Laparoscopic remedy for failed laparoscopic anti-reflux procedures

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Background
Surgical remedy for failed anti-reflux surgery is a successful choice.
Patients and methods
The study was conducted at the General Surgery Department of Ain Shams University Hospitals during the period from October 2018 to December 2020. It included 20 patients with recurrent gastroesophageal reflux disease after failed previous anti-reflux surgery to evaluate the outcomes of redo anti-reflux surgery in recurrent cases and to determine the feasibility, safety, and efficacy of the procedures.
Results
The initial procedure in these patients was laparoscopic Nissen fundoplication. In all, 24 patients were included, but after esophageal motility study (manometry) four of them had a functional (motility) disorder and were excluded from our study. So, only 20 patients were studied. The causes of failure were migration (eight patients), disruption (three patients), migration with disruption (seven patients), and high BMI (two patients). The surgical remedy options done were hiatal repair, rewrap, hiatal repair and rewrap, and gastric bypass, respectively. No mortality was reported and the complications were minor. Postoperative follow-up showed significant improvement in symptoms and patient satisfaction.
Conclusion
Laparoscopic remedy for failed anti-reflux surgery is a feasible, safe choice in treating recurrent gastroesophageal reflux disease. It shows promising results and should be offered to patients with recurrence.

Keywords:
gastroesophageal reflux disease, recurrence, secondary anti-reflux surgery

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Introduction

Gastroesophageal reflux disease (GERD) is one of the biggest health problems affecting about 10–20% of the adult population and it has been increasing markedly in the previous two decades [1].

Laparoscopic anti-reflux surgery is now a treatment of choice for patients that have suboptimal response to pharmacological therapy. Unlike medical therapy, which decreases the acidity of the regurgitated material, anti-reflux surgery builds a mechanical obstacle to stop regurgitated material from reflux to esophagus [2].

Randomized clinical trials done in tertiary centers have revealed rates of recurrence of reflux up to 15% post anti-reflux surgery. Cohort studies also have revealed the high-recurrence risk of GERD postsurgery [3].

The common causes of failure are improper preoperative diagnosis or anatomical error. With recurrence or complications, patients have the option of being treated conservatively or surgical remedy [4]. Thoracotomy or laparotomy was previously done to treat the recurrence. Nowadays laparoscopic remedy surgery is being successfully done with results showing much less morbidity than remedy through thoracotomy or laparotomy done in the previous era [5].

Aim

Our aim is to evaluate the outcomes of redo anti-reflux surgeries in recurrent cases and to determine the feasibility, safety, and efficacy of the procedures.

Patients and methods

This was a prospective clinical study that was conducted at Ain Shams University Hospitals on 20

patients with failed anti-GERD surgery during the period from October 2018 to December 2020.

All cases were operated by or under supervision of consultant surgeons at the Upper GIT Surgery Unit at Ain Shams University. An informed consent was taken from all the patients after being informed about the details of the procedure, its possible complications, and anticipated morbidity.

Approval of the Research Ethics Committee at Faculty of Medicine, Ain Shams University was obtained on 22-9-2018.

Inclusion criteria

Patients with persistent symptoms affecting lifestyle (patients with a DeMeester score of more than 14.72).

Exclusion criteria

Those with the following were excluded:

(1) Patients for whom anesthesia is risky (ASA 3 or above).
(2) Patients with known history of psychiatric illness.
(3) Primary procedure was not laparoscopic from the start or was not completed laparoscopic.
(4) Patients with secondary motility problems and GERD.

All patients will be subjected to the following:

Preoperative assessment

(1) Clinical assessment:
   (a) General examination.
   (b) Detailed medical, surgical, and family history.
   (c) Modified DeMeester score (Table 1) for symptom severity discussing heartburn, regurgitation, and dysphagia.
   (d) Patient satisfaction level assessment by Health Related Quality of Life (HRQL) score (Fig. 6).
(2) Investigations:
   (a) Routine laboratory investigations.
   (b) Barium study.
   (c) Upper gastrointestinal endoscopy.
   (d) Esophageal manometry and 24-h pH monitoring (calculating the DeMeester score)

