Postoperative Dysphagia and Short-term Outcomes Following Laparoscopic Floppy Nissen Fundoplication Combined with V-flap Suturing

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Abstract

Objective

To compare postoperative dysphagia and anti-reflux efficacy between laparoscopic floppy Nissen fundoplication with V-flap suturing (LNF-V) and conventional laparoscopic Nissen fundoplication (LNF).

Methods

This retrospective cohort study included patients with gastroesophageal reflux disease (GERD) who underwent LNF-V or LNF between January 2022 and January 2024 at the Department of General Surgery of Xuanwu Hospital, Xiong an Xuanwu Hospital, and Beijing Feng tai Hospital of Traditional Chinese Medicine. After applying inclusion and exclusion criteria, 173 patients were enrolled, including 113 in the LNF-V group and 60 in the LNF group. In the LNF-V procedure, following the standard 360° fundoplication, the wrap was further sutured to the left and right diaphragmatic crura to form a V-shaped configuration. Saeed dysphagia scores and Gerd-Q scores were assessed preoperatively and at 3, 6, and 12 months postoperatively. Operative time, intraoperative blood loss, hospital stay, and postoperative complications were also recorded.

Results

There were no significant differences between the two groups in baseline characteristics including sex, age, BMI, symptom duration, lower esophageal sphincter (LES) pressure, and DeMeester score ($P > 0.05$). Intraoperative blood loss and hospital stay were also similar. The operative time was slightly longer in the LNF-V group than in the LNF group ($P < 0.001$). Regarding dysphagia, Saeed scores were significantly lower in the LNF-V group at 3 to 6 months postoperatively ($P < 0.001$), indicating better recovery of swallowing function; by 12 months, scores were comparable between the groups ($P = 0.785$). Gerd-Q scores at 3 months were significantly lower in the LNF-V group ($P = 0.008$), reflecting better reflux symptom control, while no significant differences were observed at 6 and 12 months ($P = 0.078$ and 0.541, respectively).

Conclusion

Compared with conventional LNF, the LNF-V technique offers better early postoperative improvement in dysphagia and reflux symptoms, with comparable long-term efficacy. It is a safe and feasible surgical option with promising clinical applicability.

Introduction

Gastroesophageal reflux disease (GERD) is a condition characterized by reflux-related symptoms and/or complications (such as esophagitis or Barrett's esophagus) resulting from the retrograde flow of gastric contents into the esophagus. The pathogenesis of GERD primarily involves lower esophageal sphincter (LES) hypotension, hiatal hernia, impaired esophageal clearance, and delayed gastric emptying. For patients with moderate-to-severe GERD—especially those who are long-term proton pump inhibitor (PPI) users with suboptimal symptom control—surgical intervention has been widely recognized as an effective treatment option. Fundoplication is the mainstay of anti-reflux surgery and achieves durable control of acid reflux by reinforcing LES pressure, extending the high-pressure zone, and reconstructing the angle of His, thereby providing durable control of GERD [1].

Since its first application in 1991, laparoscopic fundoplication has become one of the standard surgical treatments for GERD due to its advantages of minimal invasiveness, faster recovery, and shorter hospital stay. Among the various techniques, Nissen fundoplication, which involves a 360° wrap around the abdominal esophagus, is considered the most effective for reflux control and is the gold standard for treating moderate-to-severe GERD [2]. However, complete encirclement of the distal esophagus may impede bolus transit, leading to postoperative dysphagia, with reported incidence rates ranging from 10–25% at one year postoperatively [3–5]. The risk is particularly elevated when the wrap is excessively tight or long, or in patients with pre-existing esophageal motility disorders. In contrast, Toupet and Dor fundoplication, which are partial wrap techniques, are associated with lower incidences of dysphagia, bloating, and gas-related symptoms, making them more suitable for patients with esophageal motility abnormalities. Nevertheless, some studies suggest that partial wraps may offer slightly inferior reflux control compared to the complete wrap of the Nissen technique, as evidenced by higher LES pressure following Nissen fundoplication [6].

Most cases of postoperative dysphagia are transient, typically caused by local edema or hematoma at the surgical site, and gradually resolve within 6 to 8 weeks postoperatively [7]. However, persistent dysphagia can occur in 3–10% of cases and may be related to an overly tight wrap, esophageal motility dysfunction, or altered anatomical relationships [3]. Management strategies include lifestyle modifications such as small frequent meals, soft diets, and prolonged chewing. For patients with severe or persistent symptoms, endoscopic dilation may be considered, and surgical revision is rarely required. To further improve surgical outcomes and reduce postoperative complications, several modified forms of Nissen fundoplication have been introduced. One such technique is the floppy Nissen fundoplication, which limits the wrap length to 1.5–2 cm and applies moderate tension during gastric fundus suturing. Studies have shown that this approach significantly lowers the incidence of postoperative dysphagia, with some reporting a reduction from 28% with the conventional technique to less than 10% [8].

To better balance reflux control and reduce the risk of dysphagia, we developed a novel modification: laparoscopic floppy Nissen fundoplication combined with V-flap suturing. This technique structurally adjusts the configuration of the fundic wrap by suturing it to both diaphragmatic crura in a V-shaped manner, thereby optimizing the tension distribution on the anterior esophageal wall and decreasing the likelihood of postoperative dysphagia. This study aims to prospectively compare this modified procedure

with conventional laparoscopic Nissen fundoplication in terms of reflux control, dysphagia incidence, in order to identify a more effective surgical refinement.

Methods

Study Population: This retrospective cohort study included patients who underwent laparoscopic Nissen fundoplication between January 2022 and January 2024 at three centers: Xuanwu Hospital of Capital Medical University, Xiong an Xuanwu Hospital, and Beijing Feng tai Hospital of Traditional Chinese Medicine. A total of 173 patients were enrolled, including 113 patients in the LNF-V group (laparoscopic floppy Nissen fundoplication with V-flap suturing) and 60 in the LNF group (conventional laparoscopic Nissen fundoplication). The enrollment flowchart is shown in Fig. 1. Clinical data were collected using preoperative and postoperative questionnaires administered by trained staff and reviewed by database administrators through electronic medical records. Patients were included if they underwent conventional Nissen fundoplication (control group) or floppy Nissen fundoplication combined with V-flap suturing (intervention group), and met at least one of the following inclusion criteria:Objective evidence of GERD with inadequate response to medical therapy. Established diagnosis of GERD and unwillingness to continue long-term proton pump inhibitor (PPI) therapy. GERD with complications such as Barrett esophagus or reflux esophagitis. Exclusion criteria were as follows: Esophageal manometry showing esophageal motility disorders preoperatively.Presence of large hiatal hernia (Hill gastroesophageal flap valve grade > 2). History of previous gastric or esophageal surgery. Incomplete follow-up data. Informed consent was obtained from all patients before surgery. The study ethics number is 2024-P2-097-02.

