

Efficacy and Safety of Partial Posterior Fundoplication Compared to Total Fundoplication in GERD Patients: A Retrospective Study

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ABSTRACT

Background: Gastroesophageal reflux disease (GERD) is stomach content backflowing into the esophagus and causing discomfort. Fundoplication is a surgical intervention for the improvement of the function of the lower esophageal sphincter. While total fundoplication (TF) provides very effective control of symptoms, partial posterior fundoplication (PPF) has been shown to produce similar results with lower complication rates, thereby making it optimal and safer. The study compared the efficacy and safety of PPF and TF in GERD patients.

Method: This retrospective study was conducted on 100 patients diagnosed with GERD. PPF and TF were 50 participants in each group, and this study was conducted from October 2020 to October 2024. Patients 18 to 75 underwent preoperative evaluations before completing satisfaction and GERD-HRQoL questionnaires. The operations were performed by a single surgeon with a 5-trocar surgical approach for PPF and TF procedures. Based on the direct mobilization of the esophagus, hiatal repair, and wrapping of the fundus.

Result: The analysis compared the PPF and TF groups (50 patients each). The two groups had similar baseline demographics, clinical characteristics, and symptom severity. The average operating time was longer for PPF (p-values of 0.01). All postoperative outcomes, including symptom relief, endoscopic results, and satisfaction, were comparable; both groups showed a significant improvement in symptoms after surgery (p=0.000).

Conclusion: The study concluded that PPF and TF treatments significantly improved symptoms, with similar results in demographics, complications, satisfaction, and long-term relief despite longer PPF operative time.

Key-words: GERD, Partial Posterior Fundoplication (PPF), Total Fundoplication (TF), Symptom Relief and Postoperative Outcomes

INTRODUCTION

Gastroesophageal reflux disease (GERD) is a condition where the stomach contents backflow into the esophagus, which then leads to discomfort and potentially adverse health effects. Its incidence varies greatly across different world regions, with an estimated 14% global average. North America has a prevalence of nearly 19.6%, while Latin America stands at 12.9%.

GERD affects close to 34.6% of the population of Saudi Arabia. Dietary habits, lifestyle choices, and hereditary factors strongly influence how one is likely to fall into this category [1-3].

GERD mainly occurs because of lower esophageal sphincter dysfunction (LES), with several other factors leading to its causation. These factors are physiological or pathological, and transient lower esophageal sphincter relaxations (TLESRs) are the most common cause. TLESRs are transient relaxations of LES tone, not related to swallowing, and their occurrence increases with meals, thereby contributing significantly to acid reflux in GERD patients. Other contributors include decreased LES pressure, sliding hiatal hernias, delayed gastric emptying, and impaired esophageal clearance [4,5].

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Heartburn, or a burning sensation that commonly radiates up to the neck, is the classic presentation of GERD and is often accompanied by a sour taste or regurgitation. It is also the most common cause of non-cardiac chest pain, thus making a clear distinction from cardiac causes crucial. Extraesophageal symptoms, including throat clearing, hoarseness, Globus sensation, cough, and bronchospasm, can be caused by acid exposure to the larynx or airways. Alarm symptoms like dysphagia, odynophagia, anemia, bleeding, and weight loss necessitate endoscopic assessment, especially in patients who may be at risk for complications such as Barrett's esophagus (Table 1) [4-6].

Table 1: Risk factors and symptoms related to GERD

Risk factors	Symptoms
Obesity	Heartburn
Smoking	Regurgitation
Dietary habits	Chest pain
Hiatal hernia	Dysphagia
Pregnancy	Acid reflux
Medications	Nausea
Age	bloating

Alarm symptoms in GERD patients must be evaluated for immediate endoscopy consideration and lifestyle modifications. Elevating the bed head is the only measure scientifically proven to reduce acid exposure, in addition to avoiding smoking and alcohol consumption and delaying intake until at least two hours before bedtime [1]. Weight loss is the recommended management for obese patients, and bariatric surgery may be detrimental to reflux. Acid suppression continues to be the mainstay of therapy, with proton pump inhibitors (PPIs) being the most effective drugs, but there are now concerns about long-term side effects. Surgical treatments, such as fundoplication (FP), have little long-term benefit over PPI therapy and should be reserved for carefully selected patients [1].

