recurrence in our study as anatomical and

Figure 11



Hiatal dissection of the stomach with disrupted old stitches.

Figure 12



Creation of new wrap without mesh fixation.

Table 1 Modified DeMeester score [14]

Dysphagia	
0	None
1	Occasional transient episodes
2	Require liquids to clear
3	Impaction requiring medical attention
Heartburn	
0	None
1	Occasional brief episodes
2	Frequent episodes requiring medical treatment
3	Interference with daily activities
Regurgitation	
0	None
1	Occasional episodes
2	Predictable by posture
3	Interference with daily activities

symptomatic recurrence irrespective of the size of the hernia. The follow-up was done at our outpatient clinic for surgery and at the endoscopy unit.

Statistical analysis

Data were collected tabulated and exported to the Statistics Open for ALL (SOFA) version 1.5.3 (statistics were performed using sofa statistics version 1.5.3. Paton-Simpson and associates Ltd, Auckland, New Zealand). The quantitative data were presented as median with SD, whereas qualitative variables were presented as numbers and percentages. The comparison of qualitative data was done by using the χ^2 test, whereas in the case of quantitative data, it was done by using independent *t*-test and paired *t*-test. *P* value less than 0.05 was considered significant.

Results

Preoperative, intraoperative, and postoperative parameters were finalized systematically in all patients and tabulated.

Preoperative outcomes

The study was done on 25 patients, comprising 11 males (44%) and 14 females (56%). The overall mean age was 46.64±5.86 years (range: 35–60 years), and no significant difference was observed between group A (47.1±5.26) and group B (46.23±6.54), with *P* value 0.724. The upper gastrointestinal tract endoscopy detected incompetent cardia in all patients with

recurrence of hiatus hernia. Three patients in group A and two patients in group B had huge hiatus hernia greater than 6 cm, and their main manifestations were reflux with dyspnea. The presence of esophagitis was detected in five patients in group A and seven patients in group B, and according to Los Angeles classification, three patients in group A and four patients in group B were classified B, whereas two patients in group A and two patients in group B were classified C, and one patient in group B was classified D, whereas associated short-segment Barrett's esophagus was detected in these five patients with no dysplasia after histopathology. In gastrointestinal barium study, recurrence of hiatus hernia was demonstrated in all patients. LES pressure was relatively low, and DeMeester pH score was relatively high in both groups. All 25 patients had previous laparoscopic Nissen fundoplication done for primary hiatal hernia repair. In ~50% of the patients, recurrence of symptoms was detected after 1 year of primary repair. All differences in the preoperative parameters and DeMeester scores were nonsignificant between both groups (Table 2).

Intraoperative

All operations were done laparoscopically in 11 and 12 patients in groups A and B, respectively, whereas only

Table 2 Patients' data and preoperative parameters

	Group A (n=12) [n (%)]	Group B (n=13) [n (%)]	<i>P</i> value
Age	35–55 47.1±5.26	38–60 46.23±6.54	0.724
Sex			
Males	5 (42)	6 (46)	0.821
Females	7 (58)	7 (54)	
BMI	30.58±2.19	30.46±2.87	0.906
Comorbidities			
Diabetes	4 (33)	3 (23)	0.572
Hypertension	5 (41.6)	4 (30.7)	0.560
Smoking	5 (41.6)	6 (46)	0.821
Use of PPI	11 (91.6)	13 (100)	0.327
DeMeester scores			
Dysphagia	0.67±0.88	0.54±0.77	0.703
Heartburn	2.25±0.75	2.23±0.83	0.952
Regurgitation	2±0.74	1.92±0.86	0.814
Global	4.92±2.23	4.7±2.28	0.248
Respiratory symptoms	2 (16.6)	3 (23)	0.689
Laryngitis	6 (50)	5 (38.5)	0.562
Chest pain	3 (25)	5 (38.5)	0.471
Epigastric pain	2 (16.6)	4 (30.7)	0.409
Fullness and early satiety	1 (8.3)	3 (23)	0.689
DeMeester pH score	49±6.16	45.9±6.38	0.233
LES pressure	9.5±1.68	9.07±1.26	0.480
Esophagitis	5 (41.6)	7 (54)	0.543
Barrett's esophagus	2 (16.6)	3 (23)	0.688
Time of recurrence after primary repair	1.41±0.47	1.46±0.48	0.814

LES, lower esophageal sphincter. All are nonsignificant.

one case in each group was converted to open surgery. In group A, dense fibrous adhesions and the high risk of perforation during dissection was the cause of conversion, whereas in group B, the cause of conversion was the accident occurrence of pneumothorax owing to a generous dissection of the previous wrap inside mediastinum and the preference of anesthesiologist to convert. After surgery was finished, an intercostal tube was inserted at the side of pneumothorax and was removed safely after 3 days after radiologically accepted chest radiography. The average duration of the intervention was 3.62 ± 0.38 h in group A versus 4 ± 0.46 h in group B, with a significant *P* value of 0.035. Blood loss was negligible, and transfusions were not needed in both groups (Table 3).