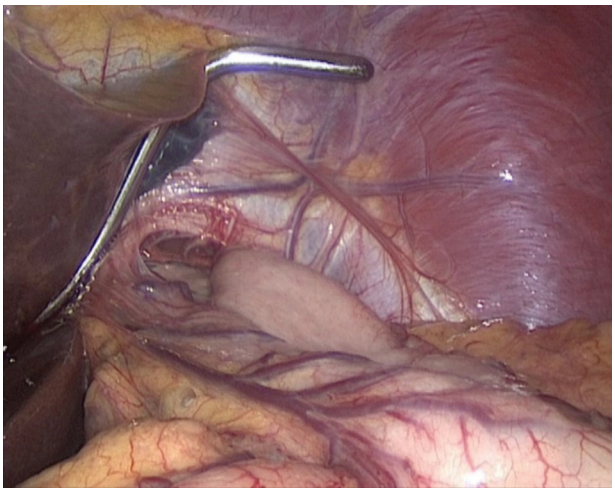
Table 1 Modified DeMeester score

Symptoms	Score	Description
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

Operative management

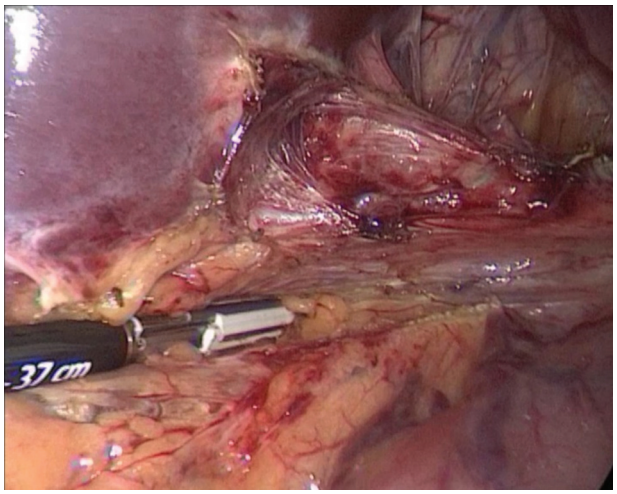
A five-puncture technique as described by Weerts *et al.* [6] and Pitcher *et al.* [7] was used for all cases where insufflation was started by Veress needle in the left midclavicular line. Then, a 10-mm port is inserted to introduce the camera in the same place. Blunt dissection is done to split adhesions. The camera is moved to a second port after placement 2–3 cm above the umbilicus in the midline. The rest of the ports are then placed under vision in the usual manner of laparoscopic Nissen fundoplication. Next steps were carried on according to the situation. Cautious dissection of hiatal region, upper gastric segment, and distal part of the esophagus was the most important and challenging step of the redo surgery (Fig. 1). After dissecting any adhesions around the stomach and the previous wrap, camera was repositioned in the supraumblical region and its distance from the umbilicus depends on the depth of the abdominal cavity. Those structures together with the wrap have to be completely identified and dissected to obtain an accurate diagnosis of the cause of recurrence and correct it (Fig. 2). The type of redo surgery was decided by preoperative assessment and intraoperative findings. The preoperative assessment and the

Figure 1



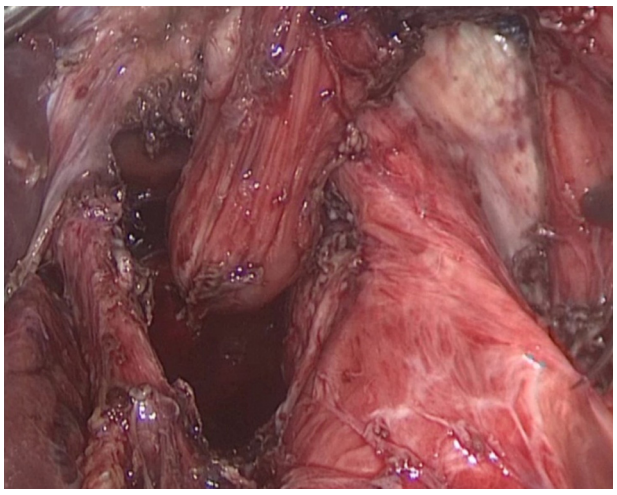
Severe adhesions requiring extensive dissection.