Variables

Clinical data collected for all enrolled patients included demographics and baseline characteristics such as sex, age, body mass index (BMI), duration of reflux symptoms, preoperative use of acid-suppressive medications, mean resting pressure of the LES, and DeMeester score. Perioperative indicators included operative time, intraoperative blood loss, time to first postoperative flatus, and length of hospital stay. Postoperative complications recorded included dysphagia, bloating, diarrhea, constipation, and belching. The primary outcome measures were Saeed dysphagia score at 1, 3, 6 and 12 months Postoperatively and Gerd-Q score at 3, 6 and 12 months Postoperatively. The Gerd-Q questionnaire consists of six items that assess heartburn, regurgitation, sleep disturbance, and use of additional medication (each scored from 0 to 3, based on frequency over the past 7 days), as well as upper abdominal pain and nausea (scored inversely from 3 to 0). The total score ranges from 0 to 18, with a score ≥ 8 suggesting probable GERD. Postoperative dysphagia was assessed using the Saeed scale, which ranges from 0 (complete inability to swallow) to 5 (normal swallowing). A score of ≤ 2 was defined as the presence of dysphagia. All patients were followed up at 1, 3, 6, and 12 months postoperatively via telephone, outpatient visits, or other means. The final follow-up was completed by December 2024.

Surgical Procedure

All procedures were performed by the same surgical team. Under general anesthesia, patients were placed in the supine position with reverse Trendelenburg tilt. A standard five-port laparoscopic technique was used to establish access. The hepato-gastric and gastrosplenic ligaments were dissected to fully expose the gastric fundus and cardia. The phreno-esophageal membrane was opened, and the distal esophagus was mobilized anterior to the abdominal aorta to a length of at least 6 cm. The left and right diaphragmatic crura were also fully exposed.

The diaphragmatic crura were first approximated using a continuous suture with 2 – 0 absorbable barbed suture for tension reduction, followed by interrupted reinforcement sutures with non-absorbable material to achieve a snug but non-constrictive hiatus around the esophagus. In patients with coexisting hiatal hernia, an absorbable mesh was applied and fixed in place using absorbable tacks. The gastric fundus was then wrapped 360° around the distal esophagus from both anterior and posterior sides, secured with three interrupted sutures, with the wrap length controlled at approximately 2 cm, completing construction of the anti-reflux valve (see Fig. 2). In the LNF-V group, after the standard floppy Nissen fundoplication, the anterior flap of the gastric fundus was further elevated and sutured in a “V” configuration (Fig. 2): one stitch on each side (left and right) and one superiorly, anchoring to the corresponding diaphragmatic crura. The left-sided suture was placed to reinforce the angle of His, while the right-sided suture was placed approximately 1 cm above the junction of the right diaphragmatic crus to avoid excessive tension or compression of the esophageal wall (Fig. 3). Prior to suturing, care was taken to ensure that the right half of the V-shaped flap did not exert undue pressure on the right esophageal wall. This additional step created a V-shaped anchoring structure, referred to as the V-flap suturing technique (see Fig. 2). This modified design aimed to reduce anterior compression on the esophagus, thereby preserving the anti-reflux effect while minimizing the risk of postoperative dysphagia.

Statistical Analysis

Statistical analyses were performed using SPSS version 29.0 (IBM Corp, Armonk, NY, USA). The normality of all continuous variables was assessed using the Shapiro–Wilk test. Variables with a normal distribution were expressed as mean ± standard deviation (Mean ± SD) and compared between groups using the independent samples t-test. Variables not conforming to a normal distribution were presented as median (interquartile range, IQR) and compared using the Mann–Whitney U test. Categorical variables were expressed as frequencies (percentages) and compared using the chi-square test or Fisher’s exact test, where appropriate (i.e., when expected counts were < 5). All statistical tests were two-tailed, and a P-value < 0.05 was considered statistically significant.

Results

The baseline characteristics of patients in the LNF-V and LNF groups showed no significant differences in gender (male: 52.2% vs. 58.3%, $P = 0.445$), age [median 53.0 years (45.0, 60.0) vs. 53.5 years (38.0, 61.0), $P = 0.761$], body mass index (24.0 ± 3.86 vs. 24.4 ± 3.45, $P = 0.477$), or symptom duration [36.0

months (12.0, 72.0) vs. 36.0 months (22.5, 69.0), $P = 0.380$]. Furthermore, the incidence of hiatal hernia (80.0% vs. 81.7%, $P = 0.750$), erosive esophagitis (64.6% vs. 65.0%, $P = 0.958$), and Barrett esophagus (4.4% vs. 8.3%, $P = 0.294$) were comparable between groups, with similar grade distributions. There were also no significant differences in LES mean respiratory pressure (9.42 ± 3.24 vs. 9.46 ± 3.30, $P = 0.942$), DeMeester score (18.46 ± 4.31 vs. 18.31 ± 4.14, $P = 0.824$), Saeed score (4.92 ± 0.27 vs. 4.95 ± 0.22, $P = 0.468$), and Gerd-Q score (11.22 ± 2.20 vs. 10.90 ± 2.01, $P = 0.348$). These results indicate that there were no significant differences in baseline characteristics between the two groups. The baseline results of the two groups of patients are presented in Table 1.

