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## Study of Laparoscopic Nissen versus Anterior Partial fundoplication in management of gastro esophageal reflux disease in children

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### ABSTRACT

**Background:** The most prevalent upper gastroesophageal disorder in Western populations is GERD. A number of techniques were recommended for this problem's prevention.

**Aim of the study:** to compare the Nissen fundoplication with partial anterior fundoplication.

**Patients and Methods:** The present comparative study comprised thirty patients with symptoms of GERD admitted in the pediatric surgery department, Al-Azhar University hospitals, and all patients submitted to preoperative clinical evaluation and investigations. Laparoscopic Nissen fundoplication (group I) or partial anterior fundoplication (group II) was randomly assigned to the patients. A consent form was signed by each participant in our study.

**Results:** Between the two groups, there has been no significant difference in intraoperative complications or length of hospital stay. But, there was a significant difference in surgical time between the two groups in favor of the partial anterior procedure. Regarding heartburn and regurgitation after 1, 3, and 6 months, there is no significant difference between the two groups. After 3 months, there had been a highly significant difference in post-operative dysphagia favoring partial anterior fundoplication between the two groups, since dysphagia was significantly less common after partial anterior fundoplication. Gas bloating was less frequent after 1, 3, and 6 months with partial anterior fundoplication but without significant differences between both groups.

**Conclusion:** Partial anterior fundoplication appears to be as safe and effective as Nissen fundoplication in treating GERD symptoms, even in patients with severe disease forms. Its technique is easier and requires less time to conduct.

**Keywords:** Laparoscopic Nissen; Partial fundoplication; gastroesophageal reflux.

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### INTRODUCTION

Gastroesophageal reflux disease (GERD) is a highly prevalent disorder with a rising frequency, resulting in a significant healthcare burden and a reduction in life quality.<sup>1</sup>

At 0 to 3 months, 20% of infants have more significant regurgitation (> 4 times/day), followed by 23% at 4-6 months, 3% at 7-9 months, and only 2% at 12 months.<sup>2</sup>

Gastro-esophageal reflux disease can manifest in a wide range of symptoms which lead to be more common after meals and are often aggravated by recumbency. Symptoms can be subdivided in to typical (heart burn and acid regurgitation), atypical (epigastric pain, dyspepsia, nausea and bloating) and

extra esophageal (chronic cough, asthma, laryngitis and dental erosions).<sup>3</sup>

Over the past 70 years, surgery for gastroesophageal reflux disease (GERD) has been evolving. There have been studies, introductions, and modifications of Belsey's wrap, Hill's gastropexy, and Nissen's fundoplication. Numerous methods were employed, including robotically assisted procedures, thoracotomy, laparotomy, thoracoscopy, and laparoscopy.<sup>4</sup>

Laparoscopic fundoplication is the gold standard operation for GERD and has been demonstrated to provide effective long-term symptom relief.<sup>5</sup>

Some surgeons recommend anterior fundoplication as an alternate surgical therapy for gastroesophageal reflux disease. Laparoscopic anterior 180° fundoplication has been shown in some studies to

have a similar ability to control reflux symptoms while reducing the occurrence of postsurgical complications.<sup>6</sup>

This work aimed to compare laparoscopic Nissen fundoplication with partial anterior fundoplication in the treatment of Gastro-esophageal reflux disease in children.

## PATIENTS AND METHODS

Thirty GERD patients were admitted from the pediatric surgery outpatient clinic at Al-Azhar University hospitals for preoperative evaluation using clinical and investigative techniques.

### Clinical evaluation: -

Patients have been asked about the existence of typical GER symptoms (heartburn, regurgitation, and dysphagia) as well as symptoms suggestive of extra-esophageal manifestations of GER, such as a history of recurrent pneumonia, asthma, or laryngitis.

The recorded symptoms have been analyzed for duration of onset, progress, severity, and drug used.

### Physical examination

Physical examination to evaluate the patient for fitting to anti reflux surgery.

### Investigations

Preoperative investigations (C.B.C, coagulation profile, liver functions, kidney functions), chest x ray and specific investigations: Upper gastroesophageal endoscopy

Gastrografin follow through with trendelenburg position.

Esophageal pH monitoring in selected cases.

### Patient grouping:

After approval by the local ethical committee, each child's parents gave their informed consent after explaining the procedure to the parents.

This study involved thirty patients who were selected at random and divided into two equal groups: Group I (15 patients) operated for GERD with laparoscopic Nissen fundoplication (360°). Group II (15 patients) operated for GERD with partial anterior fundoplication (180°).