Figure 2



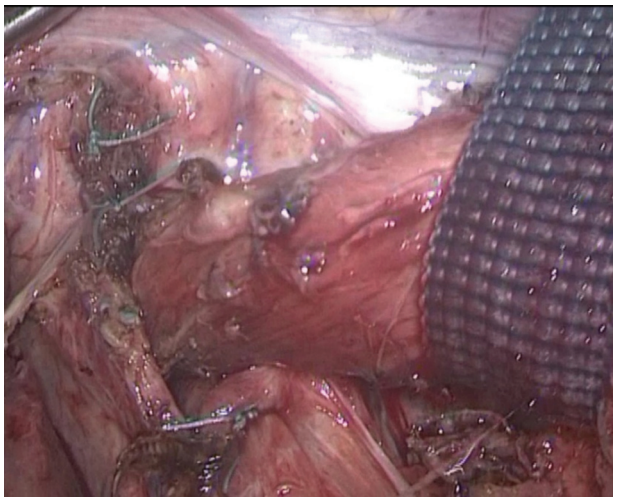
Wrap migration through wide hiatal defect with disruption.

Figure 3



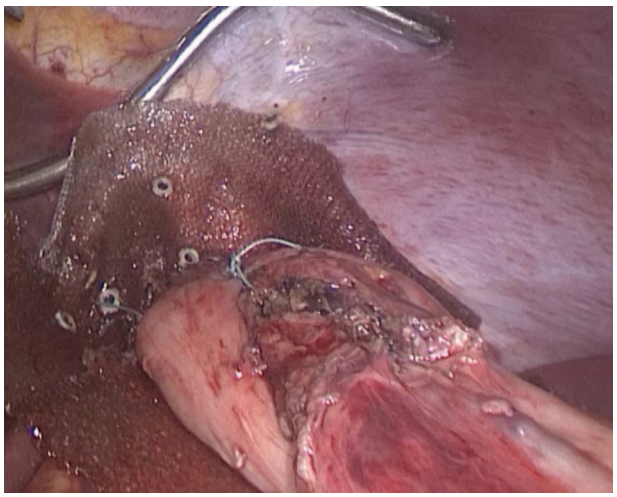
Sutures in anterior and posterior parts of the crura for repair.

Figure 4



Very wide hiatus after dissection.

Figure 5



Mesh fixed over the repaired hiatus and the new wrap.

anatomical operative findings declared the surgical option suitable for remedy.

Transhiatal migration of wrap was corrected by proper esophageal mobilization and reducing all of the herniated stomach followed by repair of the posterior crura by two to three sutures (Fig. 3). However, if the hiatus was still wide, one to two sutures were done in the anterior portion (anterior to esophagus) of the crura guided over a 40 F bougie. Mesh fixation was required to augment the repair when the defect was large (Fig. 4) using a composite mesh (Fig. 5). If the wrap was disrupted, the fundoplication was reconstructed. Proper esophageal mobilization and hiatal dissection was adequate to reduce the gastroesophageal junction and 2 cm of the distal part of the esophagus back inside the abdomen with no tension.

For patients with high BMI and no anatomical cause of recurrence, laparoscopic Roux-en-Y gastric bypass was done.

Postoperative follow-up

Preoperative and postoperative symptomatic assessment and patient satisfaction scores were assessed by personal interviews.

Immediate postoperative follow-up

After surgery, the patients were transferred to the ward and were kept NPO for the first night after surgery. The next day morning, a gastrografin swallow study was performed to exclude leakage or obstruction. Once

Figure 6

• **Scale**: No symptoms = **0**; Symptoms noticeable, but not bothersome = **1**; Symptoms noticeable and bothersome, but not every day = **2**; Symptoms bothersome every day = **3**; Symptoms affect daily activities = **4**; Symptoms are incapacitating, unable to do daily activities = **5**
• **Questions**
__ 1. How bad is your heartburn? 0 1 2 3 4 5
__ 2. Heartburn when lying down? 0 1 2 3 4 5
__ 3. Heartburn when standing up? 0 1 2 3 4 5
__ 4. Heartburn after meals? 0 1 2 3 4 5
__ 5. Does heartburn change your diet? 0 1 2 3 4 5
__ 6. Does heartburn wake you from sleep? 0 1 2 3 4 5
__ 7. Do you have difficulty swallowing? 0 1 2 3 4 5
__ 8. Do you have pain with swallowing? 0 1 2 3 4 5
__ 9. Do you have bloating or gassy feelings? 0 1 2 3 4 5
__ 10. If you take medication, does this affect your daily life? 0 1 2 3 4 5
__ How satisfied are you with your present condition? Satisfied __ Neutral __ Dissatisfied __

HRQL patient satisfaction score.

excluded, clear fluids were allowed. After discharge, patients remained on soft diet for 10 days. All patients were followed up at our clinic after 2 weeks of discharge and were assessed for symptomatic improvement and satisfaction.

