

# Laparoscopic Thal versus laparoscopic Nissen fundoplication in children: comparative study regarding outcome and patient satisfaction

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**Introduction** Gastroesophageal reflux disease is a common condition in pediatric age group. Many surgeons believe that complete fundoplication provides better reflux control, yet it results in more dysphagia and gas-bloat symptoms. On the other hand, a partial wrap is reported to have fewer adverse effects but a higher failure rate in controlling reflux. Until now, there is no agreement and little evidence as to whether complete or partial fundoplication is the optimal procedure in this age group.

**Patients and methods** This is a prospective single-blinded randomized comparative study that included 30 patients who were admitted in the time period from May 2013 to May 2015 and were treated laparoscopically by either Nissen or Thal fundoplication.

**Results** Operative time (minutes) was significantly longer in the Thal group (186 ± 52) when compared with the Nissen group (150 ± 48) ( $P=0.031$ ). Intraoperative complications showed no significant difference when comparing the two groups. Although the incidence of postoperative dysphagia was statistically insignificant, the duration of dysphagia did show significantly shorter

duration in the Thal group (median: 6 days), when compared with the Nissen group (median: 17 days). There was no recurrence in the Thal group, whereas there was one recurrence in the Nissen group.

**Conclusion** This study suggests that Thal fundoplication offers an effective alternative to Nissen fundoplication with apparently shorter duration of dysphagia and thus earlier return to the normal eating pattern. Level of evidence: 1b. *Ann Pediatr Surg* 13:74–77 © 2017 Annals of Pediatric Surgery.

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## Introduction

Gastro-esophageal reflux disease (GERD) is a common condition in the pediatric age group. It is defined as the pathologic consequences of the involuntary passage of gastric contents into the esophagus. Infants and children suffering from GERD may have growth retardation, esophagitis, reflux-associated reactive airway disease, aspiration, and life-threatening apnea. For those patients, surgical management is indicated [1]. Nissen fundoplication is the most popular laparoscopic operation for the management of GERD applying a complete wrap. Some surgeons believe that complete fundoplication provides better reflux control, yet results in more dysphagia and gas-bloat symptoms [2]. On the other hand, a partial wrap is reported to have fewer adverse effects but a higher failure rate in controlling reflux. Fundoplication according to Thal is a less commonly used procedure utilizing a partial wrap anteriorly for valve formation [3]. Some studies suggest that it can achieve more effectiveness than the other fundoplication techniques [4]. Until now, there is no agreement and little evidence as to whether complete or partial fundoplication is the optimal procedure in this age group [5].

## Patients and methods

This is a prospective single-blinded randomized comparative study that was conducted at the Pediatric

Surgery Unit in Mansoura University Children Hospital, and included 30 patients who were admitted to the unit in the time period from May 2013 to May 2015 and diagnosed as having GERD.

The protocol of this study design was approved by the ethics committee of our institution.

A detailed written consent was obtained from the parents to have a laparoscopic antireflux procedure.

Parents were made aware of the procedure and its complications before surgery but were blinded to the type of operation performed.

Patients were managed laparoscopically either with the Nissen fundoplication or Thal fundoplication procedures. All included patients were suffering from GERD not responding to medical treatment or symptomatic hiatal hernia. Patients with neurological impairment were excluded. Patients were randomly assigned into two groups: laparoscopic Nissen [6] and Thal fundoplication [7].

Patients of both groups were evaluated as regards operative time and complications, as well as for postoperative dysphagia, and its duration, bloating, vomiting, and recurrence. Parent satisfaction was assessed using visual analog score during each follow-up visit. Parents were asked to compare the postoperative quality of life

with the preoperative and to score their satisfaction from 0 to 10. A score of 0 was defined as being very discontent and a score of 10 as being very satisfied.

Data were expressed as number and percent, median and range, or mean  $\pm$  SD, as appropriate. Test of normalization was done using Shapiro–Wilk test of normality. Changes in qualitative data were compared using  $\chi^2$ -test, or Fisher's exact test if one value was less than 5. Changes in quantitative data were tested using independent sample *t*-test for parametric data, whereas for nonparametric data Mann–Whitney *U*-test was used.

## Results

This study included 30 patients. The age range (at time of operation) was between 7 months and 6 years, with a median age of 19 months. As regards sex distribution, 18 (60%) of them were male while the remaining 12 (40%) were female. The body weights (at time of operation) ranged from as low as 5 kg to as high as 21 kg, with a mean weight of  $10.7 \pm 4.2$  kg. There was no statistically significant difference when the two groups were compared for demographic data.