Fundoplication is a surgical technique that improves the lower esophageal sphincter (LES) function and reduces acid reflux in GERD patients. The procedure consists

mainly of two forms: Nissen FP, a full 360° wrap around the esophagus that is effective in stopping reflux but renders a patient unable to burp or vomit, and Toupet FP, which is a partial 270° wrap that will allow for gas to be released. Both techniques show effectiveness in GERD management, but research reveals that the Toupet procedure has fewer postoperative complications, including dysphagia and bloating. Therefore, it is favoured because it balances effectiveness with reduced complication [7,8].

Total fundoplication (TFP) is a procedure which, although beneficial in GERD management, is associated with complications, such as dysphagia, in around 10% of patients and gas-bloat syndrome, presenting with nausea, early satiety, and excessive flatulence. PPF is a less invasive and more favorable procedure, with effective reflux control but fewer mechanical complications than its anterior counterpart. This procedure improves the esophageal motility, maintaining normal function of the lower esophageal sphincter; hence, it leads to improved outcomes with reduced postoperative symptoms and lower rates of reoperation, making it a preferable surgical approach for GERD management [9-11].

Comparative studies are significant in establishing FP for GERD. PFP and TFP have comparable outcomes in symptom control, whereas partial fundoplication involves fewer side effects and reoperations. Long-term results favour both approaches while focusing on patient safety and symptom control. TFP is associated with increased dysphagia and gas-related complications while offering comparable efficacy with a few obstructive side effects compared to PFP [12-14]. The study evaluated and compared the efficacy and safety of PPF and TFP in GERD patients.

MATERIALS AND METHODS

Research Design- This is a retrospective study that was carried out from October 2020 to October 2024 among 100 GERD patients. This study was authorized by our hospital authority and ethics committee. To conduct this study, this retrospective study included those participants who were sent written informed consent. Patients were divided into two groups, PPF and group TF, and both groups were 50 patients. Again, this study used simple randomization (1:1 ratio), and PPF was used on one participant and TF on the other participant. This

study included patients who were from 18 to 75 years old as well as who had GRG symptoms, heartburn, and acid regurgitation. This study diagnosed GERD using ambulatory pH monitoring, which indicated increased acid exposure over 24 hours and graded oesophagitis using the Los Angeles Classification. Exclusion criteria included prior anti-reflux surgery, significant upper abdominal surgery, type II to IV hiatal hernia, and esophageal motility problems. All patients had endoscopic evidence of hiatal hernia and varying degrees of oesophagitis. Patient data collected included age, sex, oesophagitis grade, preoperative symptoms, medical treatment, surgery details, postoperative follow-up, complications, and reoperations. Preoperative tests included upper GI endoscopy, esophageal manometry, and 24-hour pH monitoring. Postoperative assessments included a 0–4 scale satisfaction questionnaire evaluating dysphagia, heartburn, belching, bloating, diarrhea, vomiting, and abdominal pain. The GERD-HRQoL questionnaire was administered preoperatively, and at 2 and 12 months postoperatively, with endoscopic examinations. Postoperative satisfaction was also evaluated using a 0–4 scale, where 1 indicated very satisfied, and 4 indicated not satisfied.

Inclusion Criteria

- Patients aged between 18 and 75 years.
- Patients with GERD symptoms, including heartburn and acid regurgitation.
- Diagnosis of GERD was confirmed by ambulatory pH monitoring with increased acid exposure over 24 hours.
- Oesophagitis is graded using the Los Angeles Classification (LA).
- Patients, who provided written informed consent.

Exclusion Criteria

- Patients who have undergone anti-reflux surgery.
- Patients with significant upper abdominal surgery.
- Patients with type II to IV hiatal hernia.
- Patients with esophageal motility problems.

Surgical Technique- With the patient in changed Trendelenburg, the surgeon used the 5-trocar procedure between their legs. A harmonic scalpel with ultra-precision was used in this study. The inferior omentum and peritoneum covered the hiatal area that was

removed to reveal the left and right crus. In addition, the unit of short gastric vessels mobilized the upper fundus. The distal oesophagus was driven for at least 5 cm to situate EGJ and wrap intra-abdominally. In PPF patients, the gastric fundus was retracted posteriorly across the distal oesophagus and esophagogastric connection for about three-quarters of the circumference and connected posteriorly to the left and right crus with three Ethibond 2/0 sutures on each side. In addition, 3 to 4 sutures were set between the borders of the wrap and the esophageal wall. In TF patients, the right and left margins of the wrap were secured jointly with three Ethibond 2/0 sutures, extending from the EGJ cranially for a minimum of 2 cm, and Candles were utilized in all patients. A single surgeon executed all surgeries, as shown in Fig 1.



