Nissen's vs Toupet fundoplication in management of GERD

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Abstract: **Introduction:** Gastroesophageal reflux disease (GERD), as generally defined, is a common clinical condition that results from the reflux of gastric material through the lower esophageal sphincter (LES) into the esophagus or oropharynx, causing symptoms and/or injury to esophageal tissue that are severe enough to disrupt a patient's life**. Aim:** To compare post-operative outcome on quality of life, anatomical failure, symptom relieve & recurrence rate between Nissen's & Toupet fundoplication. **Patients and Methods:** All patients attempting surgical management of gastoesophageal reflux disease at Ain-shams university hospitals & Nasser institute for medical research and treatment at the period from January 2018 to September 2018: Nissen's: 10 patients, Toupet: 10 patients. **Results:** The present study is not without limitations. The sample size was relatively small, was from a two centers and all patients refused the postoperative objective evaluations. Evaluation of postoperative dysphagia, a subjective questionnaire was used to determine whether patients had dysphagia or not during follow-up, Grading of dysphagia was done by applying Likert scale in the postoperative clinical assessment. In addition, the follow-up was relatively short. Larger multicenter trials are necessary to firmly establish the differential effectiveness of these two procedures**. Conclusion**: Laparoscopic Toupet Fundoplication seems to be as safe and effective as Laparoscopic Nissen Fundoplication, but showed a lower incidence of postoperative dysphagia, while this study sought to characterize post-operative efficacy of two fundoplication procedures, the optimal anti-reflux strategy for patients with GERD still remains inconclusive given the current literature available. Additional multicenter prospective studies with long-term follow-up data are neededery.

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1. Introduction

Gastroesophageal reflux disease (GERD), as generally defined, is a common clinical condition that results from the reflux of gastric material through the lower esophageal sphincter (LES) into the esophagus or oropharynx, causing symptoms and/or injury to esophageal tissue that are severe enough to disrupt a patient's life ***(Aziz et al., 2016).***

GERD is much more prevalent in Western countries, represented in Europe and USA than in Asiatic countries. It has been shown that GERD prevalence increases in parallel with the remarkable growth of obesity. It is very frequent in the community and ranges from 10% to more than 30%, according to the various population-based studies ***(Savarino et al., 2017).***

The term encompasses both symptoms and pathophysiologic changes to the esophageal mucosa, which occur as a result of exposure of the distal esophagus to acidic gastric contents after episodes of gastroesophageal reflux ***(Herregods et al., 2015).***

There are two main phenotypic manifestations, erosive reflux disease (ERD) and non-erosive reflux disease (NERD) and the latter includes the majority of patients (up to 70%). the progression from NERD to ERD, from mild to severe ERD and from ERD to Barrett's esophagus may occur only in a small number of cases, ranging from 0% to 30%, 10-22% and 1-13%, respectively ***(Savarino et al., 2017).***

GERD can manifest in a wide range of symptoms which tend to be more common after meals and are often aggravated by recumbency. Symptoms can be subdivided into typical (heartburn and acid regurgitation), atypical (epigastric pain, dyspepsia, nausea, bloating, and belching) and extraesophageal (chronic cough, asthma, laryngitis and dental erosions) ***(Francis & Vaezi,. 2015).***

Pathophysiology of GERD is multifactorial. Pathologic reflux is thought to occur when the injurious properties of refluxed gastric acid, bile, pepsin, and duodenal contents overwhelm normal esophageal protective antireflux barriers, such as esophageal acid clearance and mucosal resistance. The primary underlying mechanism causing pathologic reflux appears to be a defective LES, which increases the volume of acidic gastric contents that refluxes into the esophagus ***(Herregods et al., 2015).***

While GERD is usually nonprogressive, in a minority of cases disease progression is associated with the development of complications that range from esophagitis, bleeding, esophageal erosions and

ulcerations, stricture formation, Barrett's esophagus to adenocarcinoma of the esophagus ***(Dunbar et al., 2016).***

GERD is typically diagnosed by a combination of clinical symptoms, response to acid suppression medication, as well as objective testing with (upper endoscopy, esophageal pH monitoring, Barium esophagram and esophageal manometry) ***(Katz et al., 2013).***

GERD is a chronic condition requiring continued management using medications and lifestyle modifications. Pharmacotherapy, particularly the use of antisecretory agents, has probably modified the natural history of GERD. Proton pump inhibitor (PPI) use, in particular, has had an enormous impact on treatment, in providing significantly improved erosive esophagitis healing rates and better symptom control. On the other hand, selected patients with severe disease may benefit from surgery to prevent relapse ***(Gyawali & Fass, 2018).***

Surgical therapy is aimed at correcting the anatomic and functional abnormalities of the esophagogastric junction that result in gastroesophageal reflux. Corrective measures include reduction of hiatal hernia, if present, construction of a fundal wrap to augment the lower esophageal sphincter (LES) and increase its resting pressure, and approximation of the diaphragmatic crura ***(Duke & Farrell, 2017).***

Nissen's fundoplication (posterior 360 degree wrap) is the golden standard for surgical treatment of gastroesophageal reflux disease (GERD). This operation involves repairing the hiatal hernia, which is often present, followed by fashioning the fundus of the stomach around the lower esophagus to form an external buttress. However, it is associated with a high incidence of postoperative complications (dysphagia and gas-bloat syndrome) ***(Su et al., 2016).***

On the other hand Toupet fundoplication (posterior 270 degree wrap) offers equivalent symptom relief and has a significantly lower risk of postoperative complications compared with Nissen's fundoplication ***(Su et al., 2016).***

Aim of the work:

To compare post-operative outcome on quality of life, anatomical failure, symptom relieve & recurrence rate between Nissen's & Toupet fundoplication.