Table 1
Baseline Characteristics of Patients in the LNF-V and LNF Groups

Variables	LNF-V group	LNF group	χ^2/t/Z	P
Gender			0.592	0.445
Male	59(52.2%)	35(58.3%)		
Female	54(47.8%)	26(43.3%)		
Age	53.0 (45.0,60.0)	53.5(38.0,61.0)	-0.305	0.761
BMI	24.0 ± 3.86	24.4 ± 3.45	0.713	0.477
Duration of symptoms (month)	36.0 (12.0,72.0)	36.0 (22.5,69.0)	-0.887	0.380
Hiatal hernia	90 (80.0%)	49 (81.7%)	0.101	0.75
Erosive esophagitis	73 (64.6%)	39 (65.0%)	0.003	0.958
Los Angeles grade A	44 (38.9%)	24 (40%)		
Los Angeles grade B	26 (23.0)	13 (21.7%)		
Los Angeles grade C	2 (1.8%)	1 (1.7%)		
Los Angeles grade D	1(0.9%)	1 (1.7%)		
Barrett esophagus	5 (4.4%)	5 (8.3%)	1.099	0.294
Mean respiratory pressure of LES	9.42 ± 3.24	9.46 ± 3.30	-0.072	0.942
DeMeester score	18.46 ± 4.31	18.31 ± 4.14	0.222	0.824
Saeed score	4.92 ± 0.27	4.95 ± 0.22	0.727	0.468
Gerd-Q score	11.22 ± 2.20	10.90 ± 2.01	0.941	0.348

In terms of operative outcomes, the operative time was significantly longer in the LNF-V group compared to the LNF group [137 minutes (89, 164) vs. 100 minutes (90, 114), Z = 4.184, P < 0.001]. Intraoperative blood loss was similar between groups [15 ml (11, 20) vs. 15 ml (10, 20), Z = 0.157, P = 0.875]. The time to first postoperative flatus was significantly longer in the LNF-V group [37 hours (31, 44) vs. 24 hours

(24, 36), Z = 4.665, P < 0.001]. The length of hospital stay was similar in both groups [7 days (7, 8) vs. 7 days (7, 8), Z = − 0.184, P = 0.854]. There were no significant differences in postoperative complications, including abdominal distension (χ^2 = 0.216, P = 0.642), diarrhea (χ^2 = 0.159, P = 0.690), constipation (χ^2 = 0.105, P = 0.746), and belching (χ^2 = 0.276, P = 0.599). The intraoperative and postoperative conditions are summarized in Table 2 and Fig. 4.

Table 2
Operative Data and Procedural Details of Patients

Variables	LNF-V group	LNF group	χ^2/t/Z	P
Operation time (min)	137 (89,164)	100 (90,114)	4.184	<0.001
Intraoperative blood loss (ml)	15 (11,20)	15 (10,20)	0.157	0.875
Postoperative time to first flatus(h)	37 (31,44)	24 (24,36)	4.665	<0.001
Hospital stay (d)	7 (7,8)	7 (7,8)	-0.184	0.854

The preoperative Saeed scores were not significantly different between the groups (4.92 ± 0.27 vs. 4.95 ± 0.22, *P* = 0.468), suggesting similar baseline swallowing function. At 1 month postoperatively, the Saeed score was significantly higher in the LNF-V group (3.50 ± 1.01 vs. 2.92 ± 0.72, *P* < 0.001). This trend continued at 3 months (4.43 ± 0.67 vs. 3.72 ± 0.59, *P* < 0.001) and 6 months (4.98 ± 0.132 vs. 4.68 ± 0.47, *P* < 0.001). By 12 months, the scores converged (4.87 ± 0.39 vs. 4.88 ± 0.32, *P* = 0.785). These results indicate that LNF-V may offer superior short-term (1–6 months) postoperative swallowing recovery compared to conventional LNF, but this advantage diminishes by 12 months. The Saeed scores of the patients before and after the operation are shown in Table 3.

Table 3
Summary of Preoperative and Postoperative Saeed Scores in the LNF-V and LNF Groups

Follow-up time	LNF-V group	LNF group	Z/t	P
Pre-operation	4.92 ± 0.27	4.95 ± 0.22	0.727	0.468
Post-operation(1 month)	3.50 ± 1.01	2.92 ± 0.72	-3.998	<0.001
Post-operation(3 month)	4.43 ± 0.67	3.72 ± 0.59	-7.018	<0.001
Post-operation(6 month)	4.98 ± 0.132	4.68 ± 0.47	-6.330	<0.001
Post-operation(12 month)	4.87 ± 0.39	4.88 ± 0.32	0.273	0.785

Regarding reflux control, the preoperative Gerd-Q scores did not differ significantly between groups (11.22 ± 2.20 vs. 10.90 ± 2.01, *P* = 0.348), suggesting comparable baseline symptom severity. At 3 months postoperatively, the LNF-V group showed significantly lower Gerd-Q scores (5.20 ± 1.17 vs. 5.70 ± 1.15, *P* = 0.008), indicating better short-term reflux symptom control. However, at 6 and 12 months, the scores were similar (5.81 ± 1.32 vs. 6.18 ± 1.27, *P* = 0.078; 6.19 ± 1.33 vs. 6.32 ± 1.36, *P* = 0.541),

suggesting equivalent mid- to long-term reflux control between the two surgical techniques. The Gerd-Q scores of the patients before and after the operation can be seen in Table 4.

Table 4
Summary of Preoperative and Postoperative Gerd-Q Scores in the LNF-V and LNF Groups

Follow-up time	LNF-V group	LNF group	Z/t	P
Pre-operation	11.22 ± 2.20	10.90 ± 2.01	0.941	0.348
Post-operation(3 month)	5.20 ± 1.17	5.70 ± 1.15	-2.663	0.008
Post-operation(6 month)	5.81 ± 1.32	6.18 ± 1.27	-1.320	0.078
Post-operation(12 month)	6.19 ± 1.33	6.32 ± 1.36	-0.612	0.541

Discussion

Dysphagia following fundoplication is a common complication of anti-reflux surgery. It can be categorized into short-term dysphagia—typically occurring within a few weeks to three months postoperatively due to edema and local inflammation—and long-term dysphagia, which persists beyond six months and is often attributed to structural or functional factors such as an overly tight wrap, excessive wrap length, wrap migration, or pre-existing esophageal motility disorders [7, 9]. Previous studies have shown that short-term dysphagia is primarily related to excessive intraoperative suture tension and postoperative tissue edema, whereas long-term dysphagia is more commonly associated with unrecognized esophageal motility abnormalities, a wrap length exceeding 2 cm, overtight crural closure, or wrap migration resulting in functional obstruction at the gastroesophageal junction [10, 11]. In our study, both short-term (1 month postoperatively) and long-term (6 months postoperatively) dysphagia scores were significantly better in the LNF-V group compared to the conventional LNF group (4.43 ± 0.67 vs. 3.72 ± 0.59; 4.98 ± 0.132 vs. 4.68 ± 0.47), suggesting that the modified Nissen procedure with V-shaped wrap fixation (LNF-V) results in less dysphagia within the first postoperative year. However, this difference diminished by the 12-month follow-up(see in Fig. 5). Among patients with significant dysphagia (Saeed score ≤ 2), the incidence was also markedly lower in the LNF-V group compared to the LNF group at 1, 3, and 6 months postoperatively (3.3% vs. 15%, 1.6% vs. 11.6%, and 1.6% vs. 8.3%, respectively). These findings indicate that the "floppy" Nissen fundoplication combined with V-shaped anterior wrap fixation may effectively reduce early postoperative dysphagia by minimizing anterior esophageal compression. Previous literature has reported a 2–6% incidence of long-term severe dysphagia following standard LNF [7, 9]; however, assessment criteria have varied across studies. For example, Nikolic et al. also utilized the Saeed scoring system and defined a score of ≤ 2 as indicative of long-term dysphagia, but their study reported a lower incidence (2%) than our LNF group (3.3%), likely due to longer follow-up duration and possibly limited sample size. Overall, our findings suggest that the LNF-V technique significantly reduces both the incidence and severity of postoperative dysphagia compared to traditional LNF.

