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DYSPHAGIA; ACHILLES TENDON OF LAPAROSCOPIC NISSEN'S FUNDOPLICATION

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The present study was carried out after obtaining the Institutional Board committee's ethical approval at Al- Azhar University Hospitals. We collected an informed written consent form signed by each subject after explaining all the details of the procedure as a new one. All patients signed an Informed Consent Form prior to enrollment in the study. This study was carried out in accordance with the principles of the Declaration of Helsinki (1964) and its later versions.

Abstract
Background: Nissen fundoplication is a contemporary strategy for alleviating symptoms, leading to an increase in overall quality of life (QoL). The effectiveness of antireflux surgery may be limited by complications of Nissen fundoplication, including the inability to vomit or belch, increased bloating, dysphagia, and recurrence.

Methods: Forty patients with gastroesophageal reflux disease (GERD) and hiatus hernia (NHS) were included in our study from July 2019 to July 2022 and underwent Laparoscopic Nissen Fundoplication (LNF).

Results: Preoperative complaints of patients included regurgitation at 30%, heartburn at 90%, dysphagia at 17.5%, bronchial asthma at 12.5%, and chronic cough at 7.5%. There were 30% with GERD, 15% with NHS, and a combined GERD with NHS was present in 55%. The mean operative time was 66.5 hours. The mean time for hospital stay was 19.4 hours.

Regarding postoperative dysphagia, 18 patients (45%) complained of dysphagia {16 patients resolved spontaneously one month later as they were mild, and two patients improved three months with balloon dilatation as there were moderate}.

Conclusion: LNF can be performed without postoperative dysphagia with meticulousness and a number of precautionary measures.

Keywords: Gastroesophageal Reflux, hiatal hernia, laparoscopic Nissen fundoplication**,** dysphagia**.**

Introduction

GERD can be triggered by augmented secretion of gastric acid, with subsequent reflux or dysfunctional cardiac sphincter. Subsequent symptoms include regurgitation, weight loss, dysphagia, and heartburn. Despite the fact that gastric acid hypersecretion may be managed medically with lifestyle modification and pharmacotherapy, sphincter dysfunction is best treated surgically. Nissen fundoplication has been found to be an effective treatment for alleviating symptoms, leading to an increase in overall QoL [(1)].

In Istanbul in 1937, Rudolf Nissen conducted a resection of the cardia and surrounded the anastomosis with a gastric fold, introducing the concept of fundoplication to prevent gastroesophageal reflux [(2)].

Complications of Nissen fundoplication, such as dysphagia, increased bloating, inability to belch or vomit, and recurrence, may limit the success of antireflux surgery [(3)].

We aimed to study short-term outcomes of LNF after standardization of some steps to avoid postoperative complications.

Patients and Methods

Forty patients suffering from GERD and NHS were included in our study from July 2019 to July 2022 and underwent LNF. Our study was performed at New Damietta University Hospital and Assiut University Hospital after informed consent of all patients was obtained with approval from Al-Azhar Faculty of Medicine's Ethical Committee, New Damietta, and Assiut.

Inclusion criteria

- Female or a male.
- Age: 18-60 years.
- Symptomatic GERD (Heartburn, regurgitation, dysphagia).
- Patients with NHS.

Exclusion criteria

- Cases with esophageal motility disorders.
- Recurrence after antireflux surgeries.
- Previous upper abdominal laparotomy.

All participants were subjected to the following:
Full history taking as well as examination.
Preoperative assessment.

- Routine laboratory investigations: CBC, SGPT, SGOT, HCV-Ab, HBsAg, FBS, urea, creatinine, bleeding time, and coagulation time.
- ECG and cardiological assessment.
- Upper Gastrointestinal Endoscopy.
- Barium meal in Trendelenburg position.
- Esophageal manometry study.

Operative Technique

The patient was placed in the Trendelenburg position, and third-generation cephalosporin was injected for the induction of anesthesia. The surgeon stood between the legs of the patient while the second assistant and the cameraman were on the operating table's left and right sides, respectively. An orogastric tube was placed to keep the stomach empty.