Short-term follow-up (3 months)

(1) Symptomatic improvement assessment (modified DeMeester score) (Table 1).
(2) Patient satisfaction assessment (HRQL) (Fig. 6).

Long-term follow-up (6 months)

(1) Symptomatic improvement assessment (modified DeMeester score) (Table 1).
(2) Patient satisfaction assessment (HRQL) (Fig. 6).
(3) 24 h pH monitoring (calculating DeMeester score).

Statistical analysis

Patients' data were tabulated and processed using SPSS (26) statistical package for Windows 7 (IBM® statistical software platform, Chicago, IL, USA). Quantitative variables were expressed by means and SD and were analyzed using paired sample *t* test. Qualitative data were expressed by frequency and percent. The results were significant when *P* value less than 0.05 and highly significant when *P* value less than 0.01.

Results

In our study, there were 20 patients with a mean age of 38.4±10.66 ranging from 25 to 62, we had 10 males and 10 females with a mean BMI of 28.55±4.11. Four (20%) patients were diabetic (Table 2).

Table 2 Preoperative demographic data

	n (%)/mean±SD
Gender	
Male	10 (50)
Female	10 (50)
Age	38.4±10.66
BMI	28.55±4.11
DM	
Yes	4 (20)
No	16 (80)
Time of recurrence (months)	17.55±13.24
Preoperative barium	
Positive	12 (60)
Negative	8 (40)

DM, diabetes mellitus.

Table 3 Preoperative upper gastrointestinal results

	n (%)
Hiatus hernia	
Yes	15 (75)
No	5 (25)
Esophageal erosions	
Yes	14 (70)
No	6 (30)

Regarding the time of recurrence, the mean time was 17.55±13.24 months and we detected recurrence preoperatively by barium in 12 (60%) patients (Table 2).

Upper gastrointestinal endoscopy showed 15 (75%) patients had hiatus hernia while five (25%) did not. Results also showed 14 (70%) patients had erosive esophagitis while six (30%) did not have esophageal erosions (Table 3).

During short-term follow-up using modified DeMeester score and patient satisfaction using HRQL we found that there was significant

Table 4 Short-term follow-up of symptoms and patient satisfaction (preoperative and 3 months)

Variables	Preoperative (mean±SD)	3 months (mean±SD)	*P* value	Significance
Heartburn	2.6±0.50	0.4±0.50	0.001	HS
Regurgitation	2.3±0.47	0.2±0.41	0.001	HS
Dysphagia	0.2±0.41	0.2±0.41	1.000	NS
HRQL	35.45±4.94	8.9±2.07	0.001	HS

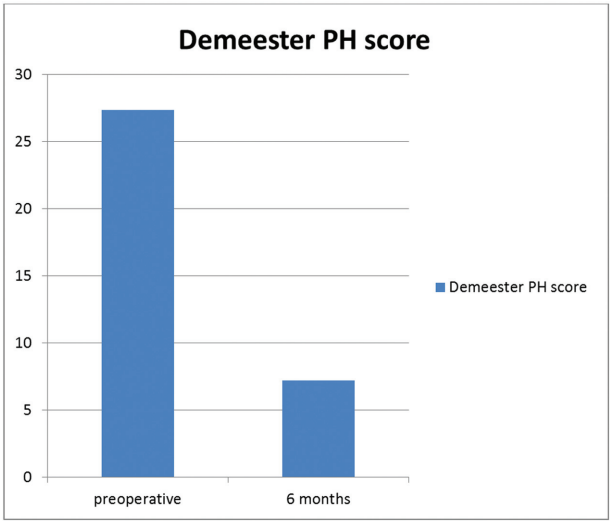
Paired sample *t* test.

Table 5 Long-term follow-up of symptoms, patient satisfaction, and pH score (preoperative and 6 months)

Variables	Preoperative (mean±SD)	6 months (mean±SD)	*P* value	Significance
Heartburn	2.6±0.50	0.35±0.49	0.001	HS
Regurgitation	2.3±0.47	0.25±0.44	0.001	HS
Dysphagia	0.2±0.41	0.2±0.41	1.000	NS
HRQL	35.45±4.94	9.6±1.39	0.001	HS
DeMeester PH score	27.35±6.64	7.2±2.73	0.001	HS

Paired sample *t* test.