Our study demonstrated that at 3 months postoperatively, the LNF-V group showed a significantly lower Gerd-Q score (5.20 ± 1.17) compared to the LNF group (5.70 ± 1.15), with the difference reaching statistical significance (P = 0.008), indicating a short-term symptomatic advantage of the LNF-V procedure. At 6 months postoperatively, the difference in Gerd-Q scores between the two groups narrowed (P = 0.08), and by 12 months, the scores were nearly identical (6.19 ± 1.33 vs. 6.32 ± 1.36), with no statistically significant difference (P = 0.541), The changes of Gerd-Q score over time is shown in Fig. 6. Spechler et al. reported that Nissen fundoplication significantly alleviated symptoms within 3 to 6 months after surgery and maintained durable efficacy over long-term follow-up in patients with refractory GERD [12]. Previous studies have primarily focused on comparing different surgical techniques, and many have found no significant differences in typical symptom control or patient satisfaction among them. For example, Wang et al. and Kamolz et al. compared floppy Nissen fundoplication and Toupet fundoplication and found comparable outcomes in terms of symptom relief and patient satisfaction [13, 14]. These findings were further supported by a meta-analysis conducted by Li et al., which included follow-up durations ranging from 6 months to 1 year. Their results indicated that while Nissen and Toupet fundoplication differed significantly in terms of postoperative complications, dysphagia, and LES pressure, these differences might translate into variations in long-term symptom control and recurrence rates [13, 15]. In our study, the superior Gerd-Q score in the LNF-V group at 3 months suggests that LNF-V may offer better short-term symptom control compared to standard LNF. However, this advantage diminished over time and was no longer evident at 6 and 12 months, aligning with previous findings. Since LNF-V is a modified version of the Nissen fundoplication, it appears to significantly reduce early postoperative dysphagia without compromising the long-term efficacy in GERD symptom control.

Naturally, we have also reflected on the underlying mechanisms and anatomical modifications behind this improved Nissen technique. The key change in LNF-V lies in securing the gastric wrap with two sutures directed upward toward the left and right diaphragmatic crura. Notably, the fixation on the left side resembles the reconstruction of the angle of His. Existing studies have demonstrated that a blunted angle of His is frequently associated with severe GERD symptoms and erosive esophagitis, whereas intraoperative restoration of the angle of His can significantly alleviate symptoms and improve quality of life in GERD patients [16–18]. The superior Gerd-Q scores observed in the LNF-V group at 3 months postoperatively support this hypothesis. Jani et al. suggested that an ideal Nissen fundoplication would create a perfectly circular wrap of the stomach around the esophagus, but in practice, it should form an elliptical shape [19]. However, this characterization is not entirely accurate. Given that the gastric fundus is sutured only on the anterior aspect of the esophagus during Nissen fundoplication, the actual shape of the wrap more closely resembles a teardrop—narrow in the front and wider in the back.

Under normal physiological conditions, the esophagus lies between the trachea anteriorly and the spine posteriorly, subject to anatomical compression, resulting in a flattened anteroposterior axis and an oblate, elliptical lumen with a wider left-right diameter [20]. In the case of an overly tight fundoplication, this natural front-to-back flattening may be reversed into a side-to-side compression, altering the esophageal lumen from its normal physiological shape. By securing the wrap to both diaphragmatic crura, the LNF-V technique may distribute tension more evenly and help preserve the esophagus's natural

geometry. We also hypothesize an alternative mechanism. During LNF-V, the upper portion of the esophageal lumen may adopt a funnel-like or “wine glass” configuration. The conical shape of a funnel allows fluid to transition from a wider cross-section to a narrower one, accelerating the flow under gravity and concentrating it toward the outlet. In contrast, although the outlet diameter may be the same in conventional LNF, the absence of such a guiding shape may limit the conversion of gravitational potential energy into kinetic energy, thereby reducing flow velocity (see in Fig. 7). This is analogous to pouring water into a bottle: using a funnel enables the water to flow quickly and directly into the neck, whereas without a funnel, the water disperses and enters more slowly. This physical model may partially explain the reduced incidence of postoperative dysphagia in the LNF-V group. However, these assumptions are based on surgical experience and theoretical reasoning; to date, there is a lack of relevant empirical research to validate these hypotheses.

This study has several limitations. First, it was a retrospective study with a relatively small sample size, which may have introduced selection bias and information bias. Second, the assessment of dysphagia was based on the Saeed score, and the evaluation of reflux symptom relief relied on the Gerd-Q score. Both instruments are subjective and depend on patients’ personal perceptions, which may be influenced by individual sensitivity to symptoms, variability in self-reporting, and emotional state—potentially leading to information bias. In addition, the study lacked objective postoperative evaluations, such as upper gastrointestinal contrast studies and 24-hour esophageal pH monitoring. Third, the follow-up period in this study was relatively short, which is insufficient to comprehensively assess the long-term efficacy and the incidence of delayed complications. To further verify the safety and effectiveness of the LNF-V procedure, future studies with larger sample sizes and prospective designs, along with long-term follow-up, are warranted.

Conclusion

Compared with conventional Nissen fundoplication, laparoscopic floppy Nissen fundoplication combined with V-shaped wrap fixation is associated with a lower incidence of early postoperative dysphagia and offers superior short-term anti-reflux efficacy.

Abbreviations

GERD
Gastroesophageal reflux disease
LNF
Laparoscopic Nissen fundoplication
LNF-V
Laparoscopic floppy Nissen fundoplication with V-flap suturing
LES
Lower esophageal sphincter
PPI

Proton pump inhibitor
IQR
Interquartile range
SD
Standard deviation

Declarations

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Xuanwu Hospital, Capital Medical University (Reference No. 2024-P2-097-02). Written informed consent was obtained from all participants prior to surgery.