Patients and Methods

Inclusion criteria

Surgical therapy should be considered in patients who have an objective diagnosis of GERD based on preoperative testing and inadequate symptom and disease control**.** An improvement of a disease-related quality of life is the main indication for antireflux surgery. ***Hunter, in 2000*** listed the following indications for patients with GERD who are candidate for surgery which involves around 10-20% of GERD patients:

A) **Refractory to medical therapy:**

- Persistent symptoms after 12 weeks of maximal medical therapy.
- Recurrence upon cessation of medications.
- Non-compliance with medical therapy or inability to tolerate medical therapy.
- Patient requesting for surgery.

B) **Development of complications:** such as

- peptic stricture,
- Intractable esophagitis, esophageal ulcers, Barrett's esophagus & bleeding.
- pulmonary complications (recurrent aspiration).

C) **Others:**

- Young patients despite successful medical management (due to lifestyle modification, life-long medical therapy, escalating doses, costs of medication).
- Patients with endoscopically or radiologically diagnosed hiatal hernias (large hiatal hernia >5 cm).

Exclusion criteria

- Esophageal motility disorders such as achalasia.
- Morbidly obese patients (body mass index greater than 35 kg/m^2).
- previous upper abdominal surgery and severely shortened esophagus.

Sampling method:

All patients (convenience) attempting surgical management of gastoesophageal reflux disease at Ain-shams university hospitals & Nasser institute for medical research and treatment at the period from January 2018 to September 2018.

Sample size:

- Nissen's: 10 patients
- Toupet: 10 patients

Preoperative evaluation:

The best candidate for surgery is the patient who has complete resolution of symptoms when treated with modern antireflux medication.

Preoperative evaluation should focus on specific anatomic and functional details that might impact technical surgical decision making such as:

- Diagnose GERD and exclude other disorders, such as lesions of esophagus or stomach.
- Measure severity of reflux (in quantity and quality).
- Define anatomy of esophagus and gastroesophageal junction.

In general, these objectives are accomplished by several tests, of which contrast studies (with barium swallows and endoscopy are most widely

used:

1. Esophagogastroduodenoscopy including biopsy at the gastroesophageal junction and histological examination,
2. Esophageal manometry (for excluding primary motor disorders e.g. achalasia, and defining the exact position of the gastroesophageal junction).
3. 24-h esophageal impedance pH monitoring to characterize the frequency, duration and extent of any kind of reflux including the possibility to correlate the patients symptoms to the reflux activities.
4. Contrast studies with barium swallow, an x-ray cinematography for a better documentation of sliding or paraesophageal hernias completes an exact evaluation of the disease.
5. CT scanning can be helpful especially when obstructive of volvulized paraoesophageal hernia is suspected.

Principles of Surgery

Based on the pathophysiological findings underlying GERD and hiatal hernias, it is clear that the most effective way to permanently restore the competency of the gastroesophageal junction and the diaphragmatic crura is to close any kind of hernia and perform some kind of wrap over the esophagus just proximal to the gastroesophageal junction. The following aspects must be observed for a long-term effective antireflux procedure:

- The wrap must be constructed over the distal esophagus, just proximal to the gastroesophageal junction, and must be fixed to the esophagus to remain in that position permanently.
- The wrap must be constructed without tension using the fundus of the stomach.
- The total wrap (e.g. "floppy" Nissen fundoplication) should be approximately two centimeters in the length in its anterior aspect (longer in its back). The partial wrap (anterior or posterior, e.g. Toupet fundoplication) is usually between one and a half to twice the length of the total wrap.
- The wrap must lie below the diaphragm without tension.
- Hernia must be corrected if one is present. The diaphragmatic hiatus must be gently attached to the esophagus, above the wrap.

Procedure Selection:

Selection of the surgical procedure and approach is based upon an assessment of esophageal contractility and length. A trans-abdominal approach is used in patients with normal esophageal contractility and length. Patients with poor contractility or questionable esophageal length are approached trans-thoracically. Those with weak esophageal contractions and/or abnormal wave progression are treated with a partial fundoplication in order to avoid the increased outflow resistance associated with a complete fundoplication.

In the majority of patients who have good esophageal contractility and normal esophageal length the laparoscopic Nissen fundoplication is the procedure of choice for a primary antireflux repair.