Figure 7



Follow –up of pH score.

improvement of heartburn (*P*=0.001) and regurgitation (*P*=0.001) but there was no significant changes in dysphagia. Also using HRQL there was significant improvement in patient satisfaction (Table 4).

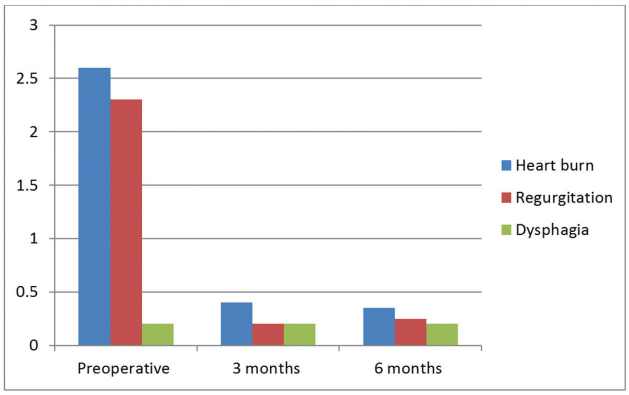
During long-term follow-up after 6 months for clinical improvement, patient satisfaction, and pH DeMeester score we found that there was significant improvement for heartburn and regurgitation but still no significant changes for dysphagia. Patient satisfaction also significantly improved. When comparing pH DeMeester score preoperatively and after 6 months, there was significant improvement with *P* value of 0.001 (Table 5, Fig. 7).

Table 6 Postoperative follow-up of symptoms and patient satisfaction (3 and 6 months)

Variables	3 months (mean±SD)	6 months (mean±SD)	*P* value	Significance
Heart burn	0.4±0.50	0.35±0.49	0.666	NS
Regurgitation	0.2±0.41	0.25±0.44	0.577	NS
Dysphagia	0.2±0.41	0.2±0.41	1.000	NS
HRQL	8.9±2.07	9.6±1.39	0.007	S

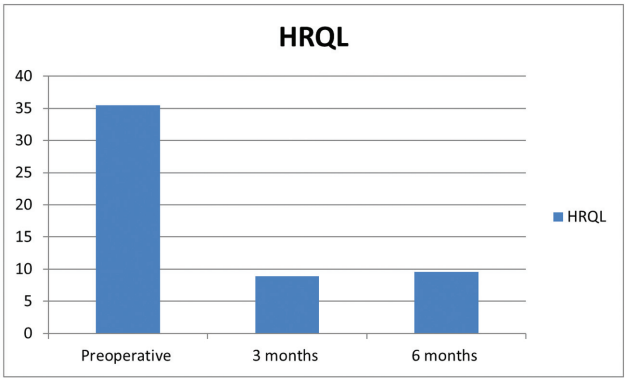
Paired sample *t* test.

Figure 8



Follow-up of clinical symptoms by modified DeMeester score.

Figure 9



Follow-up of patient satisfaction.

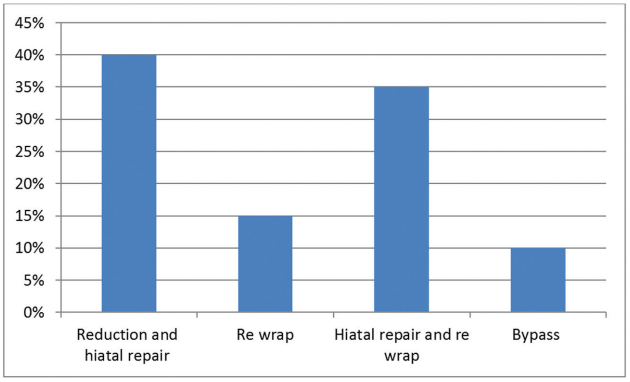
When analyzing changes of clinical and patient satisfaction from 3 and 6 months, there was only significant changes in patient satisfaction, but this change was an increased score from 8.9±2.07 to 9.6 ±1.39, which mean that patient satisfaction became worse after 6 months (Table 6 and Figs 8 and 9).

In all, 24 patients were included but after esophageal motility study (manometry) four of them had functional (motility) disorder and were excluded from our study. So only 20 patients were studied.

Table 7 Cause of recurrence

Cause of recurrence	Procedure done	*n* (%)
Migration	Reduction and hiatal repair	8 (40)
Disruption	Re wrap	3 (15)
Migration and disruption	Hiatal repair and re wrap	7 (35)
High BMI	Bypass	2 (10)

Figure 10



Procedures done.

