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ORIGINAL ARTICLE

Laparoscopic Posterior Partial Fundoplication Versus Total Fundoplication in Anti-reflux Surgery: A Comparative Study

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Abstract

The aim of the present study was to evaluate advantages of partial posterior fundoplication (PPF) compared with traditional total fundoplication (TF). The study included 90 patients with GERD at El-Minia University Hospital between January 2019 and January 2023, divided randomly into group A: PPF (no. 45 patients) and group B: TF (no. 45 patients). All included patients had endoscopic hiatal hernia and various degrees of esophagitis. Postoperative follow-up included satisfaction questionnaire, degree of heartburn questionnaire, frequent belching, inability to belch, bloating, diarrhea, vomiting, abdominal pain, and endoscopic evaluations. Heartburn improved in all patients ($p=0.000$). Shorter operative time was observed in group B ($p=0.007$). There is no significant difference in overall satisfaction level between the two groups ($p=0.5$). Surgical treatment is the favorite option for the treatment of GERD. PPF has the advantage of shorter operative time and can be safely used with outcomes similar to that of TF.

Keywords Fundoplication · Anti-reflux surgery · Nissen · Toupet

Introduction

Proton pump inhibitors (PPIs) are one of the therapeutic options for patients with GERD. However, anti-reflux surgery is now a well-established therapeutic option. Laparoscopic anti-reflux surgery has been proved to be more effective than PPIs for treatment of GERD [1, 2] with elimination of some dangerous long-term side effects of PPIs [3, 4]. Laparoscopic anti-reflux surgery restores the functional and anatomical insufficiencies in the EGJ. However, it is considered much invasive and has some unavoidable mechanical complications such as bloating and dysphagia [5]. Total Nissen fundoplication (TF) is the most commonly performed anti-reflux surgery [6]. Alternative surgical procedures have been invented aiming at minimizing the mechanical complications of TF [7]. Toupet invented his 180° posterior wrap in the 1960s, and thereafter an anterior 180° wrap was designed [8]. A series of randomized clinical studies reported that partial fundoplication (PF) is associated with fewer mechanical complications (e.g., flatulence and bloating) than TF [9, 10]. However, it is reported that TF is better than PF in terms of reflux control, durable function of the wrap and recurrence rate [11, 12]. This implemented modification of PF to encircle 3/4 the circumference of the lower esophagus what is called laparoscopic posterior partial fundoplication (PPF). The aim was to maintain the advantages of fewer mechanical complications of the partial wrap and the advantages of reflux control of TF. The aim of the present study was to evaluate the advantages of PPF compared with a traditional TF.

Patients and Methods

The study included 90 patients with GERD at El-Minia University Hospital between January 2019 and January 2023. The study was approved by Minia College of Medicine Institutional Ethics Committee. Written informed consent was obtained from all included patients. Patients were divided randomly into two groups; group A: PPF (no. 45 patients) and group B: TF (no. 45 patients). Patient selection was made using simple randomization (1:1 ratio); PPF was applied to one patient and TF to the other patient, in

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sequential order. The study included patients aged 18–75 years with GERD symptoms, mainly heartburn and acid regurgitation. GERD diagnosis was confirmed by ambulatory pH monitoring showing increased acid exposure over 24 h. Esophagitis was graded according to Los Angeles classification (LA) [13]. Patients with previous anti-reflux surgery or major upper abdominal surgical procedures, type II to IV hiatal hernia and those with esophageal motility disorders were excluded. All included patients had endoscopic hiatal hernia and various degrees of esophagitis. Patients' data including age, sex, grade of esophagitis, duration of preoperative symptoms and medical treatment, date of surgery, duration of operation, postoperative follow-up, postoperative complications, and reoperation were all recorded. Preoperative investigations included 24-h pH monitoring, upper GI endoscopy, and esophageal manometry. Postoperative follow-up included satisfaction questionnaire assessing presence or absence of dysphagia to solids or liquids on 0–4 scale (0: no swallowing problems, 1: difficult swallowing of solid food, 2: difficult swallowing of soft food, 3: difficult swallowing of liquids, and 4: difficult swallowing of both solids and liquids). Another questionnaire determining the degree of heartburn, frequent belching, inability to belch, bloating, diarrhea, vomiting, abdominal pain on 0–4 scale (0: no symptoms, 1: mild (notable but not annoying every day), 2: moderate (notable and annoying every day), 3: often (influencing daily life), and 4: very often (limiting daily life)) was administered to all patients [14]. Gastroesophageal reflux disease health-related quality of life (GERD-HRQoL) questionnaire was administered to patients preoperatively, 2 and 12 months postoperatively together with endoscopic evaluations. Postoperative satisfaction was assessed using 0–4 scale (1: very satisfied, 2: satisfied, 3: neutral, and 4: not satisfied) [16]. All patients were followed up for 1 year.