A verses needle was utilized to create a pneumoperitoneum of up to 14 mmHg. The first optical port (10 mm) was positioned in the supra-umbilical midline at the intersection of the lower one-third and the upper two-thirds and between the xiphoid and umbilicus process. The introduction of the laparoscope through this port, two operating ports (10mm-5mm) inserted below the costal margins at the midclavicular line, a port for liver retraction (5mm) below the xiphoid process, and an assistant port (5mm) at the midaxillary line below the costal cartilage.

Initially, the abdominal cavity was examined with a 30° scope (Fig 1). Following the liver's left lobe retraction, the right posterior aspect of the esophagogastric junction was reached. The initial step consisted of dividing the pars flaccida of the lesser omentum with a vessel-sealing device, preserving the anterior vagus nerve's hepatic branch. Then, we divided the pars condense of lesser omentum (Fig.2), reaching the pharyngoesophageal membrane, which divided transversely for separation from the esophagus and to enter the mediastinum (Fig 3) with identification and preservation of the anterior vagus.

At this point, the anesthetist retracted the orogastric tube to be outside the esophagus to be not rigid for protection against esophageal injury during the separation of the right crus from the esophagus right side by vessel sealing device and blunt dissection; the posterior vagus nerve was identified and preserved (Fig 4).

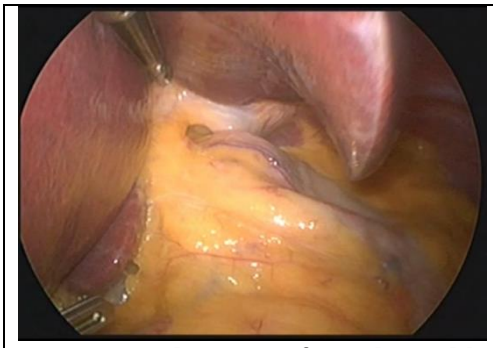

Fig (1): Exploration of esophageal hiatus.

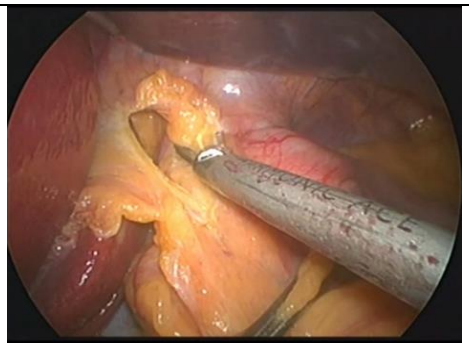

Fig (2): Division of pars flacida and condensa with preservation of hepatic nerve.

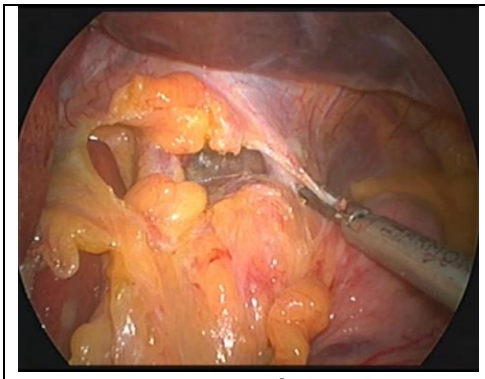

Fig (3): Division of the pharyngoesophageal membrane to enter the mediastinum.

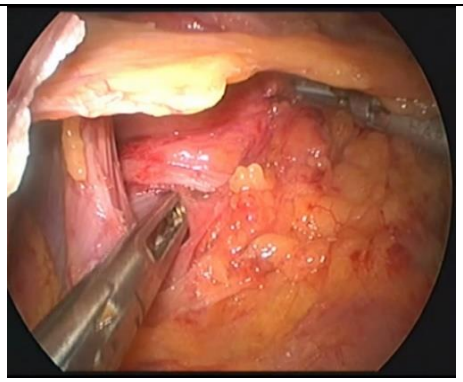

Fig (4): Posterior dissection with preservation of posterior vagus nerve.