All patients had been followed at 1, 3 and 6 months. The follow up was done by clinical examination, Gastrografin follow through after 1 month and Upper gastroesophageal endoscopy after 3 months.

### Operative procedure:

#### Laparoscopic Nissen fundoplication

On a split-leg table, the patient is lying down with their arms out. At the patient's right shoulder, monitors are positioned at eye level. On the left side, the operating surgeon is standing. The first assistant

is on the opposite side from the camera person, who is likewise standing to the patient's left.

Divide the gastro-hepatic omentum using the harmonic scalpel. If at all possible, the anterior vagus' hepatic branch is preserved.

In order to expose the abdominal esophagus, the peritoneum covering the right crus is split. The crura are removed to reveal the posterior V-shaped decussation of the esophagus.

The OGJ is shifted from left to right, revealing the suitable right crus limb. A window is established behind the esophagus.

Crural closure is done by interrupted two or three stitches of 2/0 silk sutures or a non absorbable monofilamentous suture material, care was taken not to excessively tighten the crura to avoid dysphagia.

Then, using the aforementioned suture materials, a floppy, short wrap covering the esophagogastric junction was created, measuring about 2 cm in length and directed using the laparoscopic instrument's metallic part.

#### Laparoscopic partial anterior fundoplication:

The Laparoscopic anterior fundoplication's first steps matched those of the Nissen operation. The fundus's anterior wall has been fixed to the diaphragmatic hiatus and the front of the esophagus to create a 180° anterior partial fundoplication. The fundus has been sutured to the right lateral wall of the abdominal esophagus, as well as the right hiatal pillar and the posterior hiatal repair, to accomplish this.

The anterior partial fundoplication restored the hiatus, enhanced the angle of His, anchored a 3 to 5 cm length of the esophagus inside the abdomen, and created a partial fundoplication that has been stitched to the esophagus as well as the hiatal ring.

## RESULTS

Group I had a median age of 7 years (ranging from 1 to 16 years), while Group II had a median age of 7 years as well (ranging from 1 to 15 years).

According to the studied patients' age and sex, with p-values of 0.933 and 0.713, respectively, there have been no statistically significant differences between groups I and II.

### Operative results

#### Operative and post-operative complications and mortality

Neither intra-operative nor post-operative mortality has been encountered during the two procedures. During dissection of the hiatus, bleeding occurred in 3 participants in group I and 2 participants in group II, and control of bleeding was achieved without the need for blood transfusion.

In Group I, 2 patients were converted to open Nissen fundoplication due to long operative time for the safety of the patient.

In 2 participants in group 1 and 2 participants in group 2, laceration of the serosa of the stomach had happened and nothing was done about it. In 4 cases, slight injury to the left lobe of the liver's capsule from the liver retractor in group 1 and 2 cases in group 2, but there was no need to repair the injury or to give blood transfusion to patients.

No cases with perforation of the stomach or esophagus, dislocation of the wrap, crural disruption or subphrenic collection.

Table 1 shows that there was no significant difference between the two groups in terms of mortality and morbidity, as measured by the rate of conversion to open surgery and laceration of the stomach fundus, but these complications were higher with Nissen fundoplication ( $P > 0.05$ ).

### Operative time

The operative time was estimated from the beginning of trocars insertion and not including the time needed for preparation and anesthesia.

The operative time for group 1 ranged from 100 – 160 minutes with mean operative time  $124 \pm 18.73$  while the operative time for group 2 ranged from 75 – 140 minutes with mean operative time  $106.67 \pm 21.93$

There is a highly significant difference between the two groups in terms of the mean surgery time ( $P < 0.001$ ).

### Post-operative assessment

The post-operative hospital stay was  $3.07 \pm 1$  days, ranging from 2–5 days in Group I and  $3.6 \pm 1.1$  days, ranging from 2–5 in Group II. There was no significant difference between the two groups in terms of the postsurgical hospital stay ( $P > 0.05$ ).

### Postoperative follow up

Both symptomatic and functional measures were used to analyze the outcome of both procedures.

### Clinical assessment

Patients have been followed up in outpatient clinics at 1, 3 and 6 months postoperatively for clinical assessment.

Early in the postoperative period, in comparison to the preoperative findings (up to one month follow-up), the incidence of transient post-operative dysphagia was higher in 5 participants in Group I and 2 participants in Group II.

Both Nissen fundoplication and partial anterior fundoplication significantly reduced symptoms of reflux following 1 month of follow-up compared to presurgical findings. However, Nissen fundoplication significantly reduced symptoms of reflux more than partial anterior fundoplication ( $P < 0.05$ ).