Consent for publication

All participants provided consent for publication of anonymized data.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

Dong Hongyi and Du Haijun contributed equally to this work and are co-first authors.

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Data Availability

All data generated and/or analysed during this study are included in this published article and its supplementary information files.

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Figures

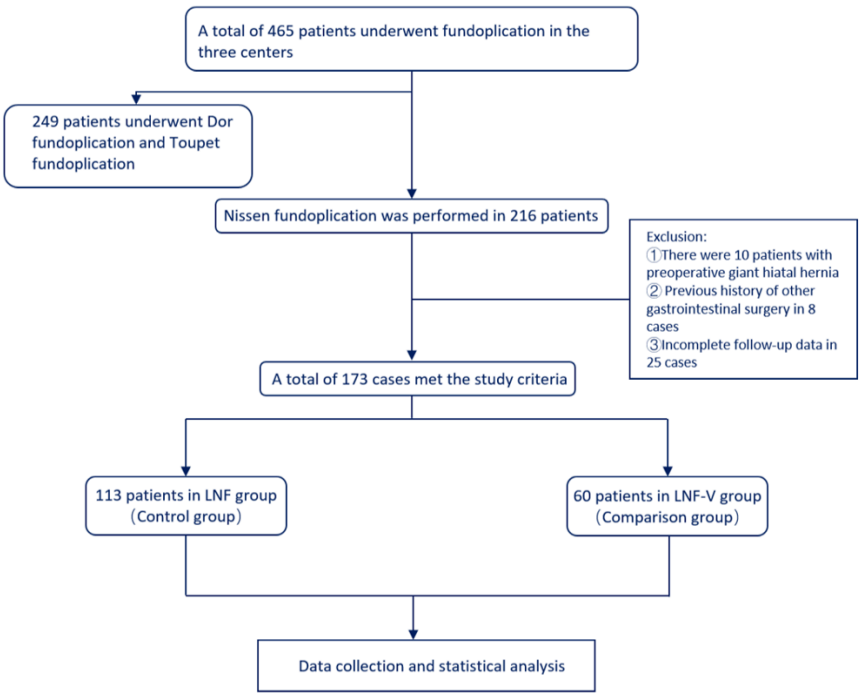

Figure 1

Flowchart of Patient Selection and Group Allocation for LNF vs. LNF-V Comparison Study

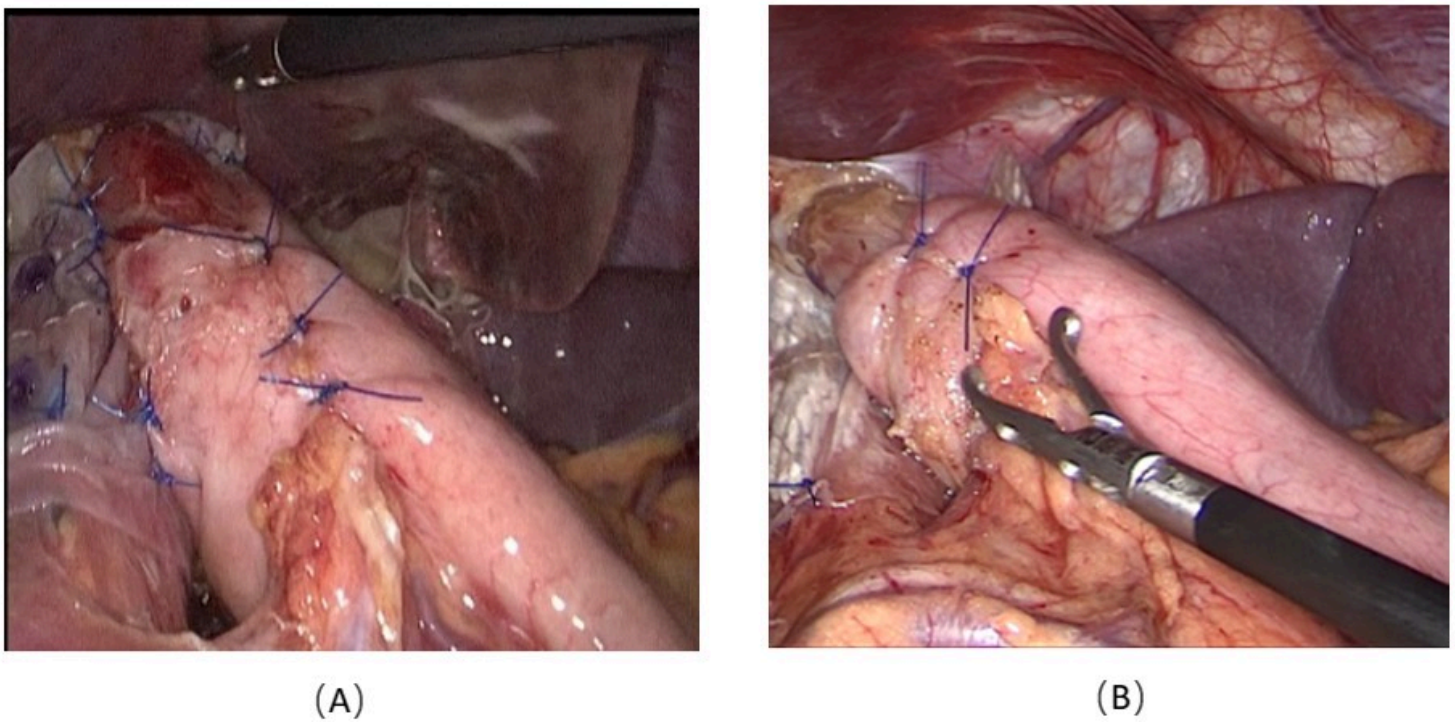

Figure 2

Schematic Illustration of Laparoscopic Nissen Fundoplication: (A) Laparoscopic floppy Nissen fundoplication with V-shaped wrap fixation;(B) Conventional laparoscopic Nissen fundoplication.