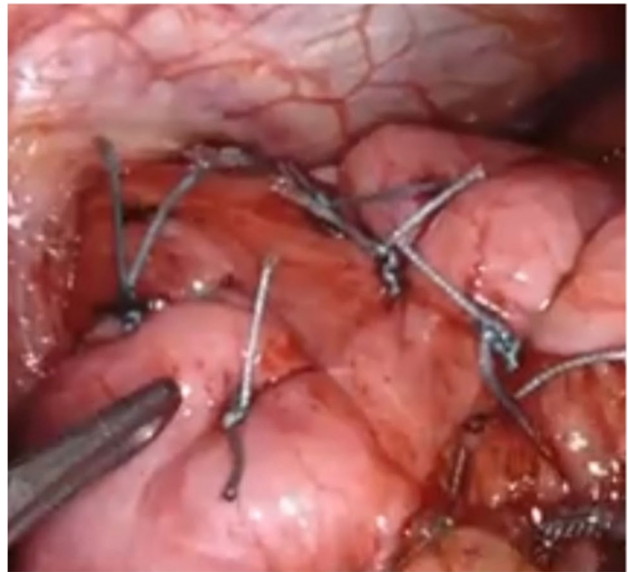

Fig. 1 Laparoscopic posterior partial fundoplication

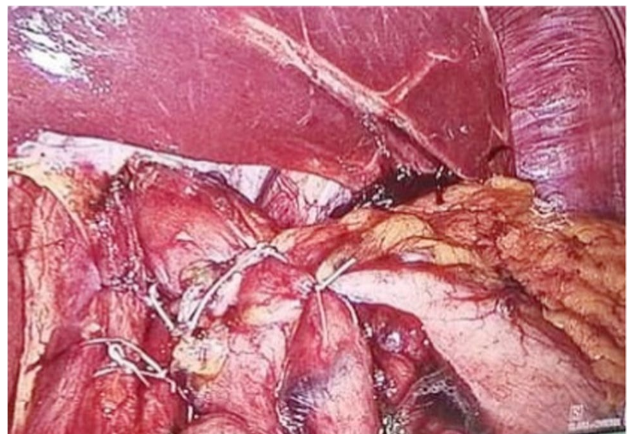

Fig. 2 Total fundoplication

Surgical Technique [15]

With patient in reversed Trendelenburg, 5-trocar technique was used with surgeon standing between patient's legs. Ultracision harmonic scalpel was used. Incision of the lesser omentum and peritoneum covering the hiatal region with exposure of left and right crus was done. Division of short gastric vessels was done to mobilize the upper part of gastric fundus. The distal esophagus was mobilized for at least 5 cm to ensure intra-abdominal position of EGJ and wrap. For PPF patients, gastric fundus was pulled posteriorly around the distal part of esophagus and EGJ for approximately 3/4 the circumference and anchored posteriorly to left and right crus with 3 ethibond 2/0 sutures for each. Then, 3–4 sutures were applied between edges of the wrap and esophageal wall (Fig. 1). For TF patients, right and left edges of the wrap were sutured together 3 ethibond 2/0 sutures from EGJ and cranially for at least 2 cm (Fig. 2). Bougies were used in all patients. All procedures were performed by only one surgeon.

Statistical Analysis

Values were given as *medians* ± *SD (*standard deviation) or percentage. Independent sample *T*-test was used to compare parametric data, whereas chi-square tests used to compare non-parametric data. *P* value of less than 0.05 was considered statistically significant.