Operative time (minutes) was significantly longer in the Thal group ( $186 \pm 52$ ) when compared with the Nissen Group ( $150 \pm 48$ ) ( $P = 0.031$ ). Intraoperative complications showed no significant difference when comparing the two groups. The incidence of postoperative dysphagia was eight (56.7%) patients in the Thal group and nine (60%) patients in the Nissen group (Table 1). That was nearly equal and showed no statistical significance. In 90% of cases of dysphagia, the condition improved with time or they needed prokinetic drugs. A total of three cases required endoscopic evaluation but without dilatation. Meanwhile, the duration of dysphagia showed a statistically significant shorter duration in the Thal group, when compared with the Nissen group ( $P = 0.043$ ). It showed a median of 6 days (0–2 weeks) in the Thal group, compared with a median of 17 days (0–56 days) in the Nissen group (Fig. 1). Bloating was significantly less frequent in the Thal group (zero patients) when compared with the Nissen group (six patients) ( $P = 0.008$ ). All patients with such complaint improved with time. There were no recurrences in the Thal group compared with one recurrence (that required redo) in the Nissen group, but this led to no statistical significance ( $P = 0.500$ ). Parental satisfaction (score of 1–10) after 1 and 3 weeks postoperatively showed no significant difference between groups. On the other hand, parental satisfaction score 2 weeks

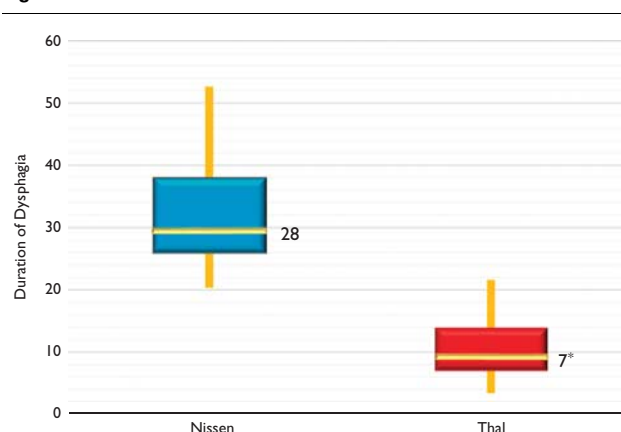
**Table 1 Postoperative data: dysphagia, recurrence, vomiting, bloating, and need for drugs**

	Nissen group (n=15)	Thal group (n=15)	P-value
Dysphagia	9 (60)	8 (56.7)	0.713
Recurrence	1 (6.6)	0 (0)	0.500
Vomiting	8 (53.3)	2 (13.3)*	0.025
Bloating	6 (40)	0 (0)*	0.008
Need for drugs	8 (53.3)	2 (13.3)*	0.025

Data are expressed as median and range or *N* (%).

\*Considered significant when  $P \leq 0.05$ .

**Fig. 1**



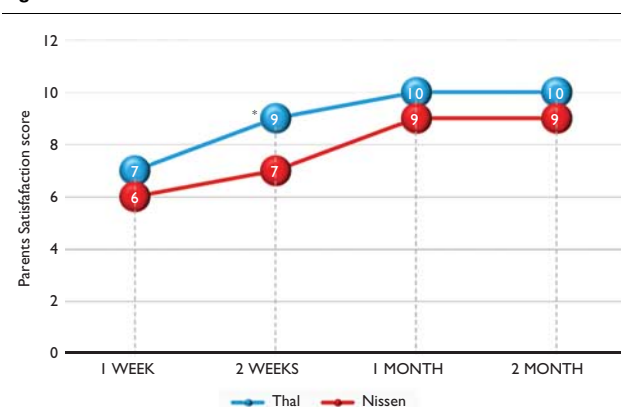
Duration of dysphagia in study groups (days). Data are expressed as numbers (Nissen group,  $n = 15$ ; Thal group,  $n = 15$ ). \*Considered significant when  $P \leq 0.05$ .

postoperatively was significantly higher in the Thal group compared with the Nissen group ( $P = 0.016$ ) (see Fig. 2). Strong negative correlation was found between parents' satisfaction score 2 weeks after surgery and postoperative bloating ( $r = -0.512$ ), and the need for medications ( $r = -0.648$ ).

## Discussion

Since the introduction of laparoscopic fundoplication in children in the mid-90s [8], Nissen fundoplication has been the most commonly adopted procedure in many institutions all over the world. This can be attributed to its effectiveness and satisfactory long-term results. However, the postoperative dysphagia and bloating frequently encountered raised the necessity for a more physiologic design of fundoplication. This is particularly important in children, as their ability to cope with distressing symptoms is limited. The development of Thal, as well as Toupet, partial wrap fundoplication gave surgeons an appealing alternative with seemingly similar

**Fig. 2**



Postoperative parental satisfaction (score: 1–10); first, second, fourth, eighth week (median) (Nissen group,  $n = 15$ ; Thal group,  $n = 15$ ).

\*Considered significant when  $P \leq 0.05$ .

effectiveness and much less postoperative side effects [9]. The hypothesis of the current study was whether the Thal anterior valve technique is of equal effectiveness as the Nissen fundoplication in addition to less dysphagia and bloating.