Technique:

Abdominal open Nissen fundoplication:

- ***Incision:***

✔ An upper midline incision from the xiphisternum to at least the umbilicus is required for good exposure. The incision can be extended below the umbilicus if necessary.

✔ Exposure can be optimized by: (1) displacing the mobile organs inferiorly by tilting the head of the operating table upwards; and (2) elevating the costal margins away from the operating table, as well as retracting them laterally and superiorly, using a retractor fixed to the operating table.

- Access to the gastro-oesophageal junction can be improved further by: (1) decompression of the stomach with a nasogastric tube; (2) retraction of the stomach inferiorly by the assistant using the nasogastric tube to achieve atraumatic purchase on the stomach (3) division of small peritoneal bands to the visceral surface of the spleen to prevent an inadvertent capsular tear; and (4) gentle retraction of the liver to the right after dividing the left triangular ligament and folding the left lobe inferiorly.
- Initial mobilization of fundus a small window is made in the peritoneum of the gastrosplenic ligament adjacent to the stomach at the level of the middle of the anterior border of the spleen. Individual leashes of vessels in this layer are ligated and divided progressively up as far as the angle of His, with division of the intervening peritoneum. Metal clips can be used to ligate the splenic ends of these cords as they are unlikely to become dislodged. This mobilization of the fundus allows progressively greater retraction of the stomach anteriorly, inferiorly and to the right.
- Initial mobilization of distal oesophagus the relatively avascular plane surrounding the oesophagus must be developed. This is best entered by dividing the peritoneal reflection of the phreno-oesophageal ligament to the left of the oesophagus and cauterizing and dividing small vessels to the left of the oesophagus.
- Identification and preservation of anterior and posterior vagal trunks at this stage the anterior vagal trunk is visible and palpable as a cord just to the right and anterior to the oesophagus. This is best gently retracted with a fine rubber sling. The posterior vagal trunk is visible between the crura posterior to the plane of dissection.
- Encircling the oesophagus from the left by passing the index finger behind it and the thumb

between the anterior vagal trunk and the oesophageal wall to make a small window in the residual tissue anchoring the right side of the distal oesophagus. A narrow Penrose drain, passed through the window and around the oesophagus, thereafter acts as the principal oesophageal retractor.

- With the oesophagus and anterior vagal trunk gently retracted to the left and right, respectively, the residual tissue anchoring the right side of the oesophagus can be mobilized, cauterized and divided under direct vision. At completion three fingers should be able to pass behind the oesophagus and through the window to the left of the anterior vagal trunk without tension. Any tension requires further mobilization in whichever is the appropriate direction.
- Crural plication with the oesophagus retracted to the right, the margins of the hiatus are identified by a combination of sharp and blunt dissection and loosely plicated with one to three 0 polypropylene (Prolene) sutures, anterior to the posterior vagal trunk.
- Fixing the fundoplication the anaesthetist passes a 52-56-Fr Hurst mercury bougie orogastrically, which acts as a stent for the fundoplication. The fundoplication is secured with two or three 2/ 0 Prolene sutures. The oesophageal wall does not need to be incorporated in these sutures, as is commonly practised, as the fundoplication sits on the left gastric leash of vessels and cannot slip inferiorly. A single suture between the left wall of the oesophagus and the fundus prevents eversion of this aspect of the fundoplication.
- Wound closure haemostasis and the position of the nasogastric tube are checked and the abdomen is closed without drainage ***(Donald et al., 2006).***

Laparoscopic Nissen fundoplication:

- Patients undergo general anesthesia and are placed in a low lithotomy position and brought into a reverse Trendlenberg position with an angle of approximately 25^0. The surgeon stands between the legs of the patient. A Veress needle is used in all cases to achieve pneumoperitoneum regardless of the previous surgical history.
- A total of five 5-mm trocars are used in most of patients. The locations of the trocars are (1) left subcostal at the anterior axillary line, (2) left subcostal at the mid-clavicular line, (3) left to the sub-xyphoid, (4)6 cm below the sub-xyphoid over the midline area, and (5) right mid-clavicular line. When the sixth port is used, it is placed right lateral to the midline at the level of the umbilicus. The sub-xyphoid port is used for a 5-mm (0) camera, or better a 45° lens is used so that a downward view of the operative field can be obtained through the supra-umbilical port. The remaining trocar sites are working right lateral ports used to retract the left lobe of the liver **(Fig 1)**.
- A nasogastric tube is placed for gastric decompression, though occasionally placement must wait until the hiatal hernia has been reduced in order to get the tube to traverse the gastroesophageal junction. Complete dissection of the hiatus with nothing in the esophagus is perfectly acceptable. Starting the dissection by opening the lesser sac near the caudate lobe of the liver immediately exposes the right crus as a landmark, facilitating the rest of the dissection. The space between the right crus and esophagus is then opened, followed by the complete dissection of the right crus posteriorly until it is seen joining the left crus, actually dissecting the majority of the left crus and creating as much of the posterior esophageal window as possible from the right side of the esophagus **(Fig 2)**.