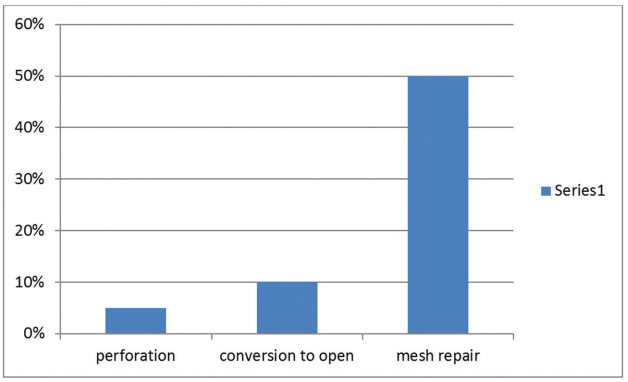
Intraoperatively we found that there were four causes of recurrence as follows: eight (40%) patients had wrap migration that were managed by reduction and hiatal repair; three (5%) patients had disrupted wrap that was managed by rewrap; seven(35%) patients had migration and disruption that were managed by hiatal repair and rewrap, two (10%) were with high BMI; and no anatomical cause of recurrence underwent gastric bypass procedure (Table 7 and Fig. 10).

During the operations, the mean operative time was 170.5±50.99, with negligible blood loss. Two (10%) patients were converted to open repair; one of them had intraoperative esophageal perforation that was repaired intraoperatively without problems. Ten (50%) patients underwent mesh fixation of the diaphragmatic defect. After the operation, the course of the patients was smooth and the mean hospital stay was 4.75±2.79 days, with the longest hospital stay for the patient who had intraoperative esophageal perforation (Table 8 and Fig. 11).

Table 8 Intraoperative data

	n (%)/mean±SD
Operative time (min)	170.5±50.99
Perforation	
Yes	1 (5)
No	19 (95)
Conversion to open	
yes	2 (10)
No	18 (90)
Mesh repair	
Yes	10 (50)
No	10 (50)
Hospital stay (days)	4.75±2.79

Figure 11



Intraoperative data.

Discussion

The rate of failing anti-reflux surgery nowadays is markedly increasing due to the marked increase in the number of cases operated upon with anti-reflux surgery compared with that two decades ago [8].

In different international nationwide studies, recurrence risk was estimated to be 17.7, 5, and 4.9% in the Swedish, Danish, and Austrian studies, respectively [9–11].

In our study, the risk of recurrence was not estimated as our aim was to assess patients who already had symptoms of recurrence after primary anti-reflux surgery.

The failure after anti-reflux surgery can be defined as persisting, recurrent, or new onset of troublesome symptoms after the primary procedure or by results of objective testing. The most frequent symptoms are recurrent heartburn and regurgitation and persisting or new-onset dysphagia [12].

Causes of failure can be functional or anatomical error. In an extensive literature review of redo-anti-reflux surgery, Furnée *et al.* [12] analyzed the causes of failures of primary anti-reflux surgery from 1625 publications. Most frequent problems were migration of the wrap and mediastinal dislocation, a partial or complete breakdown of the wrap, a slippage of the wrap, and other anatomical changes. These results show that migration of the wrap, wrap

breakdown, slippage, and paraesophageal herniation of the gastric fundus account for 70% of the causes.

Dysphagia is one of the most frequent complications of fundoplication [13]. In our study, the target sample was patients with reflux recurrence, so we did not discuss patients with dysphagia whereas other studies discussed both.

Regarding causes of failure of anti-reflux surgery, in the study by Abdel-Raouf El-Geidie *et al.* [14], the causes of reflux recurrence were wrap migration in 24%, wrap disruption in 24%, slipped wrap in 10%, wrap migration with disruption in 7%, and paraesophageal hernia in 3%. There were also complications that caused dysphagia like tight wrap in 14% and tight crural repair in 10%.

In the study by Curet *et al.* [15], causes of failure included paraesophageal hernia in 14.8%, tight wrap in 7.4%, wrap disruption in 33.3%, stricture in 7.4%, slipped fundoplication in 11.1%, wrap migration in 7.4%, and no apparent anatomical cause in 14.8%.

In the Singhal *et al.* [16] study, causes of failure were slipped fundoplication in 31.5%, disrupted warp in 28.5%, twisted wrap in 11.5%, tight wrap causing dysphagia in 8.3%, and no apparent anatomical cause in 20.5%.