However, there has been a significant difference across the two groups in terms of dysphagia favoring partial anterior fundoplication since dysphagia is significantly reduced with partial anterior fundoplication ( $p < 0.05$ ).

Both Nissen fundoplication and partial anterior fundoplication are efficient for controlling reflux symptoms after three and six months of follow-up. There is no statistically significant difference between the two procedures in terms of symptoms of reflux (heartburn, regurgitation); however, dysphagia is still more prevalent in group 1 despite not being statistically different ( $P > 0.05$ ).

Table 2 shows that When compared to presurgical symptoms, both Nissen fundoplication and partial anterior fundoplication have been significantly beneficial in treating reflux symptoms at 1, 3, and 6 months following the procedure. There have been no significant differences between the two procedures with respect to heartburn symptoms.

After 3 months, there had been a highly significant difference across the two groups in terms of post-operative dysphagia, favoring partial anterior fundoplication because the amount of dysphagia was much lower with partial anterior fundoplication ( $P < 0.001$ ). After 6 months follow up dysphagia still higher but was not significantly different ( $P > 0.05$ ).

As regarding post-operative gas bloating, all patients were examined for abdominal distension or discomfort, early satiety, epigastric fullness, epigastric pain.

Gas bloating was less frequent after 1, 3, and 6 months with partial anterior fundoplication, but there were no significant differences between both groups.

Esophago-gastroscopy was performed to all patients of both groups. The endoscopic aspect of the distal esophagus was evaluated carefully.

The endoscope revealed normal examination in 10 participants of Group I, and 5 participants had isolated erosive lesions at the lower end of the esophagus and improved after 6 months of medical treatment.

In Group II, the endoscopic examination was normal in 12 patients, and 3 patients had isolated small erosions with a successful rate of improving esophagitis with medical treatment.

		Group I No.= 15	Group II No.= 15	Test value	P- value	Sig.
Bleeding	No	12 (80.0%)	13 (86.7%)	0.240*	0.624	NS
	Yes	3 (20.0%)	2 (13.3%)			
Converted to open	No	13 (86.7%)	15 (100.0%)	2.143*	0.143	NS
	Yes	2 (13.3%)	0 (0.0%)			
Stomach serosal injury	No	13 (86.7%)	14 (93.3%)	0.370*	0.543	NS
	Yes	2 (13.3%)	1 (6.7%)			
Liver capsule injury	No	11 (73.3%)	13 (86.7%)	0.833*	0.361	NS
	Yes	4 (26.7%)	2 (13.3%)			
Pneumothorax surgical emphysema	No	15 (100.0%)	15 (100.0%)	-	-	-
	Yes	0 (0.0%)	0 (0.0%)			
Mortality	No	15 (100.0%)	15 (100.0%)	-	-	-
	Yes	0 (0.0%)	0 (0.0%)			
Oesophageal perforation	No	15 (100.0%)	15 (100.0%)	-	-	-
	Yes	0 (0.0%)	0 (0.0%)			

P-value > 0.05: Nonsignificant; P-value < 0.05: Significant; P-value < 0.01: Highly significant

\*: Chi-square test

**Table 1:** Comparison between group I and group II among Operative, post-operative complications and mortality of the studied patients.