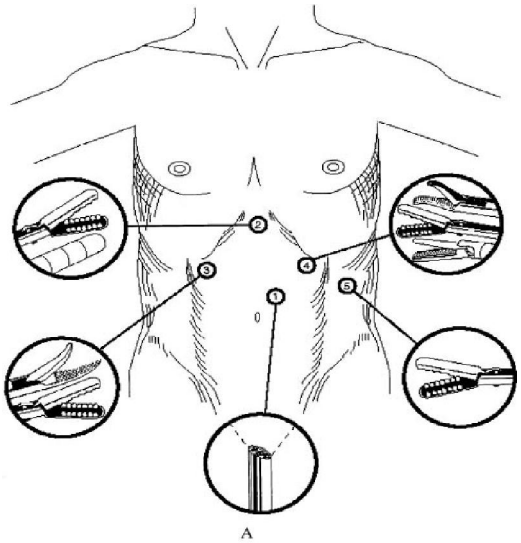

Fig. 1: The trocar sites.

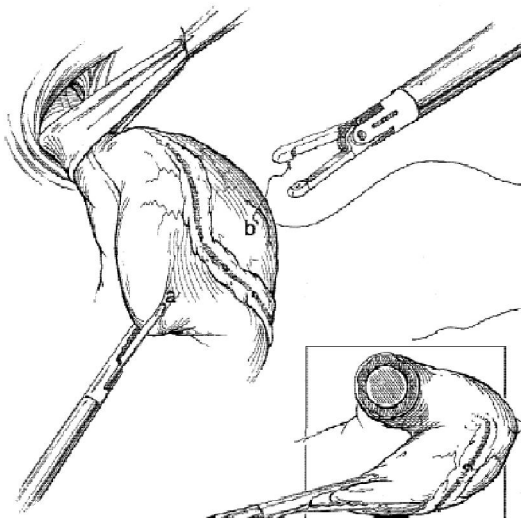

Fig. 2: Marking the posterior wall.

▪ Once the anterior esophageal peritoneal covering is opened, and the fundus and angle of His is taken down, the window behind the esophagus is already completely open and little further dissection is required i.e. Hepato-gastric ligaments are divided, and the phreno-esophageal ligaments are divided anteriorly to free the anterior esophagus. The anterior and posterior vagus nerves are left intact. The esophago-gastric junction is brought back into the abdominal cavity approximately 4 to 5 cm in length; the most important technical point of the entire operation is to *completely* take down the fundus off of the left hemi-diaphragm, as the fundus is what makes up the wrap, not the body.

▪ This requires sharp dissection of the peritoneum just above the fundus from the left crus all the way over to the first short gastric vessel, followed by *extensive* blunt dissection behind the fundus until it is laying there floppy. The window behind the esophagus will then be huge, and any remaining attachments can easily be removed using a blunt dissector applied from the patient's right side, short gastrics and gastro-phrenic ligaments are divided by a 5-mm *Liga-sure* handle or the *Harmonic Scalpel*, thus facilitating full fundic mobility, It may not be necessary to take down any short gastric vessels as long as this technique is used **(Fig 3)**.

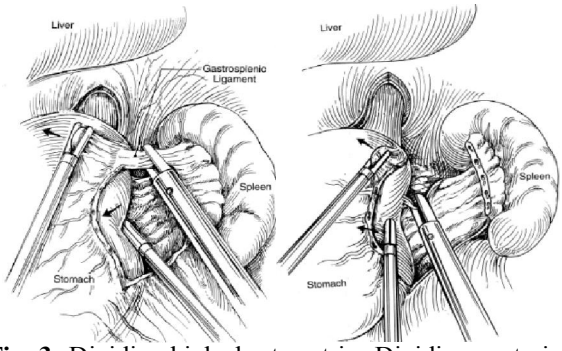

Fig. 3: Dividing high short gastrics Dividing posterior peritoneum of the stomach.

▪ There is always ample fundus to use for the wrap using this dissection approach, but they are classically taken in classic Nissen's procedure. Crural stitches are placed to close the hiatal defect with the 0-Ethibon interrupted stitch using ESS (Ethicon Suture System, Ethicon Endo-Surgery, Inc., Cincinnati, Ohio, USA). A full 360^0 wrap is performed in all with or without a bougie in place e.g. Tubingen balloon.

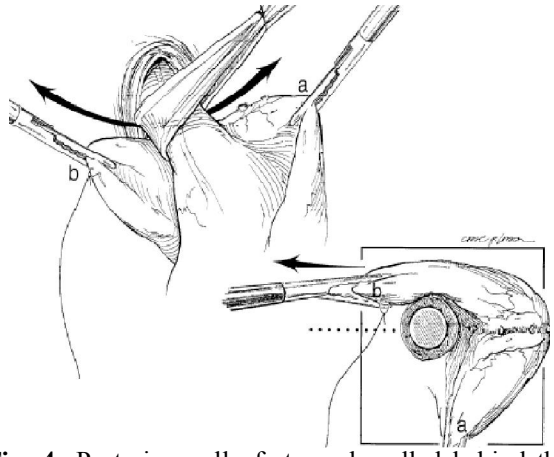

Fig. 4: Posterior wall of stomach pulled behind the esophagus.