The right crus should be dissected down to the confluence with the left crus. Dissection of the esophagus from the left crus and posterior attachment was done for complete lower esophageal mobilization to get 3-6 cm intra-abdominal without tension. Short gastric vessels were divided utilizing a vessel sealing device (Fig 5) to create floppy and tension-free fundic wrap. The retro retroesophageal space was widened to facilitate the wrap's passage. The esophagus was then retracted upward with tape incorporating both anterior and posterior vagal nerves.

Fig (5): Division of short gastric vessels.

The subsequent phase involved crural repair: interrupted sutures, utilizing non-absorbable material, were put posteriorly to approximate diaphragmatic crura (Fig 6). In the resting position without tension on the GE junction, calibration could be performed either by modeling the crural repair on the diameter of the esophagus or by utilizing a 50F bougie.

The last step is the passage and fundic wrap fixation, atraumatic forceps passed below the hepatic nerve and behind the esophagus, from right to left. It was utilized to grasp the gastric fundus posterior wall to the left of the esophagus and to pull it behind, making a 360° wrap, and a "shoe-shine" maneuver was performed to confirm adequate fundic mobilization (Fig 7).

Two or three interrupted stitches were created to secure the wrap, forming a 2cm wrap (Fig 8), which was fixed on the remaining part of the pharyngoesophageal membrane at the esophageal side. It is better to be directed to the right side, not the Medline. The right side of the wrap was attached to the right crus with one non-absorbable suture (Fig 9), and the left side was fixed to the left crus or diaphragm (Fig 10).

The procedure concluded with the removal of the bougie, final inspection of fundoplication (Fig 11), assuring hemostasis, and insertion of a tube drain at the left hypochondrium before closing the port sites.

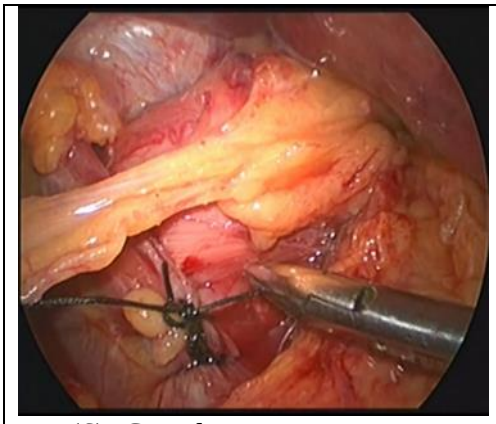

Fig (6): Crural repair.

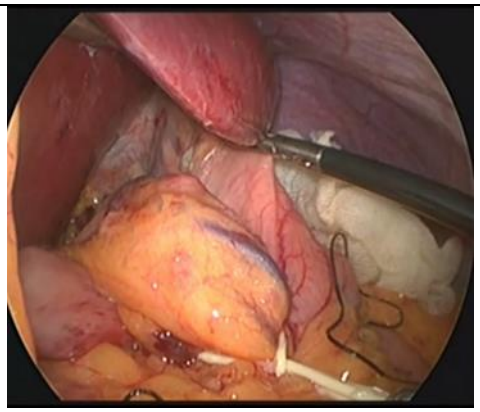

Fig (7): Shoe-shine maneuver.

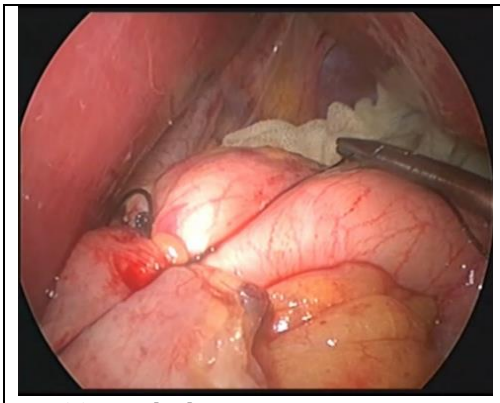

Fig (8): Fundoplication.