Post-operative follow up		Group I No.= 15	Group II No.= 15	Test value*	P- value	Sig.
Heart Burn	No	13 (86.7%)	12 (80.0%)	0.240	0.624	NS
	Yes	2 (13.3%)	3 (20.0%)			
Month	No	13 (86.7%)	12 (80.0%)	0.240	0.624	NS
	Yes	2 (13.3%)	3 (20.0%)			
3 Months	No	13 (86.7%)	12 (80.0%)	0.240	0.624	NS
	Yes	2 (13.3%)	3 (20.0%)			
6 Months	No	15 (100.0%)	15 (100.0%)	1.034	0.309	NS
	Yes	0 (0.0%)	0 (0.0%)			
Regurgitation	No	13 (86.7%)	12 (80.0%)	0.240	0.624	NS
	Yes	2 (13.3%)	3 (20.0%)			
Month	No	13 (86.7%)	12 (80.0%)	0.240	0.624	NS
	Yes	2 (13.3%)	3 (20.0%)			
3 Months	No	15 (100.0%)	12 (80.0%)	3.333	0.068	NS
	Yes	0 (0.0%)	3 (20.0%)			
6 Months	No	15 (100.0%)	15 (100.0%)	-	-	-
	Yes	0 (0.0%)	0 (0.0%)			
Dysphasia	No	10 (66.7%)	13 (86.7%)	1.677	0.195	NS
	Yes	5 (33.3%)	2 (13.3%)			
Month	No	10 (66.7%)	13 (86.7%)	1.677	0.195	NS
	Yes	5 (33.3%)	2 (13.3%)			
3 Months	No	11 (73.3%)	15 (100.0%)	4.615	0.032	S
	Yes	4 (26.7%)	0 (0.0%)			
6 Months	No	13 (86.7%)	15 (100.0%)	2.143	0.143	NS
	Yes	2 (13.3%)	0 (0.0%)			
Gas bloating	No	10 (66.7%)	13 (86.7%)	1.677	0.195	NS
	Yes	5 (33.3%)	2 (13.3%)			
Month	No	10 (66.7%)	13 (86.7%)	1.677	0.195	NS
	Yes	5 (33.3%)	2 (13.3%)			
3 Months	No	11 (73.3%)	14 (93.3%)	2.160	0.142	NS
	Yes	4 (26.7%)	1 (6.7%)			
6 Months	No	13 (86.7%)	15 (100.0%)	2.143	0.143	NS
	Yes	2 (13.3%)	0 (0.0%)			
Respiratory symptoms	No	13 (86.7%)	13 (86.7%)	0.000	1.000	NS
	Yes	2 (13.3%)	2 (13.3%)			
Month	No	13 (86.7%)	13 (86.7%)	0.000	1.000	NS
	Yes	2 (13.3%)	2 (13.3%)			
3 Months	No	15 (100.0%)	15 (100.0%)	-	-	-
	Yes	0 (0.0%)	0 (0.0%)			
6 Months	No	15 (100.0%)	15 (100.0%)	-	-	-
	Yes	0 (0.0%)	0 (0.0%)			

P-value > 0.05: Nonsignificant; P-value < 0.05: Significant; P-value < 0.01: Highly significant

\*: Chi-square test

**Table 2:** Post-operative clinical assessment of both groups.

## DISCUSSION

The most prevalent upper gastroesophageal disorder in Western populations is GERD.<sup>7</sup>

The wrap step for strengthening the lower esophageal sphincter is the most challenging, inconsistently performed, and operator-dependent phase in the GERD operation. The preceding steps attempted to restore and reconstruct the intra-abdominal oesophagus and crural closure. However, by reinforcing the lower esophageal sphincter, an unnatural and possibly dangerous volvulus of the gastric fundus is created.<sup>8</sup>

Oleynikov et al.<sup>9</sup> and Heider et al.<sup>10</sup>, stated that patients experiencing GERD and impaired peristalsis have usually been recommended for partial fundoplication. But the results showed that in individuals having impaired peristalsis, a partial fundoplication as well as a complete fundoplication are both useful in treating GERD symptoms.

The patients in this study were randomly classified into two groups without dependency on whether esophageal body motility was impaired or not. The present study comprised thirty individuals with symptoms of GERD who required therapy with proton pump inhibitors (PPIs).

Patients have been assigned to either laparoscopic Nissen fundoplication or laparoscopic partial anterior fundoplication at random. There were 2 cases (13.3%) converted to open fundoplication due to long operative time for the safety of the patient (Group I has two cases and Group II has none).

The rate of conversion to open procedure (13.3%) was in comparison with that of Watson et al.<sup>11</sup>, who recorded a conversion rate of 8%, and Landreneau et al.<sup>12</sup>, who achieved a conversion rate of 6%. Another study conducted by Baigrie et al.<sup>13</sup> found a conversion rate of 0%. According to Rebecchi et al.<sup>14</sup>, the conversion rate was 0%. Kneist et al.<sup>15</sup> discovered a 1.3% rate of conversion.

In this study, the mean surgery time was 106.67 ± 21.93 minutes for partial anterior fundoplication and was 124 ± 18.73 minutes for floppy Nissen fundoplication. There has been a significant difference in surgery time between the two groups in favour of the partial anterior wrap. This might be because, if needed, short gastric dissection takes more time.

The mean operative time in the current study correlates with the findings of Laws et al.<sup>16</sup>, who measured 155 min for Nissen fundoplication.

In contrast, the mean operative time in the current study seems to be slightly shorter when compared to Peters et al.<sup>17</sup>, who measured 202 ± 58 min for Nissen fundoplication.

In addition, Chrysos et al.<sup>18</sup>, reported 100 ± 22 min for Nissen fundoplication. Also, Chrysos et al.<sup>19</sup> again recorded 67 ± 15 minutes. Kneist et al.<sup>15</sup> observed that the average surgical time for partial anterior fundoplication was 90 minutes.