In the Wykypiel *et al.* [11] study, causes of failure included wrap migration in 37% and slipped wrap in 12%.

In our study, causes of recurrence were wrap migration in 40% of patients, wrap disruption in 15%, wrap migration with associated disruption in 35%, and high BMI with no apparent anatomical cause in 10%.

Obesity is a known risk factor for GERD development. Obesity is associated with higher risk of a worse outcome after anti-reflux surgery, mainly because of reflux recurrence or hiatus hernia development. However, there is an increase in the use of anti-reflux surgery in the management of gastroesophageal reflux in obese patients [17]. During the last decade, many studies assessed the adverse effects of obesity on the outcome of anti-reflux surgery, some of which suggested that obesity is linked to a worse outcome [18–20].

Many studies recommend that patients suffering from GERD with a high BMI should be considered for Roux-en-Y gastric bypass instead of fundoplication [21]. Some studies even recommend some technical modifications in laparoscopic sleeve gastrectomy in obese patients with reflux [22].

In Schietroma *et al.* [21], recurrence of reflux after fundoplication was recorded in 27 patients, 19 of them were overweight (BMI 30–35). Whereas patients with a BMI more than 35 were excluded from the study as they were candidates for bariatric surgery rather than anti-reflux surgery. In our study, two (10%) patients with high BMI and no apparent cause of recurrence underwent bypass surgery with better results at follow-up.

Regarding patient selection, our study used detailed analysis of medical history, assessment of symptom severity using modified DeMeester score, assessment of patient satisfaction level using the HRQL score, doing proper investigative workup including barium study, esophageal manometry, and 24-h pH monitoring calculating the DeMeester score (including only patients with a score above 14.72). Patients who had correctable anatomical or functional causes were chosen to undergo secondary anti-reflux surgery.

This can be compared with other studies like Abdel-Raouf El-Geidie *et al.* [14], which was based on having intolerable symptoms, having no major risk factors, radiology, endoscopy, and pH monitoring results showing anatomical or functional correctable disorder and patient's preference of surgery over medical treatment. In the Curet *et al.* [15] study, it was based on having severe, persistent refractory symptoms assessed by endoscopy, esophageal motility study, and 24 h pH monitoring. In the Singhal *et al.* [16] study, anti-reflux surgery was offered only when medical treatment and endoscopic procedures did not provide symptomatic improvement and when anatomic and functional findings were consistent with symptoms.

Regarding the time of recurrence, it ranged from 2 weeks to 25 years (mean, 2.3 years) in a study done by Curet *et al.* [15], and in the Funch-Jensen *et al.* [10] study, the mean time was 2 years.

Regarding the interval between primary fundoplication and redo operation, the mean duration was 42 months in the study by Singhal *et al.* [16], and it was 31 months in the study by Wykypiel *et al.* [11].

In our study, the time for recurrence ranged from 4 to 48 months with an average of 17.55±13.24 months.

Regarding the primary anti-reflux procedure, the Abdel-Raouf El-Geidie *et al.* [14] study (29 patients) discussed patients who underwent open Nissen fundoplication (41.4%), open Toupet fundoplication (27.6%), laparoscopic Nissen fundoplication (13.8%), laparoscopic Nissen-Rossetti (10.3%), and laparoscopic Toupet (6.9%).

Primary procedures discussed in the Curet *et al.* [15] study (27 patients) were laparoscopic Nissen fundoplication in 77.7%, paraesophageal hernia repair in 7.4%, laparoscopic Toupet fundoplication in 3.7%, open Allison's repair in 3.7%, open Allison's repair with truncal vagotomy and pyloroplasty in 3.7%, and Belsey fundoplication in 3.7%.

In the Singhal *et al.* [16] study (302 patients), primary procedures carried out were laparoscopic Nissen fundoplication in 62.6%, and laparoscopic Toupet fundoplication in 36.8%.

In our study, we were more selective as we discussed only laparoscopic Nissen fundoplication as a primary procedure.

In the study by Abdel-Raouf El-Geidie *et al.* [14], symptomatic outcome was assessed by the symptomatic severity and well-being score, which had a mean of 3.4 ±2.1 before operation that then significantly improved to 1.3±2.4 after surgery ($P<0.001$). Of the patients, 79.3% were satisfied with the decision to do a reoperation and 69% of patients reported good to excellent control of heartburn and regurgitation. However, objective outcome was assessed using radiology, endoscopy, manometry, and 24-h pH monitoring from which the DeMeester score was calculated for patients with recurrent reflux. It had a mean of 28.7±15.5 before surgery that showed significant improvement to 7.9±4.3 after surgery. All this was conducted over a mean period of 28.2±11.8 months [14].