Results

The involved 90 patients were divided randomly into two groups; group A: PPF (no. 45 patients) and group B: TF (no. 45 patients). There were no significant differences in age, sex, BMI, incidence of esophagitis or Barrett's esophagus between the two groups. There was also no significant difference in the preoperative clinical data as regard duration of symptoms or duration of medical treatment between the two groups ($p = 0.4$, 0.6; respectively). Preoperative Grade A esophagitis was the most common in both groups (64% vs. 60%), with no significant difference between the two groups ($p = 0.5$) (Table 1). Operative time was significantly shorter in group B (PPF) ($p = 0.007$). Hospital stay was almost the same for both groups (*mean* = 1.86, 1.73 days; respectively) ($p = 0.3$). Complications in group A developed in 2 patients; port site bleeding in one patient which was controlled laparoscopically and infected hematoma in another patient treated conservatively. However, in group B, only one patient developed DVT which was treated conservatively. There was no significant difference in incidence of complications between the two groups ($p = 0.5$). Reoperation was needed in one patient in group A due to unimproved difficult swallowing during the year of follow-up, but without significant difference between the two groups ($p = 0.3$). There was also no significant difference between the two groups as regard postoperative symptoms which were treated conservatively. Endoscopy at second postoperative month showed no esophagitis in 11 patients (12%), while endoscopy at twelfth postoperative month revealed complete improvement of esophagitis in 78 patients (86.7%). There was no significant difference between the two groups as regards the two follow-up endoscopies ($p = 0.8$, 0.5; respectively). As regards overall satisfaction level, 48 patients were very satisfied (53.3%); 35 patients were satisfied (38.9%); 5 patients were neutral (5.5%); and 2 patients were not satisfied (2.2%) with their resulting condition ($p = 0.5$) (Table 2). Heartburn was improved in all patients with significant difference between preoperative and postoperative periods in each group ($p = 0.000$) (Table 3). PPIs were recommended for all patients with grade A and B esophagitis diagnosed in the twelfth postoperative month.

Discussion

PPF had been shown to be as successful as TF in randomized controlled trials [16–18]. A study by Negre [19] showed bothersome gastrointestinal symptoms in 26% of patients and unbearable gastrointestinal complaints in 10%, while Swanstrom and Wayne [20] reported postoperative gastrointestinal symptoms in 96% of patients. This wide difference in results in literature may be due to that not all patients were operated on by the same surgeon and postoperative evaluation was made by different observers. This was overcome in the present study as all patients were operated on by the same surgeon, and postoperative assessment was done by a single observer. Dysphagia and bloating were discussed in the literature as the most common postoperative symptoms [21, 22]. In the present study, 23 patients (25.5%) reported various degrees of bloating, with equal number in both groups reporting mild bloating not affecting daily life. Only one patient in TF group reported medium bloating that affects daily life which may not be related to reflux surgery [23, 24]. Postoperative dysphagia may be divided into early and late forms. It may be due to several reasons (e.g., undiagnosed motility disorder, denervation of the lower esophagus, and tight wrap) [25, 26]. Different rates of dysphagia were reported in the literature; 25% by Beldi and Glattti [27], 34% by Frantzides et al. [28] and 10% by Parsak et al., it was mainly to solid food [14]. In the present study, dysphagia was reported in 6 patients (6.7%) which was consistent with

Table 1 Patients' preoperative data

Data	Group A	Group B	*p* value
Age (*mean*, *SD*)	36.46 *SD* 8.17	35.35 *SD* 9.46	0.5
Sex (no., male/female)	21/24	22/23	0.8
BMI (*mean*, *SD*)	27.93 *SD* 2.34	27.35 *SD* 2.44	0.2
Esophagitis (no., %)	10 (22)	11 (24.5)	0.8
Barrett's esophagus (no., %)	9 (20)	8 (18)	0.8
Duration of symptoms (*mean*, *SD*)	103.44 *SD* 40.01	110.44 *SD* 36.82	0.4
Duration of medical treatment (*mean*, *SD*)	104.44 *SD* 39.29	108.78 *SD* 36.25	0.6
Grade of esophagitis: (no., %)			0.5
A	29 (64)	27 (60)	
B	11 (24.5)	13 (29)	
C	3 (7)	4 (9)	
D	2 (4.5)	1 (2)	