Follow-up

The follow-up period for all patients was 12 months, at first, third, sixth, and 12th months postoperative (Table 4). The median postoperative dysphagia score was 0.48 ± 0.52 for group A and 1.31 ± 1.03 for group B, with a significant *P* value of 0.012. Overall, two patients in group A had moderate dysphagia and two patients had mild dysphagia experienced at 6 months postoperative, whereas three patients in the group B had severe dysphagia, three patients had moderate dysphagia, and two patients had mild dysphagia. Endoscopic dilatation was done for patients with severe dysphagia at sixth-month endoscopic visit. At 12th month follow-up,

dysphagia scores were nearly equal between both groups with two patients having mild dysphagia in group A and three patients having mild to moderate dysphagia in group B. Regarding symptoms of reflux including heartburn and regurgitation, noticeable differences were detected in comparison with preoperative scores in both groups, with a nonsignificant difference of postoperative median scores between both groups. Regarding postoperative LES pressure done at 12th month, relatively higher readings were observed in group A than group B, with a significant *P* value less than 0.001. However, pH monitoring done at the same month was relatively higher in group A than group B but with a nonsignificant *P* value. Esophagitis was improved in three patients in group A and two patients were downgraded from class C to class A, whereas in group B, six patients showed improvement of esophagitis and only one patient was downgraded from class D to class B. Barrett's esophagus showed gradual regression during the sixth-month follow-up endoscopic visit in both groups and regressed in all patients in group B at 12th month, whereas persisted in only one patient in group A and he was subjected to endoscopic mucosal resection of Barrett mucosa according to our upper gastrointestinal unit policy. Anatomical recurrence was observed in three patients in group A at the 12th-month endoscopic visit, which was confirmed with an esophagogastric barium study, whereas no anatomical recurrence was observed in group B. Revising heartburn and

Table 3 Operative parameters

	Group A (n=12)	Group B (n=13)	<i>P</i> value
OR time (h)	3.62 ± 0.38	4 ± 0.46	0.035*
Blood loss (ml)	175 ± 26.2	180.75 ± 40	0.667
Conversion to open	1 (8.3)	1 (7.7)	0.952
Intraoperative complications	1 (8.3)	1 (7.7)	
Hospital stay (days)	2.5 ± 0.68	2.3 ± 0.48	0.417

*Statistically significant difference.

Table 4 Postoperative data

	Group A (n=12)	Group B (n=13)	<i>P</i> value
DeMeester score			
Dysphagia	0.48 ± 0.52	1.31 ± 1.03	0.012*
Heartburn	0.92 ± 0.79	0.54 ± 0.66	0.206
Regurgitation	0.75 ± 0.86	0.62 ± 0.65	0.662
Global	3.75 ± 1.4	3.7 ± 1.1	0.970
DeMeester pH score	17.58 ± 5.1	15 ± 1.47	0.093
LES pressure	16.7 ± 2.9	21.5 ± 2.5	<0.001*
Esophagitis [n (%)]	2 (16.6)	1 (7.7)	0.490
Barrett's esophagus [n (%)]	1 (8.3)	0	0.288
Recurrence [n (%)]	3 (25)	0	0.05*
Postoperative satisfaction [n (%)]	10 (83.3)	12 (92.3)	0.490

LES, lower esophageal sphincter. *Statistically significant difference.

regurgitation scores for these three patients, it was relatively higher with increased DeMeester pH scores, whereas LES pressure was accepted. These three patients were instructed to continue PPI, to decrease their weight, and reconsult if their symptoms deteriorate.

Discussion

With the evolution of laparoscopy, better identification of the hiatal area is achieved than with open surgery, and revisional surgery may be safely done by experienced surgeons; this is combined with lower morbidity and mortality rates, shorter hospital stay, and more patient satisfaction [15,16].

There are many studies evaluating the role of mesh reinforcement in hiatus hernia repair, with different outcomes. Most of the techniques were reported to achieve good clinical outcomes; however, a simple sutured technique remains an acceptable approach [17].

Our study was conducted on 25 patients who presented with recurrent symptomatic hiatus hernia, of whom 12 patients underwent redolaparoscopic fundoplication without mesh and 13 patients underwent the same technique with mesh reinforcement. All preoperative parameters were nearly equal between both the groups. The main complaint of our patients was intractable GERD associated with other symptoms such as dysphagia, chest pain, dyspnea, epigastric pain, and laryngitis. During operations, we noticed a relatively shorter time associated with redofundoplication alone, with a nearly equal rate of morbidities. The conversion during the study was 8% (two patients), either owing to dense adhesions with the risk of esophagogastric perforation or the occurrence of pneumothorax.

During postoperative 12-month follow-up, we noticed clinical improvement regarding patients' symptoms in both groups, with relatively significant dysphagia observed after the use of mesh, and this was associated with higher LES pressure in this group.