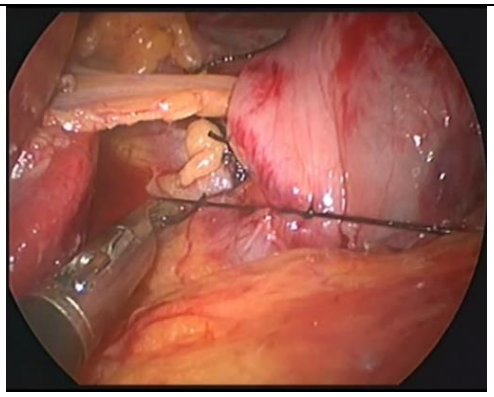

Fig (9): The right side of the wrap fixed to right crus.

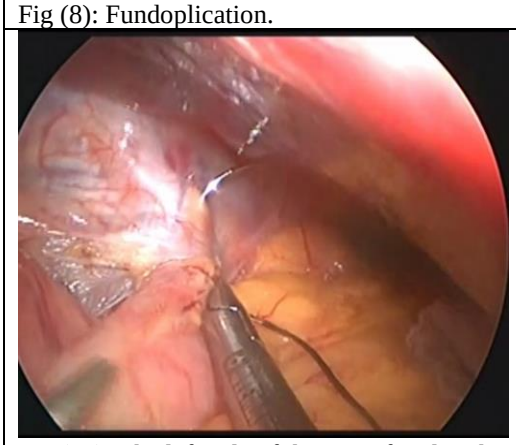

Fig (10): The left side of the wrap fixed to the diaphragm.

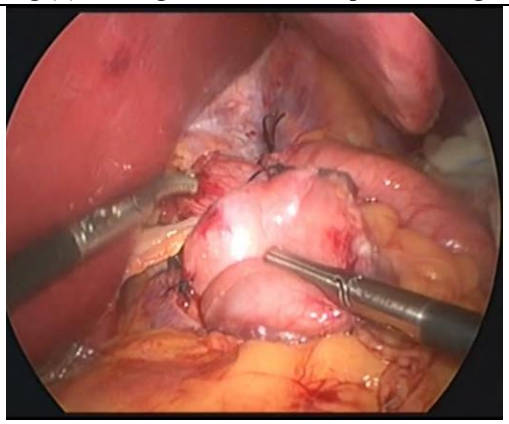

Fig (11): Final appearance.

Postoperative Follow up

Oral feeding started 7-27 hours postoperatively, the tube drain was removed, and patients were discharged from the hospital. Follow-up was carried out one week, one month, three months, and one year postoperative at the Outpatient Clinic.

Statistical Analysis

Data analysis, as well as statistical presentation, were performed utilizing the mean, standard deviation, and chi-square test by the 22nd version of the SPSS.

Results

Forty patients, with a mean age of 38.1 (18-60 years), were included in our study from New Damietta and Assiut University Hospital from July 2019 to July 2022. Subjects underwent LNF for NHS or GERD. There were 17 females (42.5%) as well as 23 males (57.5%).

Perioperative dysphagia, regurgitation, and heartburn were assessed based on the **DeMeester-Johnson reflux scale [(4)]**. Regurgitation was graded as severe=3 (history of aspiration), moderate=2 (predictable with lying down, straining, or position change), mild=1 (occasional after lying down, a large meal or straining), and none=0.

Heartburn grades were: severe=3 (constant, marked disability in daily life activities), moderate = 2 (the main reason for a medical issue or a medical visit), mild=1 (persistent symptom, with no prior medical treatment history), and none=0. Dysphagia grades were severe=3 (meat impaction history that necessitates medical intervention), moderate=2 (the need for liquids to clear), mild=1 (occasional with coarse foods), and none=0.