In the current study, operative time was found to be significantly longer in the Thal procedure. By reviewing literature, only one comparative study considered operative duration as an aspect for comparison between the two techniques [5]. In that study, no significant difference was found in contrast to our study results. In that study, partial fundoplication operative time showed a median of 142 min (range: 78–710 min) and complete fundoplication took 120 min (range: 60–205 min). On the other hand, similar prospective studies on adult patients demonstrated no difference in operative time between the two techniques [10].

During follow-up, dysphagia of variable degree was the most common complaint in patients of either groups of the current study. It was encountered in nearly 60% of patients with no difference in incidence among either the Thal or Nissen patients. Notably, dysphagia was mild and short-lived in about 90% of the cases of the two techniques. The degree of dysphagia also varied. Most of the patients (90%) showed improvement just by temporarily avoiding solid food and using prokinetic drugs. Only three cases required endoscopic evaluation, but none of them needed dilatation. Meanwhile, the duration of dysphagia showed a wide variation. Remarkably, post-Thal fundoplication patients reported earlier improvement of dysphagia, whereas post-Nissen patients suffering from dysphagia reported a significantly longer duration of this complaint. Kubiak *et al.* [11] reported a significantly higher incidence of dysphagia after complete wrap of 11.8% in a prospective study including 175 patients, compared with 2.4% after Thal fundoplication. Other studies reported no relation of dysphagia to the type of wrap [11,12]. Dysphagia after Thal procedure was reported in another study with an incidence of 2% [13]. Mauritz *et al.* [14] studied 1280 patients in a meta-analysis in which they reported postoperative dysphagia ranging from 0 to 33% of patients. However, this rarely lasted after the first few months following surgery. In addition, they noted that postoperative dysphagia was more commonly reported after complete fundoplication than after partial fundoplication. In the present study, only 10% of patients with dysphagia had symptoms severe enough to require endoscopic evaluation. Moreover, all of them improved on follow-up with no need for dilatation. Early dysphagia is mostly resulting from postoperative edema, and resolves spontaneously. In contrast, in some cases with persistent complaint, a tight approximation of the crura or a tight wrap is usually the cause [15]. Generally, pediatric patients undergoing antireflux surgery are expected to have not only a rapid recovery and return to normal activity, but also a complete relief and cessation of drug intake. Thus, it is frustrating for both the surgeon and the parents when dysphagia occurs postoperatively [16].

In the present study, postprandial epigastric fullness and discomfort, also described as bloating, was not encountered during the follow-up of patients after Thal fundoplication. In comparison, 40% of Nissen fundoplication patients suffered from bloating to a variable degree throughout their postoperative course. Large body of literature documents a relatively higher incidence after complete wrap. Mathei *et al.* [17] reported a 14% incidence of bloating in their series. Another earlier review reported a 35% incidence, but most of the patients report fading out of symptoms over time [18]. Conversely, in the recent meta-analysis by Mauritz *et al.* [14] no bloating was reported in any prospective study.

In the current study, there was only one case of recurrence, which was in the Nissen group (6.7%) in the form of wrap transmigration. In that particular case, this could be attributed to the presence of shortening of the esophagus as she suffered from long-standing esophagitis and esophageal stricture preoperatively. This case later had a laparoscopic redo where the hiatus was found to be wide and needed repair. This finding is in contrast to that reported by Kubiak *et al.* [11] who showed a significantly higher revision rate after partial wrap than in complete wrap (15.9 vs. 5.9%). However, that study included a significant share of neurologically impaired children. On the other hand, other large studies showed no difference between either types of wrap (2.5%), such as Esposito *et al.* [12]. In a study comparing the two techniques but on post-tracheoesophageal fistula repair patients, the need for reoperation was slightly more after Thal fundoplication (19%) than after Nissen (13%). However, this difference did not reflect any statistical significance [5].

In the present study, during the second week postoperatively, the satisfaction score demonstrated a significant difference between groups. Remarkably, by the second week postoperatively, post-Thal patients showed earlier rise of satisfaction. Apparently, the shorter duration of dysphagia allowing the child to return to normal eating habits, less bloating, and less need for drugs all played a prominent role. By reviewing literature, no studies comparing the quality of life after Thal and Nissen fundoplication in the pediatric population could be found. However, one multicenter study on adult patients illuminates similar findings as the present study as regards better early postoperative improvement of the quality of life after partial wrap [19].

## Conclusion

The results of this study suggest that Thal fundoplication offers an effective alternative to Nissen fundoplication with apparently shorter duration of postoperative dysphagia and thus earlier return to the normal eating pattern and higher parents' satisfaction. Finally, further studies with larger sample size, longer follow-up, and more objective postoperative evaluation will reveal more conclusive results.

## Conflicts of interest

There are no conflicts of interest.

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