▪ The fundus of the stomach is pulled behind the esophagus, brought to the right side of the esophagus, and released **(Fig 4)**. If there was no tendency for the fundus to retract back to the left side, we considered this to be adequate mobilization and followed this by a loose wrap. A total of three intra-operative stitches are placed taking a sero-mucosal bite of the stomach, then the esophagus, and then the stomach. Finally, the area is irrigated with normal saline until the fluid is completely clear and the excess is removed. The ports are then removed and the pneumoperitoneum is relieved. Preemptive anesthesia is used in all the port sites, and at the end of the procedure local anesthesia with lidocaine 1% and Marcaine 0.5% (50/50 mixture), approximately 25 ml in all, is used. The wounds are closed with a 4-0 Monopril interrupted stitch ***(Cai et al., 2008).***

Laparoscopic Toupet fundoplication

- The patient is positioned on the operating room table in supine position, with their arms tucked. After intubation and induction of general anesthesia, a urinary catheter is placed and an upper midline incision is made from subxiphoid to supraumbilical. Raising the head of the bed 20°–30° helps to cause the small intestine and omentum to fall inferiorly creating maximum hiatal exposure.
- Retraction of the left lobe of the liver forward to expose the esophageal hiatus. At this point it may be necessary to divide the left triangular ligament of the liver.
- The phrenoesophageal ligament is incised circumferentially around the esophagus to display the edges of the two hiatal pillars. Attention to detail is required during this dissection to prevent injury to the left and right vagal trunks that are found anteriorly and posteriorly respectively. Additionally, the surgeon

must be meticulous during this dissection to avoid iatrogenic esophageal perforation.

- When the distal esophagus is thoroughly freed from its surroundings, umbilical tape or a Penrose drain is placed behind and around the esophagus to retract it anteriorly exposing the posterior hiatus.
- The stomach is retracted inferiorly to expose 5–6 cm of distal esophagus. The hiatus is then closed posteriorly with interrupted permanent suture.
- Hiatal closure can be tight when repairing a large hiatal or paraesophageal hernia, or preferably somewhat lax when performing a fundoplication, particularly in a patient with a motility disorder such as achalasia.
- The short gastric vessels are ligated along the upper third of the gastric fundus (from the inferior pole of the spleen proximally, or approximately 10–15 cm inferior to the Angle of His) allowing free rotation of the gastric fundus without tension.
- A retroesophageal window is created and the posterior wall of the fundus is grasped and dragged behind the posterior vagus and posterior distal esophagus. A "shoeshine" maneuver is performed to confirm that no twisting of the esophagus is present **(Fig. 5)**. If the fundus is grasped and pulled correctly, it should lie to the right of the esophagus without retracting back when let free.

Fig. 5: "Shoe shine" maneuver ***(Broeders et al., 2011).***

- Retraction of gastric fundus towards midline, which in turn retracts the esophagus, exposing the posterior hiatus **(Fig. 6).** A posterior gastropexy is performed by suturing the posterior fundus to the inferior crus with one to three interrupted permanent sutures.

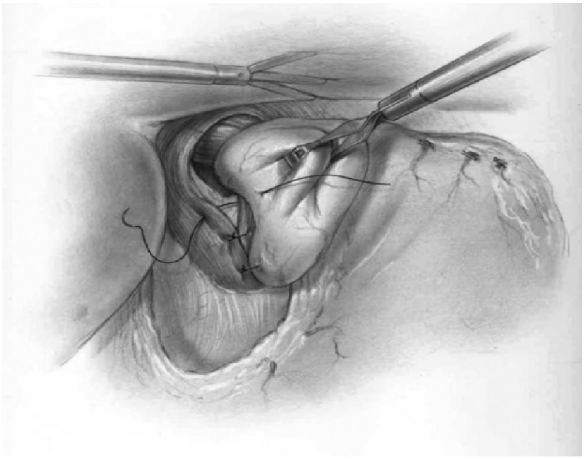

Fig. 6: Posterior gastropexy sutures with crural closure ***(Broeders et al., 2011).***

- A bougie is then placed carefully.
- Two coronal stitches are placed at 10 and 2 o'clock securing the shoulders of the fundus to the diaphragmatic hiatus. Next, two to three interrupted sutures are placed from the esophagus to the left and right fundus **(Fig. 7)** ***(Stefanidis et al., 2012).***

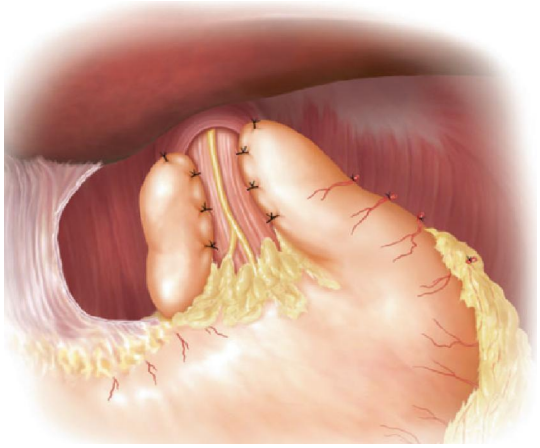

Fig. 7: Completed posterior partial fundoplication ***(Broeders et al., 2011).***

3. Results

Statistical analysis:

Recorded data were analyzed using the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean± standard deviation (SD). Qualitative data were expressed as frequency and percentage.