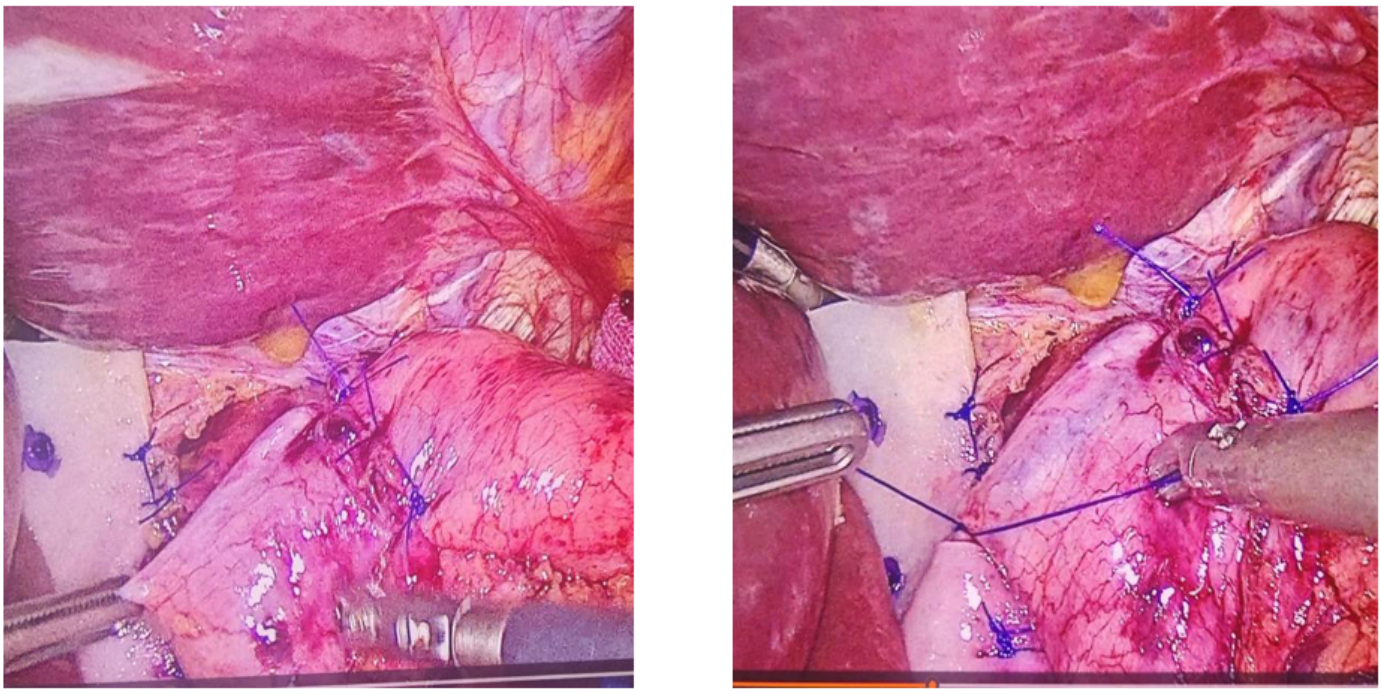

Figure 3

Detailed Illustration of Right-Sided Gastric Fundus Fixation to the Diaphragm After Laparoscopic Nissen Fundoplication: The right fold of the wrap is sutured to the right crus of the diaphragm, typically at a point approximately 1 cm above the junction of the left and right crura. Care should be taken to avoid placing the suture too high. Prior to suturing, it is essential to ensure that the right half of the V-shaped wrap does not exert compressive pressure on the right lateral wall of the esophagus. The left side of the V-shaped wrap may be fixed slightly higher as appropriate.

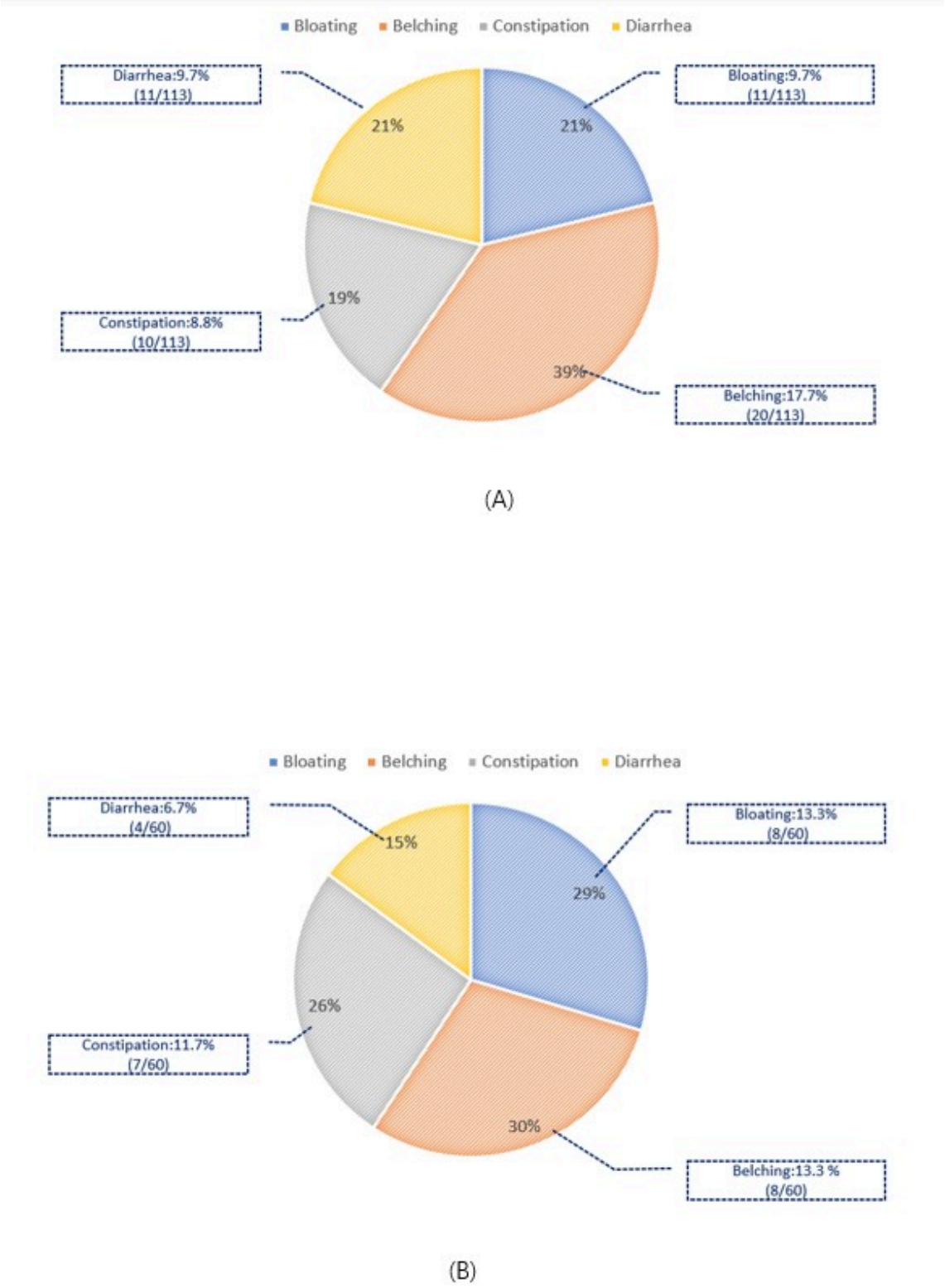

Figure 4

Incidence and Proportion of Postoperative Complications in the LNF-V and LNF Groups: (A) LNF-V group; (B) LNF group