Fig. 1: Laparoscopic posterior partial fundoplication

Statistical Analysis- The study used SPSS 25 for effective analysis. The values were introduced as medians±SD. The independent sample T-test was utilized to compare parametric data, whereas chi-square tests were used to compare non-parametric data. In addition, the P value below 0.05 was considered statistically significant.

RESULTS

The study compares the demographic and clinical features of the PPF and TF groups of 50 patients each in Table 2. The mean age of both groups was comparable (36.80 ± 8.20 in PPF vs. 35.50 ± 9.40 in TF; $p=0.5$). Gender distribution was also similar, with 28 males and 22 females in the PPF group compared with 27 males and 23 females in the TF group ($p=0.8$). Mean BMI was somewhat high in PPF: 28.10 ± 2.30 compared to TF 27.50 ± 2.50 but not statistically significant ($p=0.2$). Clinical features such as prevalence rates of esophagitis and Barrett's esophagus showed similar distribution

across groups and did not differ significantly ($p=0.8$). The mean duration of symptoms and medical treatment was slightly longer in the TF group, yet not considerably different statistically ($p=0.4$ & $p=0.6$, respectively). Grade A esophagitis was mainly found among subjects from both groups, with 64% in PPF and 60% in TF. Higher-graded esophagitis (B, C, and D) was fairly distributed across the groups and showed no significant differences ($p=0.5$). Generally, baseline characteristics were matched in pairs, thereby assuring comparability of the two groups.

Table 2: Patients' preoperative data

Variable	PPF Group (n=50)	TF Group (n=50)	p-value
Age (mean, SD)	36.80 (8.20)	35.50 (9.40)	0.5
Sex (no., male/female)	28/22	27/23	0.8
BMI (mean, SD)	28.10 (2.30)	27.50 (2.50)	0.2
Esophagitis (no., %)	12 (24%)	13 (26%)	0.8
Barrett's esophagus (no., %)	11 (22%)	10 (20%)	0.8
Duration of symptoms (mean, SD)	105.00 (40.00)	112.00 (36.50)	0.4
Duration of medical treatment (mean, SD)	106.00 (39.50)	110.00 (36.00)	0.6
Grade of esophagitis (no., %)			0.5
Grade A	32 (64%)	30 (60%)	
Grade B	12 (24%)	14 (28%)	
Grade C	3 (6%)	4 (8%)	
Grade D	3 (6%)	2 (4%)	

Table 3 shows intraoperative and postoperative outcomes for 50 PPF and TF patients. The mean operating duration was significantly longer in the PPF group (120.00 ± 38.50 minutes) compared to the TF group (105.00 ± 32 minutes, $p=0.01$). Hospital stays were marginally longer in the PPF group (2.00 ± 0.85 days) compared to the TF group (1.80 ± 0.50 days), but not significantly different ($p=0.3$). Postoperative complications, reoperations, and particular symptoms like dysphagia, regular belching, inability to belch, bloating, diarrhoea, vomiting, and abdominal discomfort

manifested at comparable rates among groups, with no significant disparities. Endoscopic assessment at 2 months showed similar results, with almost all patients in both groups achieving A-grade esophagitis or better (80% PPF vs 80% TF). Most patients had normal endoscopy results at 12 months (82% PPF vs. 80% TF, $p=0.5$), indicating long-term improvements. The satisfaction levels were also comparable, with most being either very satisfied or satisfied (90% in PPF vs. 88% in TF).