The following tests were done:

- Independent-samples t-test of significance was used when comparing between two means.

- Chi-square (x^2) test of significance was used in order to compare proportions between qualitative parameters.
- The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following:
- Probability (P-value)
  - P-value <0.05 was considered significant.
  - P-value <0.001 was considered as highly significant.
  - P-value >0.05 was considered insignificant.

The results of the present study are demonstrated in the following tables and figures.

Table (5): Comparison between groups according to demographic data.

Demographic data	Group I: Nissen *(n=10)*	Group II: Toupet *(n=10)*	t/x2#	p-value
Age (years) Mean±SD Range	 34.70±7.12 24-46	 36.00±7.59 25-49	0.156	0.697
Sex Female Male	 5 (50.0%) 5 (50.0%)	 5 (50.0%) 5 (50.0%)	0.000	1.000
Residence Giza Kaliobeya Menoufia Sharqiya	 1 (10.0%) 4 (40.0%) 4 (40.0%) 1 (10.0%)	 0 (0.0%) 5 (50.0%) 3 (30.0%) 2 (20.0%)	1.587	0.662

t-Independent Sample t-test; #x^2: Chi-square test
p-value >0.05 NS

This table shows no statistically significant difference between groups according to demographic data.

Table (6): Comparison between groups according to medical history.

Medical History	Group I: Nissen *(n=10)*	Group II: Toupet *(n=10)*	x2	p-value
Heart Burn Negative Positive	 1 (10.0%) 9 (90.0%)	 1 (10.0%) 9 (90.0%)	0.000	1.000
Regurge Negative Positive	 2 (20.0%) 8 (80.0%)	 1 (10.0%) 9 (90.0%)	0.392	0.531
Chest Pain Negative Positive	 8 (80.0%) 2 (20.0%)	 8 (80.0%) 2 (20.0%)	0.000	1.000
Dysphagia Negative Positive	 6 (60.0%) 4 (40.0%)	 6 (60.0%) 4 (40.0%)	0.000	1.000
Odynophagia Negative Positive	 10 (100.0%) 0 (0.0%)	 10 (100.0%) 0 (0.0%)	0.000	1.000
Hoarseness Negative Positive	 10 (100.0%) 0 (0.0%)	 10 (100.0%) 0 (0.0%)	0.000	1.000
Asthma Negative Positive	 10 (100.0%) 0 (0.0%)	 10 (100.0%) 0 (0.0%)	0.000	1.000
Cough Negative Positive	 10 (100.0%) 0 (0.0%)	 10 (100.0%) 0 (0.0%)	0.000	1.000

#x^2: Chi-square test; p-value >0.05 NS

This table shows no statistically significant difference between groups according to medical history.

Table (7): Comparison between groups according to investigation.

Investigation	Group I: Nissen *(n=10)*	Group II: Toupet *(n=10)*	t/x2#	p-value
Hiatus Hernia (HH) Negative Positive	 2 (20.0%) 8 (80.0%)	 4 (40.0%) 6 (60.0%)	0.000#	1.000
Erosive esophagitis Negative Positive	 6 (60.0%) 4 (40.0%)	 4 (40.0%) 6 (60.0%)	0.800#	0.371
Barrett's esophagus Negative Positive	 10 (100.0%) 0 (0.0%)	 10 (100.0%) 0 (0.0%)	0.000#	1.000
LES Pressure mmHg Mean±SD Range	 10.70±4.52 3-17	 12.60±2.07 9-15	1.460	0.243
Esophageal Body Peristalsis% Mean±SD Range	 88.00±19.89 50-100	 90.50±15.71 60-100	0.097	0.759
DeMeester Score Mean±SD Range	 21.00±4.67 15-29	 19.30±4.69 15-30	0.660	0.427
No. of Episodes Mean±SD Range	 9.40±4.38 4-16	 6.60±2.99 3-12	2.791	0.112

t-Independent Sample t-test; #x^2: Chi-square test p-value >0.05 NS

This table shows no statistically significant difference between groups according to investigation.

Table (8): Comparison between groups according to anatomical failure & recurrence.

	Group I: Nissen *(n=10)*	Group II: Toupet *(n=10)*	x2	p-value
Anatomical Failure Negative Positive	 10 (100.0%) 0 (0.0%)	 10 (100.0%) 0 (0.0%)	0.000	1.000
Recurrence Negative Positive	 10 (100.0%) 0 (0.0%)	 10 (100.0%) 0 (0.0%)	0.000	1.000

x^2: Chi-square test; p-value >0.05 NS

This table shows no statistically significant difference between groups according to anatomical failure and recurrence.