In the Singhal *et al.* [16] study, patients filled a questionnaire asking about foregut symptoms and satisfaction 1 year after surgery and then every 2 years. Accordingly, it was found that 68.1% of patients had significant symptomatic improvement. Subjective satisfaction assessment was performed on a scale of 1–10, a score of 8 or more was considered excellent satisfaction and 76% showed excellent satisfaction (>8/10).

In our study, follow-up of improvement included an assessment of symptomatic improvement by the modified DeMeester score and patient satisfaction by HRQL score done as a baseline preoperative assessment, then at 3 months and at 6 months after the operation. There was significant improvement in symptom score and patient satisfaction at 3 months postoperatively. HRQL score baseline was 35.45±4.94, at 3 months it was 8.9±2.07, then at 6 months was 9.6 ±1.39. We noticed a significant decrease in patient satisfaction between 3 and 6 months HRQL scores, which may be attributed to psychological factors and patient tolerance.

There was also significant improvement in 24 h pH results. DeMeester score was 27.35±6.64 before surgery and then improved to 7.2±2.73 6 months after surgery.

Previous studies demonstrated that serious complications during redo fundoplication (e.g. gastric and esophageal perforations) are frequent and require considerable technical expertise [23].

Abdel-Raouf El-Geidie *et al.*s [14] study reported intraoperative complications like mild left pneumothorax in 3.4%, bleeding due to oozing from the spleen in 3.4%, and gastric perforation in 6.9%. Some patients had postoperative complications like gastric perforation 3.4%, wound infection in 3.4%, incisional hernia in 3.4% (open procedure), wrap migration in 3.4%, disruption in 3.4%, and severe reflux in 3.4%.

In the Danish study, the conversion rate from laparoscopy to open procedure was 16.1%. They also compared conversion rates between low volume centers (31.6%) and tertiary specialized centers (13.3%) which were also significant leading to the recommendation of centralization of such procedures [10].

In the Austrian study, conversion rate was 10.8%. In 50% of cases, the conversion cause was adhesions. Other causes were splenic injury (12.5%), gastric perforation (12.5%), or esophageal perforation (6.3%), bleeding (6.3%), and others (12.5%) including obesity, very long operative time, or unexpected cholecystitis [11].

In other studies like Smith *et al.* [5], Curet *et al.* [15], and Singhal *et al.* [16], conversion rates were 8, 3.7, and 7%, respectively.

In our study, the conversion rate was 10% (two patients), which was comparable to many of the previously mentioned studies. One of those two

patients had intraoperative esophageal perforation that was repaired successfully.

In the Danish study, one (0.81%) patient died after complications of a gastric perforation [10], and in the Austrian study mortality was 0.44% [11].

No mortality was recorded in other studies like Curet *et al.* [15] and Abdel-Raouf El-Geidie *et al.* [14]. This was the same for our study.

Regarding operative time, in the Abdel-Raouf El-Geidie *et al.* [14] study it ranged from 72 to 280 min (mean, 132±39). It ranged from 2.3 to 7.1 h (mean, 4.1 h) in the studies by Curet *et al.* [15] and a mean of 189.5±61.9 in Singhal *et al.* [16].

In our study, operative time ranged from 110 to 255 min (mean, 170.5±50.99), with the longest operative time in the two patients who were converted to open.

Hospital stay mean was 4.9 days (3–16 days) in the Abdel-Raouf El-Geidie *et al.* [14] study, 3.7 days (1–22 days) in the Curet *et al.* [15] study, and 3 days in the Funch-Jensen *et al.* [10] study.

In our study, the mean hospital stay was 4.75±2.79 with the longest hospital stay for the patient who had esophageal perforation (14 days).

Our study was limited by the small sample size and short follow-up time; further follow up of patients will be recorded.

Conclusion

Laparoscopic secondary anti-reflux surgery is a feasible, safe option in the treatment of GERD recurrence after failed anti-reflux surgery. It shows promising results and should be offered to patients with recurrence.

Patients with high BMI should undergo Reux-enY gastric bypass surgery instead of fundoplication as obesity is associated with a poorer outcome after fundoplication.

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Conflicts of interest
There are no conflicts of interest.

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