Patients' preoperative complaints included: regurgitation in 12 patients (30%) {10 patients mild and two moderate}, heartburn in 36 patients (90%) {9 patients mild, 26 moderate, one severe}, dysphagia in 7 patients (17.5%) {5 patients mild and tow moderate}, bronchial asthma five patients (12.5%), chronic cough in 3 patients (7.5%) (Table 2).

There were 12 patients (30%) with GERD, 6 patients (15%) with NHS, and a combined GERD with NHS was detected in 22 cases (55%) (Table 1).

The mean operative time was 66.5 hours (40-90 hours). The postoperative feeding ranged between 7-27 hours with a mean of 17.4 hours. One patient experienced intraoperative bleeding; the source was large, short gastric vessels managed with clips. The mean time for hospital stay was 19.4 hours (8-28 hours) (as shown in Table 3).

As regards the postoperative inability to belch and bloating, there were 16 patients (40%) {12 patients demonstrated spontaneous regression after one month of follow-up, while four patients improved with antispasmodics and antiflatulence three months later} (Table 3).

Postoperatively, there were three patients (7.5%) complained of regurgitation and heartburn {mild in two patients improved with PPI and prokinetic drugs at three months, one severe and persists due to NHS recurrence}(Table 2).

Regarding postoperative dysphagia, 18 patients (45%) complained of dysphagia {16 patients with mild symptoms improved spontaneously one month later, and two patients with moderate symptoms improved after three months with balloon dilatation}. Three months later, there was complete regression of bronchial asthma and cough (Table 2).

Three patients (7.5%) experienced postoperative retrosternal pain, which gradually subsided over the course of one month. There was one recurrence (2.5%) with persistent heartburn and regurgitation; esophagogastric endoscopy revealed recurrence after one year, necessitating a redo (as shown in Table 3). No mortalities were recorded during the follow-up period.

Table (1): The studied participants' baseline characteristics

Variable	Frequency (%)
Age	
Mean (Min-Max)	38.1 **(**18-60**)**
Sex	
Male	23 (57.5%)
female	17 (42.5%)
Classification	
GERD	12 (30%)
NHS	6 (15%)
GERD+ NHS	22 (55%)

Variable	Frequency
Operative time (Minutes)	
Mean (Min-Max)	66.5 **(**40-90**)**
Postoperative sequelae	
Oral feeding (hours)	
Mean (Min-Max)	17.4 (7-27)
Hospital stay (hours)	
Mean (Min-Max)	19.4 (8-28)
Gastric bloating	
n (%)	16 (40%)
Retrosternal pain	
n (%)	3 (7.5%)
Recurrence	
n (%)	1 (2.5%)

Table (2): Preoperative versus Postoperative symptoms of the patients

	Preoperative N=40	**Postoperative N=40**	**P value@**
Regurgitation	12 (30%)	3 (7.5%)	0.000*
Heartburn	36 (90%)	3 (7.5%)	0.000*
Dysphagia	7 (17.5%)	19 (47.5%)	0.000*
Bronchial asthma	5 (12.5%)	0 (0.0%)	0.000*
Cough	3 (7.5%)	0 (0.0%)	0.000*

@ McNemar test was utilized, ***** p-value < 0.05 is significant

Table (2): Operative time and postoperative sequelae among the study participants

Discussion

Winklestein identified GERD as a significant clinical issue in 1935, and Allison identified it as the etiology of esophagitis in 1946 [5,6]. Currently, surgery is a recognized approach for the treatment of GERD. In recent years, antireflux surgery has gained popularity because of the development of the laparoscopic method and its benefits, which include a less stressful and intrusive procedure and a quicker return to regular daily activities. Consequently, this approach has become the gold standard for surgical care of GERD [7].

The general principles to treat GERD and NHS involve creating an esophagus's lengthy intra-abdominal segment, cardio calibration [8] utilizing the Law of La Place principle, and restoring the normal length-tension relationship of the muscle responsible for the lower esophageal sphincter. LNF follows these principles and is currently extensively utilized[9].