Table (9): Comparison between groups according to symptoms relieve.

Symptoms Relieve	Group I: Nissen *(n=10)*	Group II: Toupet *(n=10)*	x2	p-value
Heart Burn Negative Positive	 8 (90.0%) 2 (10.0%)	 5 (50.0%) 5 (50.0%)	0.879	0.348
Regurge Negative Positive	 9 (90.0%) 1 (10.0%)	 7 (70.0%) 3 (30.0%)	0.312	0.576
Chest Pain Negative Positive	 7 (70.0%) 3 (30.0%)	 8 (80.0%) 2 (20.0%)	0.267	0.606

x^2: Chi-square test; p-value >0.05 NS

This table shows increase symptoms relieve of group I: Nissen compared to group II: Toupet according to symptoms relieve, there is no statistically significant difference between groups.

Table (10): Comparison between groups according to complications.

Complications	Group I: Nissen *(n=10)*	Group II: Toupet *(n=10)*	x2	p-value
Dysphagia				
Negative	7 (70.0%)	8 (80.0%)	0.267	0.606
Positive	3 (30.0%)	2 (20.0%)		
Chest pain on eating				
Negative	7 (70.0%)	8 (80.0%)	0.267	0.606
Positive	3 (30.0%)	2 (20.0%)		
Gas-Bloat				
Negative	7 (70.0%)	9 (90.0%)	1.250	0.264
Positive	3 (30.0%)	1 (10.0%)		
Postprandial fullness				
Negative	1 (10.0%)	2 (20.0%)	0.392	0.531
Positive	9 (90.0%)	8 (80.0%)		
Restriction in belching				
Negative	5 (50.0%)	6 (60.0%)	0.202	0.653
Positive	5 (50.0%)	4 (40.0%)		
Increased flatus				
Negative	1 (10.0%)	2 (20.0%)	0.392	0.531
Positive	9 (90.0%)	8 (80.0%)		

x^2: Chi-square test; p-value >0.05 NS

This table shows increase complications of group I: nissen compared to group II: toupet according to complications, there is no statistically significant difference between groups.

4. Discussion

The final goal of Laparoscopic Anti-reflux Surgeries (LARS) is to improve the Quality of Life (QoL) of patients with GERD by controlling reflux symptoms, and to reduce or eliminate reflux-related complications. However, it is controversial whether subjective descriptions or objective examination findings are more appropriate for evaluating the efficacy of Laparoscopic Anti Reflux Surgeries (LARS).

In this study, we studied the outcome and postoperative complications of (20) patients undergoing Laparoscopic Nissen Fundoplication (LNF) & Laparoscopic Toupet Fundoplication (LTF). According to the findings from this study, the following conclusions can be drawn. First, the prevalence of patient satisfaction was similar between LNF and LTF, and was high (LNF, 89.17 %; LTF, 87.42 %). Second, LTF was as effective as LNF with respect to symptom control. Third, the prevalence of postoperative dysphagia was higher after LNF.

Strate et al. (2018) used patients' main complaint, 24-h pH monitoring and endoscopy for the evaluation of GERD recurrence, and found that a large proportion of patients who had positive 24-h pH monitoring tests or esophagitis seen on endoscopy did not complain of recurrent reflux symptoms. Since GERD is mainly defined on the basis of patients' symptoms, the present study assessed patients' subjective symptoms as the most appropriate index for evaluating the efficacy of Laparoscopic Anti-Reflux Surgeries. In the present study, severity of patients' postoperative symptoms and Quality of Life were evaluated by the use of specific questionnaires, and showed that LNF and LTF resulted in similar significant improvements in short-term (6 months) Quality of Life and relief of typical GERD symptoms such as heartburn, regurgitation and chest pain. Additionally, patients were equally satisfied (nearly 90%) with LNF and LTF, a result that is supported by a previous study, **Shaw et al (2010)**. Therefore, based on patient satisfaction, LNF and LTF appear to be equally effective and safe for the treatment of GERD.

Although Laparoscopic Anti-Reflux Surgeries can effectively control reflux symptoms, it may be associated with several complications, the most common being dysphagia.

Anatomic factors including a tight wrap, distal migration of the wrap over the stomach, migration of the wrap into the mediastinum, or tight approximation of the crura had been initially implicated in the

pathogenesis of postoperative dysphagia. Whether partial fundoplication may provide adequate reflux control and minimize complications associated with an 'over-tight' fundal wrap is still controversial.

It is generally accepted that a weakened LES can lead to gastro-esophageal reflux. In the present study, both LNF and LTF significantly improved Lower Esophageal Sphincter Pressure (LESP) 6 months after surgery, although the improvement was more significant after LNF than after LTF. Uncertainty exists over what level of LESP can prevent reflux while still avoiding dysphagia. Moreover, even though the increase in LESP was significantly less after LTF than after LNF, the increase seemed sufficient to prevent the reflux of gastric contents. Results of the present study also support the view that LTF can control reflux symptoms for GERD.