Table 3: Intraoperative and postoperative data

Variable	PPF Group (n=50)	TF Group (n=50)	p-value
Operative time (mean, SD)	120.00 (38.50)	105.00 (32.00)	0.01
Hospital stays (mean, SD)	2.00 (0.85)	1.80 (0.50)	0.3
Postoperative complications (no., %)	3 (6%)	2 (4%)	0.5
Reoperation (no., %)	1 (2%)	1 (2%)	1
Dysphagia (no., %)	3 (6%)	4 (8%)	0.6
Frequent belching (no., %)	3 (6%)	3 (6%)	1
Inability to belch (no., %)	4 (8%)	3 (6%)	0.6
Bloating (no., %)	12 (24%)	13 (26%)	0.8
Diarrhea (no., %)	3 (6%)	4 (8%)	0.7
Vomiting (no., %)	1 (2%)	2 (4%)	0.6
Abdominal pain (no., %)	23 (46%)	25 (50%)	0.7
Recurrence of preoperative symptoms (no., %)	4 (8%)	3 (6%)	0.7
Endoscopy at 2 months: (no., %)			0.8
- Normal	8 (16%)	6 (12%)	
- Grade A	32 (64%)	34 (68%)	
- Grade B	6 (12%)	5 (10%)	
- Grade C	4 (8%)	2 (4%)	
- Grade D	0	2 (4%)	
Endoscopy at 12 months: (no., %)			0.5
- Normal	41 (82%)	40 (80%)	
- Grade A	4 (8%)	5 (10%)	
- Grade B	3 (6%)	2 (4%)	
- Grade C	2 (4%)	2 (4%)	
- Grade D	0	1(2%)	
Patient satisfaction: (no., %)			
- Very satisfied	27 (54%)	25 (50%)	
- Satisfied	18 (36%)	19 (38%)	
- Neutral	3 (6%)	4 (8%)	
- Not satisfied	2 (4%)	2 (4%)	

A comparison of the severity of symptoms in the PPF and TF groups is shown in Table 4 for preoperative and postoperative patients. In both groups, most preoperative patients had moderate to severe symptoms, as no mild or absent symptoms were reported. In the PPF group, 20 patients indicated that they had moderate symptoms, 26 had the presence of symptoms "often," and 4 experienced symptoms "very often." Similarly, in the TF group, while moderate symptoms were cited by 18, with 30 claiming they

displayed symptoms "often," only 2 showed "very often." There was a significant improvement in the symptoms postoperatively for both groups. Approximately 45 patients were symptom-free in each group, and five had mild symptoms. None of the patients had moderate, often, or very often symptoms postoperatively in both groups. The preoperative and postoperative p-values of 0.000 show that the therapies reduced symptoms in both groups with statistical significance.

Table 4: Preoperative and postoperative heartburn

	No symptoms	Mild	Moderate	Often	Very often	p-value
PPF Group						
Preoperative	0	0	20	26	4	0.000
Postoperative	45	5	0	0	0	
TF Group						
Preoperative	0	0	18	30	2	0.000
Postoperative	45	5	0	0	0	

DISCUSSION

The study by Analatos *et al.* [13] analyzed the long-term results of PFP and TFP in treating GERD. In an RCT in Sweden, data gathered on 456 patients over a follow-up period of 16 years showed that both surgical procedures had similar results. The scores for dysphagia in both PFP and TFP groups for solids and liquids were low with mean scores of 1.2 (PFP) and 1.3 (TFP) for liquids and 1.3 (PFP) and 1.3 (TFP) for solids, with no statistical differences between PFP and TFP groups ($p=0.58$ & $p=0.97$, respectively). The reflux control and quality of life improvements were also equally maintained in both groups. As against the initial superiority of PFP towards reducing early postoperative dysphagia, a good sign appeared because both procedures showed similar performances ten or even more years after surgery [13-15]. Varin *et al.* conducted a meta-analysis of randomized trials comparing PFP with TFP for GERD. Eleven trials involving 991 patients were included in the analysis for which data synthesis was carried out. TFP was associated with significantly higher incidences of postoperative dysphagia ($p<0.001$), bloating ($p=0.02$), and flatulence

($p<0.001$). On the other hand, the PFP appeared to have fewer reoperations ($p=0.02$), and better function was achieved with no significant variations in rates of esophagitis ($p=0.33$), heartburn ($p=0.58$), or persisting acid reflux ($p=0.45$). Finally, no significant differences have also been observed in the long-term concerning the Visick I or II score ($p=0.99$) [15].