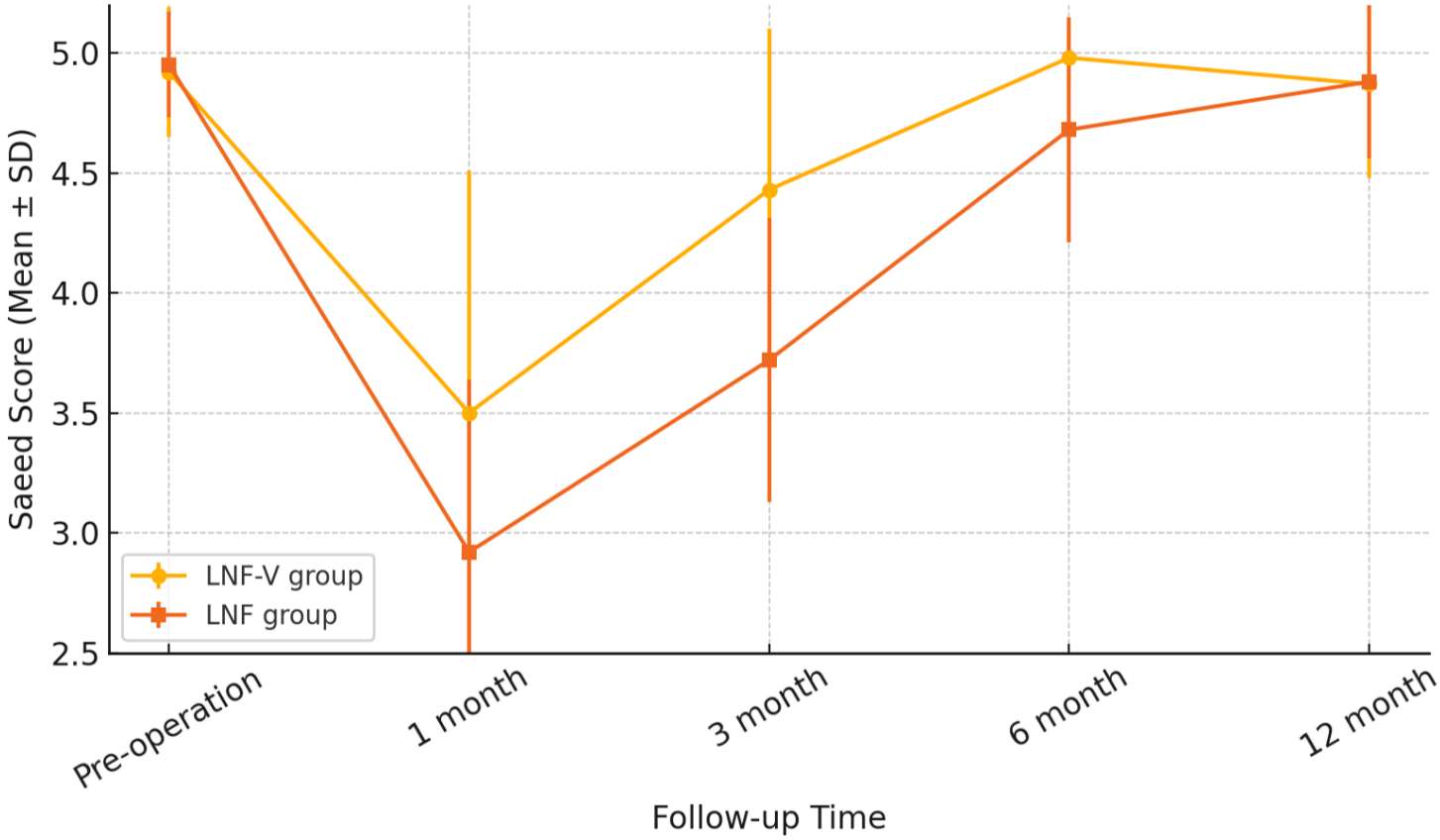

Figure 5

Postoperative changes in Saeed Scores in the LNF-V and LNF Groups

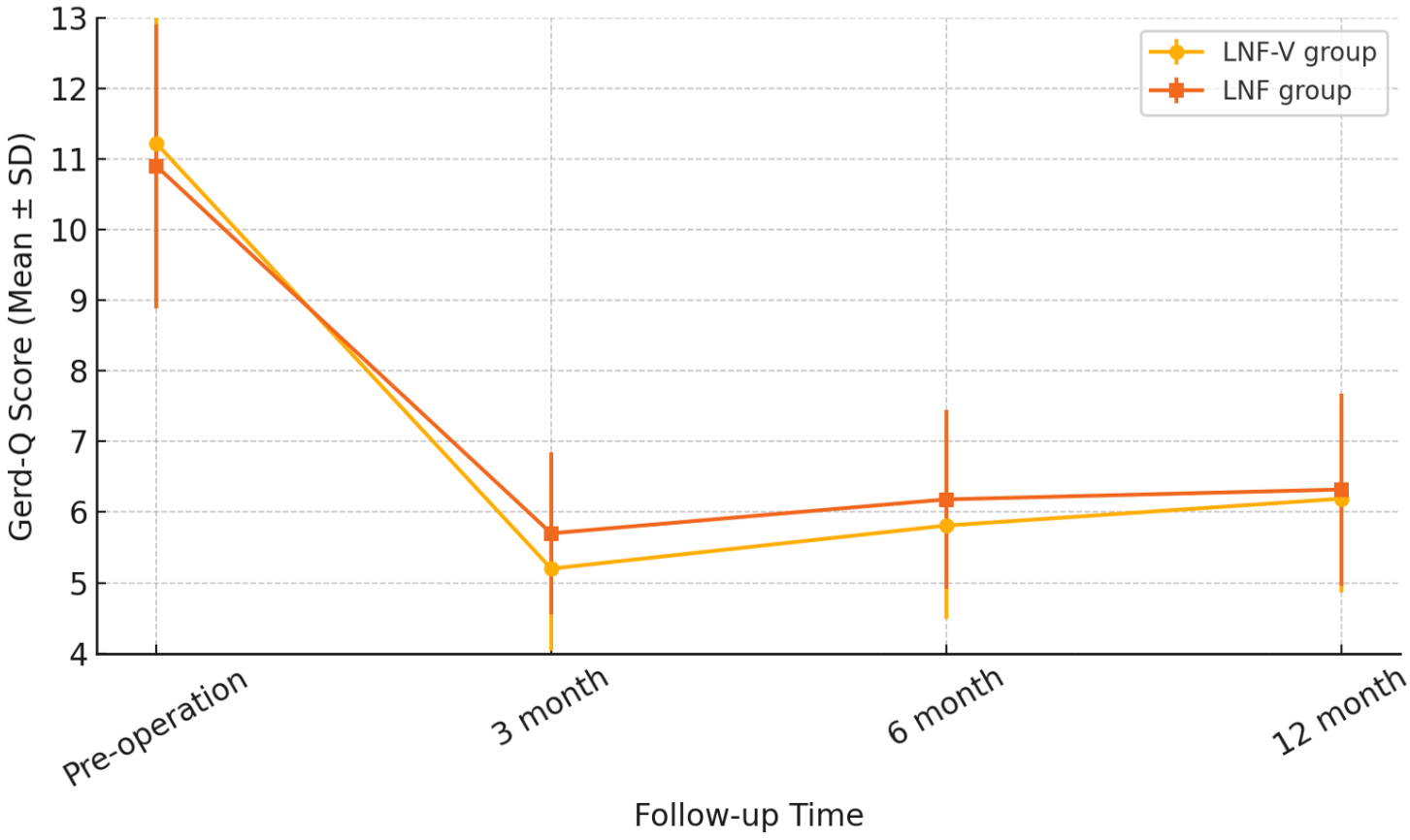

Figure 6

Postoperative changes in Gerd-Q score in the LNF-V and LNF Groups

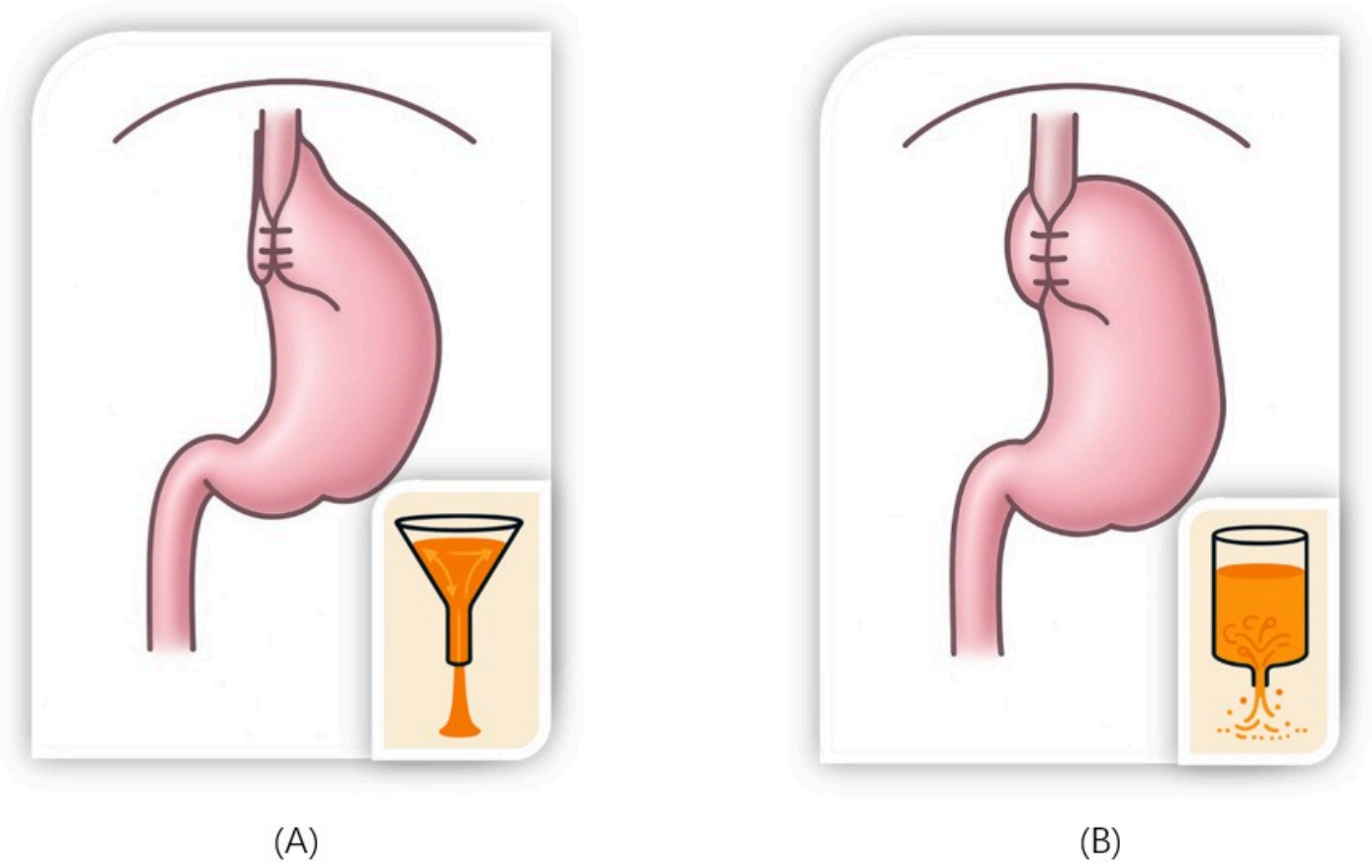

Figure 7

Illustrations and Mechanisms of LNF-V and LNF Procedures: (A) LNF-V; (B) LNF

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SPSSoperationinformation.xlsx
- SPSSbaseline.xlsx
- SPSSComplication.xlsx
- SPSSGerdQ.xlsx
- SPSSsaeed.xlsx