Excessive elevation of LESP after LNF may frequently lead to incomplete relaxation of the esophageal sphincter, creating high esophageal outflow resistance and leading to further persistent dysphagia as illustrated by (***Shan et al., 2010)***. In the present study, dysphagia was more common after LNF than after LTF, an observation supported by previous studies ***(Watson et al., 2015).***

In contrast, (***Mickevicius et al., 2013)*** study observed that the prevalence of postoperative dysphagia was not related to the type of fundoplication, but to the wrap length. A recent study, conducted by (***Qin et al., 2013)***, demonstrated that in the short term (4 days after surgery), the incidence of dysphagia was higher after LNF compared with LTF, but that the difference was decreased significantly at 1 year after surgery.

As for whether preoperative Esophageal motility (EM) was an indication for "tailored therapy", the subgroup analyses showed that Esophageal Motility was not correlated with postoperative dysphagia, indicating that "tailored therapy" according to Esophageal Motility was not indicated, which was consistent with other reports published by (***Broeders et al., 2014)***. It should be noted that the definition of Esophageal Motility in the included studies was not consistent, which might affect the ability to reach true conclusion.

Chicago classification is the newest and the most comprehensive criteria of diagnosing Esophageal Motility disorders to date, which was defined by utilizing high resolution esophageal manometry instead of traditional esophageal manometry. Unfortunately, none of included patients in our study used Chicago classification to evaluate esophageal dysmotility.

In the study conducted by (***Lund et al., 2017)***, it showed patients with impaired esophageal body motility who underwent Nissen fundoplication had a higher rate of moderate-to-severe dysphagia compared with patients with normal esophageal body motility. In the present study there was no significant difference between the two groups. The differences in these results may be attributed to differences in technical skills between surgeons, to the preoperative esophageal body motility or to the length of follow-up.

The cause of the gas-bloat syndrome has been attributed to several complex anatomic and functional factors, including vagus nerve injury, slippage, dislocation or disruption of the wrap, defective LES relaxation, preexisting gastric motility disorders, or even to a completely different mechanism of belching in postfundoplication patients. A recent study demonstrated that belching pattern is altered by LNF, by reducing gastric belching (air venting from the stomach) and increasing supragastric belching (no air venting from the stomach) ***(Broeders et al., 2011)***. In our study, LTF was superior in terms of gas-bloat syndrome. A tendency for fewer gas bloat symptoms after LTF in the follow up period has also been reported in prior studies ***(Trus et al., 2016).***

In this study, reappearance of GERD symptoms was not found to correlate with GERD recurrence. GERD symptoms may result from acid reflux, esophageal hypersensitivity, sustained esophageal contractions or abnormal tissue resistance. Esophageal hypersensitivity may be an independent phenomenon or may overlap with GERD. It describes a condition in which an esophageal stimulus induces GERD symptoms but without any esophageal injury. In other words, patients with esophageal hypersensitivity have a lower threshold for the perception of physiologically nonpainful stimuli.

In our study, reappearance of GERD symptoms (heart pain and regurge) occurred in (30,20%) of patients following LNF and (20,10%) of patients following LTF. However, the DeMeester scores after both LNF and LTF were not measured. Therefore, several recent publications held the view that the recurrence of GERD should be identified by pH studies instead of simply subjective symptoms ***(Thompson et al., 2017).***

Worries regarding GERD recurrence have long made surgeons to select the Nissen technique rather than the Toupet technique. However, the inadequate data about reflux recurrence with LNF and LTF in our experience appears to be dt. Short follow up period and lack of objective testing. In contrast (***Farrell et al., 2010)*** showed a higher rate of recurrence after LTF at 1 year, but the significance of their data is impaired by significant differences in the sample size of the two groups. In skilled hands, the risk of postoperative heartburn and regurgitation after Laparoscopic Anti-Reflux Surgeries is directly related to the laparoscopic technique and is now very low. Patients should be

informed of the likely benefits of fundoplication on recurrence as well as the potential risk of complications so that they can make an informed decision about these surgical options.

The present study is not without limitations. The sample size was relatively small, was from a two centers and all patients refused the postoperative objective evaluations. Evaluation of postoperative dysphagia, a subjective questionnaire was used to determine whether patients had dysphagia or not during follow-up, Grading of dysphagia was done by applying Likert scale in the postoperative clinical assessment. In addition, the follow-up was relatively short. Larger multicenter trials are necessary to firmly establish the differential effectiveness of these two procedures.

Conclusion:

In conclusion, Laparoscopic Toupet Fundoplication seems to be as safe and effective as Laparoscopic Nissen Fundoplication, but showed a lower incidence of postoperative dysphagia.

While this study sought to characterize post-operative efficacy of two fundoplication procedures, the optimal anti-reflux strategy for patients with GERD still remains inconclusive given the current literature available. Additional multicenter prospective studies with long-term follow-up data are needed.

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