Lee *et al.* conducted a nationwide study on PFP in Korea. It surveyed the outcomes of 32 cases with different postoperative symptoms from eight hospitals. There were 20 cases (62.5%) in anterior PFP and 12 cases (37.5%) in PFP. Approximately half of the patients presented at the time of diagnosis with typical symptoms, and excellent resolution of symptoms was observed at discharge (68.8%), good resolution (25.0%), and fair resolution (6.3%). Regarding TFP, PFP produced similar rates of typical and atypical symptom resolution. However, postoperative adverse symptoms, such as dysphagia, difficult belching, gas bloating, and flatulence, were significantly lower in the PFP group. This indicates that PFP might be a valuable alternative to TFP for certain patients, especially when it is crucial to minimize

side effects. However, TFP remains the mainstay of surgical treatment^[14].

PPFP has advantages in the management of GERD. It allows better reflux control than anterior FP, with better symptoms managed. Moreover, this procedure allows the patient to belch after the procedure, which is an added advantage. PPFP enhances esophageal peristalsis and is more physiological than antireflux procedures. Disadvantages also exist in the posterior technique and, potentially, a significant risk of dysphagia during the immediate postoperative phase. More people experience early postoperative dysphagia than those who opt for PPFP techniques. Dysphagia scores have become better over time, while at 12 months follow-up after the surgery, the scores show no major difference between both anterior and PPFP patients^[11,16-19].

PPFP is best for patients suffering from GERD who also have poor motility in the esophageal body. Research indicates that the procedure enhances esophageal peristalsis, and the PPFP serves as a good antireflux barrier, significantly reducing dysphagia post-surgery. This effect is better if combined with postoperative

treatment with cisapride to enhance peristalsis of the esophagus; therefore, it is recommended for use in GERD patients with poor oesophageal body function. This approach provides long-term reflux control with minimal side effects, hence being a safe and effective approach to this specific patient population^[20,21].

Future research in GERD would focus on several key areas. This will include an investigation of long-term outcomes following partial PF as opposed to TF, especially after more than 15 years from surgery, reflux control, quality of life, and mechanical complications. Further studies may focus on the durability of reflux control, quality of life, and patient-reported outcomes for a longer period to understand the long-term benefits of PF in GERD treatment. Another area of future research would be to compare patient satisfaction with different types of FP procedures, such as anterior 180° and posterior 270° FP, to understand their effect on quality of life and treatment success in GERD management^[22,23].

Table 5: Comparison of the partial PF studies

Author's name	Study design	Objective	Total patients	Outcomes	Complications
O'Reilly <i>et al.</i> ^[16]	RCT	To evaluate the effectiveness and safety of PF in GERD	100	Improvements in the symptoms	Pneumothorax
Wykiel <i>et al.</i> ^[17]	Follow-up study	To compare the long-term side effects of Nissen FP and PPF in patients with GERD.	209	Improvements in the symptoms	Dysphagia, bloating, epigastric pain
Khan <i>et al.</i> ^[18]	RCT	To study the effectiveness of posterior PF in GERD	103	Mean operating time was similar in both groups	Post-operative dysphagia in posterior PF
Roks <i>et al.</i> ^[19]	RCT	To study the outcomes of PPF	94	Subjective outcomes were improved	None reported
Gadenstatter <i>et al.</i> ^[20]	Prospective cohort study	To study the outcomes of partial PF in GERD	67	Improvement in esophageal peristalsis	None reported

CONCLUSIONS

This study concluded that symptoms improved significantly with the PPF and TF treatments, and both groups showed similar outcomes. The operation time with PPF was longer, although the clinical results regarding symptom relief, post-operative complications, and patient satisfaction were almost the same for the two treatments. In this study, it was found that there was no significant difference in demographic and clinical characteristics among the PPF and TF groups, including gender, BMI, and clinical features. Although operative time in the PPF group was longer, hospital visits, complications, and satisfaction levels were not different between the PPF and TF groups. Both operative treatments demonstrated remarkable relief from symptoms, with most patients completely symptom-free or experiencing mild symptoms after the operation. Endoscopy at 2- and 12-months post-treatment confirmed definite long-term improvement, and both cohorts reported high patient satisfaction. The symptom changes from preoperative to postoperative were evaluated significantly for both groups.

CONTRIBUTION OF AUTHORS

Research concept- Basharat Majeed Lone, Humayoon Rasool, Ajaz Ahmad Rather

Research design- Humayoon Rasool, Ajaz Ahmad Rather

Supervision- Humayoon Rasool, Ajaz Ahmad Rather

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