No intra-operative or post-operative mortality have been encountered during this study in both procedures. The morbidity that was recorded with Nissen fundoplication was higher than that was recorded with partial anterior fundoplication but not significant.

The mean post-operative hospital stay in this study was 3.07 ± 1.1 days in Group I and 3.6 ± 1.1 days in Group II. In terms of post-operative hospital stay, there's no significant difference between the two groups.

The results in this study correlated with those of Laws et al.<sup>16</sup> who noted 2.7 days for Nissen fundoplication. Also, Chrysos et al.<sup>19</sup>, recorded that the mean post-operative 2.6 ± 0.4 days for Nissen fundoplication (range, 1 to 5 days).

A partial anterior or Nissen fundoplication is equally successful in controlling heartburn and regurgitation, with no significant differences across the two groups, according to our evaluation of the clinical improvements in postoperative symptoms (heartburn and regurgitation) at 1, 3, and 6 months.

At the conclusion of the research, the percentage increased in both groups to reach approximately 98% in group I and 95% in group II. After 3 months, approximately 90 % of reflux symptoms were controlled in group I (Nissen), whereas approximately 70% were controlled in group II (partial anterior). This indicates that Nissen fundoplication is more effective at reducing symptoms of reflux in the early post-operative period, but there were no significant differences across the two groups during long-term follow-up.

In another study Baigrie et al.<sup>13</sup> discovered that after 2 years, patients with anterior hemi fundoplication had a reflux control of nearly 90%, while patients with Nissen fundoplication had a control of nearly 100%.

Regarding the onset of postoperative dysphagia in our study, at the 3-month follow-up, it became greater in the Nissen group and significantly different. At the 6-month follow-up, the beginning of dysphagia has lessened in the Nissen group, although it remains greater than the partial anterior group.

In a similar manner, Kneist et al.<sup>15</sup> in Germany found that following partial anterior fundoplication, there was better reflux control and decreased dysphagia occurrence. Also, in the Baigrie 13 study published in 2005, there was a less frequent onset of dysphagia for both solids and fluids after anterior fundoplication than in Nissen.

In a study published by Fein and Seyfried<sup>20</sup>, they recorded a higher incidence of dysphagia in Nissen patients, but this was weighted against a higher rate of recurrent symptoms in anterior group patients. This may be due to multiple studies included in that study and a longer term of follow-up.

Following a 5-year follow-up, research by Nijjar et al.<sup>21</sup>, was published in 2010 and found no differences in dysphagia ratings among the two groups.

Ma et al.<sup>22</sup> found a significant decrease in postsurgical dysphagia in individuals undergoing partial fundoplication ( $P < 0.0001$ ). Broeders et al.<sup>23</sup> stated a similar result.

In terms of gas bloating, our research indicated that people with Nissen had more of it than the partial anterior group. Watson et al.<sup>11</sup>, also reported no cases of gas bloating in their study (1995), which included 26 patients. Also, in Ma et al.'s<sup>22</sup> study (2012), they found that after partial fundoplication, there was a lower occurrence of inability to belch.

Broeders et al.<sup>23</sup> found that the partial anterior group had a lesser occurrence of gas-related symptoms (bloating, flatulence, incapability to belch) than the Nissen group.

On the other hand, in Cai et al.<sup>24</sup> study (2008), there was no difference between the two groups. This might be as a result of a longer follow-up period (ten years).

Esophago-gastroscopy was performed to all patients of both groups. The endoscopic aspect of the distal esophagus was evaluated carefully.

The endoscope revealed normal examination in 10 participants of Group I, and 5 participants had isolated erosive lesions at the lower end of the esophagus and improved after 6 months of medical treatment.

In Group II, the endoscopic examination was normal in 12 patients and 3 patients had isolated small erosions with successful rate in improving esophagitis with medical treatment.

Also, Peters et al.<sup>17</sup> recorded that esophagitis was completely resolved in 93% of patients following Nissen fundoplication. Broeders et al.<sup>23</sup> in their study at (2013) recorded healing of esophagitis 71% in (LAF) versus 77% in (LNF).

### CONCLUSION

Partial anterior fundoplication appears to be as safe and effective as Nissen fundoplication in treating GERD symptoms, even in patients with severe disease forms. Its technique is easier and requires less time to conduct. With partial anterior fundoplication, there are fewer postoperative sequelae linked to dysphagia and symptoms of gas.

Conflict of interest : none

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