However, the differences in the improvement of esophagitis and Barrett's esophagus were nonsignificant between both groups, but we observed that rapid improvement was achieved more in the mesh group.

The actual recurrence of hiatus hernia should be considered only in symptomatic patients. Even if the patient has radiologically recurrent hiatus hernia associated with no symptoms, it is a relative recurrence or no recurrence is to be considered [4].

We had three cases with recurrence after 1 year with redofundoplication alone, which was confirmed endoscopically and radiologically with moderate symptoms of reflux, which required medical treatment and further follow-up. In these patients, relatively huge hernia was found intraoperatively with wide hiatus, and also two of them had excess weight gain postoperatively.

The preoperative determination of the dimension of the herniated stomach and the hernia extent is crucial, as reported by Granderath and colleagues, because larger hiatal hernias more than 6 cm in diameter are associated with a higher rate of recurrence [7,18,19].

A study was done by Watson and colleagues on 126 patients with first-time hiatal hernia repair divided into three groups (43 sutures alone, 41 sutures with absorbable mesh, and 42 sutures with permanent mesh), with long-term follow-up, including 5-year subjective symptom data combined with 3- to 4-year objective hernia recurrence data. The study demonstrated a recurrent hernia of any size in 39% with suture only repair, 57% with suture and absorbable mesh, and 43% with suture and permanent mesh. Proportions of recurrent hernia greater than 2 cm and reoperations for recurrence were not different [20].

Some studies demonstrated that the most of the patients with small recurrent hernias treated with laparoscopic Nissen fundoplication with mesh reinforcement remain symptom-free up to 5 years of follow-up and usually did not require further surgery [21].

Oor and colleagues conducted a study between 2013 and 2016 on 72 patients with hiatal hernia randomized for primary repair using nonabsorbable sutures and sutures reinforced with nonabsorbable mesh. After 1 year of follow-up, there have been no differences in the number of recurrent hiatal hernias demonstrated by barium swallow radiology or upper gastrointestinal endoscopy, the number of surgical reinterventions, or in chest pain and heartburn scores, with comparable dysphagia and satisfaction scores. Compared with the preoperative symptoms, both groups demonstrated a comparable and significant reduction in chest pain score and dysphagia score [22,23].

Dysphagia is the main problem after antireflux surgery, with an incidence of 3–24% after Nissen fundoplication. Most reported complications are not related to the use of a mesh during the procedure. The mesh-related complications reported most was stenosis at the gastroesophageal junction. This is probably

owing to shrinkage of the mesh, which is more common in a synthetic mesh [24–27].

During our follow-up, no cases of recurrence or erosion and migration of mesh were noticed, but the high rate of postoperative stricture formation was observed maximum at sixth month; eight patients (61%) had different degrees of dysphagia in comparison with four patients (33%) in the other group, with a significant difference.

Braghetto and colleagues performed laparoscopic hiatal hernia repair in 173 patients (total group). Early postoperative complications were observed in 35 patients (27.1%) and one patient died (0.7%) because of massive lung thromboembolism. A total of 129 patients were followed-up for a mean of 41 ± 28 months. Mesh reinforcement was done in 79 of these patients. In this group, late complications, and stricture, were observed in five patients (2.9%), with no incidence of mesh erosion and migration to the esophagogastric junction. Moreover, in our study, we did not observe mesh erosion or migration [28].

Porziella *et al.* [29], reported that dysphagia may be observed during the early postoperative period after mesh repair with antireflux procedure, but this dysphagia usually resolves; if it does not or if it exacerbates, mesh migration must be excluded.

Zhang and colleagues in their systematic review on studies comparing mesh augmentation versus suture repair of the esophageal hiatus, reported 11 studies (four randomized, nine nonrandomized) comparing mesh ($n=719$) versus suture ($n=755$) repair. Mesh augmentation was correlated with a reduced overall recurrence rate compared with suture repair. There was no significant difference in the incidence of complications between groups. The improvement of dysphagia was better following suture repair. Moreover, Huddy and colleagues and Tam and colleagues have both noticed a reduced rate of hernia recurrence after mesh reinforcement compared with primary suture repair at short-term follow-up (up to 12 months) [10,30,31].

Furtado and colleagues reported a review of 100 patients who underwent fundoplication for the hiatus hernia repair without mesh with an average 24 months following surgery. There were five recurrences of hernias that had a vertical height of greater than 2 cm from the diaphragmatic hiatus, with three patients necessitating reoperation for severe dysphagia. Small recurrences (<2 cm) occurred in 20

patients. The median time to recurrence was 40 months. At 2 years, recurrence of any size had occurred in 24% of cases [32].

Conclusion

Mesh reinforcement is associated with less recurrence rate in comparison with redolaparoscopic Nissen fundoplication alone during the short-term follow-up, but it is associated with more incidence of postoperative dysphagia. Mesh reinforcement is specially recommended for large defects more than 6 cm.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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