Table 2 Intraoperative and postoperative data

	Group A	Group B	*p* value
Operative time (*mean*, *SD*)	123.11 *SD* 38.95	102.55 *SD* 31.92	**0.007**
Hospital stay (*mean*, *SD*)	1.89 *SD* 0.86	1.73 *SD* 0.45	0.3
Postoperative complications (no., %)	2 (4.5)	1 (2)	0.5
Reoperation (no., %)	1 (2)	0	0.3
Dysphagia	2 (4.5)	4 (9)	0.4
Frequent belching	2 (4.5)	2 (4.5)	1
Inability to belch	5 (11)	2 (4.5)	0.2
Bloating	11 (24.5)	12 (27)	0.8
Diarrhea	4 (9)	3 (6.5)	0.7
Vomiting	0	1 (2)	0.3
Abdominal pain	22 (49)	25 (55.5)	0.5
Recurrence of preoperative symptoms	3 (6.5)	2 (4.5)	0.6
Endoscopy at 2 months: (no., %)			0.8
- Normal	7 (15.5)	4 (9)	
- Grade A	31 (69)	35 (77.5)	
- Grade B	5 (11)	4 (9)	
- Grade C	2 (4.5)	2 (4.5)	
- Grade D	0	0	
Endoscopy at 12 months: (no., %)			0.5
- Normal	39 (87)	39 (87)	
- Grade A	3 (6.5)	5 (11)	
- Grade B	3 (6.5)	1 (2)	
- Grade C	0	0	
- Grade D	0	0	
Patient satisfaction: (no., %)			
- Very satisfied	25 (55.5)	23 (51)	
- Satisfied	17 (38)	18 (40)	
- Neutral	3 (6.5)	2 (4.5)	
- Not satisfied	0	2 (4.5)	

* Independent sample *T*-test, *p* value <0.05 is significant

Table 3 Preoperative and postoperative heartburn

	No symptoms	Mild	Moderate	Often	Very often	*p* value
Group A (no.)						
- Preoperative	0	0	18	25	2	**0.000**
- Postoperative	40	5	0	0	0	
Group B (no.)						
- Preoperative	0	0	16	28	1	**0.000**
- Postoperative	42	3	0	0	0	

*Chi-square test, *p* value <0.05 is significant

the literature and was mainly linked to swallowing of solid food [14]. While frequent belching postoperatively may indicate loose fundoplication, late frequent belching may suggest shift of the wrap representing an important symptom during follow-up. Inability to belch is also a common postoperative complaint in reflux patients which may be due to injury of afferent nerves of belch reflex during dissection of short gastric vessels. A recent study by Parsak et al. found that the rate of frequent belching and inability to belch to be 11.3% and 20%; respectively [14], while our study reported lower rate of 4.4% and 7.8%; respectively, which may be due to higher learning curve and meticulous dissection by our surgeon. Postoperative heartburn is not necessarily a symptom of GERD, as it may be attributed to previous irritation of

the esophagus, and it may take 3 months to resolve [28, 29]. Our study demonstrated heartburn to various degrees in all patients preoperatively, while this rate declines significantly to 8.9% postoperatively ($p = 0.000$) and occurred mostly once a week which did not bother the patient. Only 5.5% of patients had recurrent symptoms and underwent medical treatment. This was consistent with results of a study by Parsak et al. who reported postoperative decline of heartburn to 11.23% and recurrent symptoms in 7.5% of patients [14]. About 92.2% of patients were satisfied with their current condition, which was comparable to a previous study reporting satisfaction rate of 92.5% [14], proving that operation is well-tolerated and effective. Laparoscopic anti-reflux surgeries had been proven to be successful with low morbidity. Development of different postoperative symptoms may be attributed to nerve injury, tight wrap, shift of wrap into the chest, dietary habits, postoperative adhesions, and swallowing of air [30]. Our study limitations were small sample size and subjective nature of some data. Our study concluded that surgical treatment is a favorite option for treatment of GERD. PPF has the advantage of shorter operative time and can be safely used with outcomes similar to that of TF.

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Data Availability The authors confirm that the data supporting the findings of this study are available within the article.

Declarations

Consent to Participate Informed consent was obtained from all the individual participants included in the study. The study was approved by Minia College of Medicine Institutional Ethics Committee.

Conflict of Interest The authors declare no competing interests.

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