Total fundoplication's mechanical complications can result in functional obstruction at the gastroesophageal junction as well as an incapacity to expel air from the stomach [3].

Traditionally, crural repair has been accomplished with sutures put posteriorly. Additionally, it is feasible to minimize the size of the hiatal utilizing an anterior hiatal repair procedure [10].

There are several reports demonstrating the effects of surgical treatment of GERD. Takeyama et al. reported on their experience with 23 LNF cases. They investigated the improvements in barium study findings, symptoms related to GERD, endoscopy, and the outcomes of intra-esophageal 24-h pH monitoring and found that the procedure was successful in 89.5% of cases, with an adequate rate of complications [11].

Hahnloser et al. [12] documented that LNF is linked with a minor but significant frequency of persistent and severe postoperative dysphagia. Temporary postoperative dysphagia was detected in nearly 50 percent of cases one week after surgery and persisted for three months in 2% to 26%

Kamolz et al. [13] illustrated that dysphagia's subjective degree as well as the perceived impairments caused by laparoscopic antireflux surgeries be anticipated based on the patient's personality. In a study by Herron et al.[14], the only risk factor for postoperative dysphagia was a preoperatively reported difficulty swallowing (p _0.029).

Infrequently, gas-bloat syndrome, as well as postoperative dysphagia, may necessitate additional surgical intervention. Postoperative dysphagia may develop from sliding local edema or the wrap and hematoma induced by excessive manipulation during the surgery [15].

Mohab et al. reported that 25 percent of cases were conservatively managed for early dysphagia, and only two cases underwent upper GI endoscopy because of frequent vomiting, demonstrating mild narrowing that did not require dilation. It is possible that the passing of the endoscope itself contributed to the achievement of a type of calibration. It has been noted that early postoperative mild dysphagia is prevalent immediately after surgery and gradually recovers when hematoma diminishes. However, postoperative dysphagia that persists longer than eight weeks appears in 20 percent of cases, which is a problem for further diagnosis or therapy. Postoperative dysphagia may also be caused by probable surgical mistakes, such as making a too-tight wrap or closing the hiatus too much [16].

Herniation of the fundic wrap into the chest might occur during the early postoperative phase, leading to numerous structural dysfunctions of fundoplication. Herniation can be due to complete or partial wrap disruption or slippage of the stomach proximal to the fundoplication in an intact or partially disrupted wrap. When the crural repair is compromised, the fundoplication may potentially herniate into the chest, and redundant fundoplication might proceed to a Para esophageal hernia [17].

In our study, recurrence was 2.5%, and no mortality was recorded.
Regarding postoperative dysphagia, 18 patients (45%) developed dysphagia; 16 patients were mild and resolved spontaneously one month later, and two were moderate and got better after three months with balloon dilatation. Postoperative dysphagia may be due to a short esophagus, edema of the wrap, tight crura, or a slight twist of the esophagus or the wrap. Our recommendations to overcome this issue are as follows:

- Preservation of the anterior vagus nerve's hepatic branch.
- Freeing of the lower esophagus to get 3-6 cm intraabdominal at ease.
- Good calibration of crural repair at a resting position of the esophagus.
- Posterior crural repair is preferred over anterior repair as it is away from each other, but also do not do more sutures posteriorly to avoid kinking of the esophagus.
- Division of short gastric vessels along the entire gastric fundus.
- As regards fundic wrap:
  - The wrap was done between the posterior wall of the gastric fundus, which is pulled to the right of the esophagus, and its anterior wall on the left, which may help prevent a stomach twist.
  - Its length is not more than 2cm.
  - Passed below the anterior vagus nerve's hepatic branch to prevent wrap migration.
  - The first stitch of fundic wrap is fixed to the esophageal side of the phrenoesophageal membrane, not the esophageal muscles.
  - Fixation of the left side of the wrap to the crura or diaphragm to regain the angel of Hiss, right side to crura, and also to prevent wrap migration.

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