Esophageal Calibration with Soft Orogastric Tube During Laparoscopic Nissen Fundoplication may Reduce Postoperative Transient Dysphagia

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Abstract Gastroesophageal reflux is the most common benign disorder of the esophagus and laparoscopic Nissen fundoplication has become the standard surgical treatment for its treatment. In our area, where the use of bougie calibration is debatable, postoperative dysphagia is encountered often after this surgery although it is usually not permanent. The aim of this study was to investigate the effect of using a soft silicone tube 39 F in diameter for esophageal calibration during laparoscopic Nissen fundoplication on the incidence of postoperative dysphagia. We divided cases scheduled to undergo laparoscopic Nissen fundoplication between January 2009 and November 2010 into two groups, each consisting 25 patients. Esophageal calibration with a 39 F silicone orogastric tube was used for the first group while there was no operative calibration in the second group. The surgical duration was recorded; the presence and severity of the postoperative dysphagia was calculated by using a dysphagia severity scoring system during the 1-year postoperative follow-up. The dysphagia severity scores were significantly lower in group 1 than group 2 on the postoperative second day and at the end of the first week and first month. We did not find a significant difference at the end of the 6-month and first year. There was also no significant difference regarding surgery duration. The use of a soft orogastric tube 39 F in diameter for esophagus calibration during laparoscopic Nissen fundoplication has significantly decreased the incidence of postoperative transient dysphagia without affecting the duration of surgery. Although dysphagia gradually resolves in the majority of patients, a safe

and easy calibration method for its prevention is worth developing, and we believe that the use of our method in larger series could be beneficial.

Keywords Laparoscopic Nissen fundoplication · Esophageal calibration · Postoperative dysphagia

Introduction

Gastroesophageal reflux is the most common benign disorder of the esophagus and can be seen at any age. Symptoms of reflux disease can be present in up to 40 % of the community and lifelong drug treatment may be required in 15–50 % to relieve these symptoms when surgery is not undertaken [1, 2]. The laparoscopic use of the fundoplication surgery, originally defined by Nissen, for the first time in 1991 has made fundoplication a favorable option for the definite treatment of reflux disease, and it has become the standard surgical treatment for the disorder with a well-documented high rate of success in increasing both the general and disease-related quality of life together with proven reliability [3–6].

Dysphagia is frequently encountered after this surgery, although it is temporary in 95 % of the cases, and has a negative effect on the patient's quality of life. Moreover, dysphagia can also lead to dangerous results such as food impaction and aspiration [7–9]. The use of calibration of the esophagus with wide-diameter bougies during the surgery to prevent postoperative dysphagia is one of the modifications added to the Nissen's original procedure for these reasons [10, 11]. However, these bougies that have been originally prepared for esophagus dilatation are rigid and their tips are relatively sharp. These bougies require care and experience for their application and can cause prolonged surgery duration, esophageal and gastric mucosa damage, and even perforation [12–14]. Some studies also report that the calibration

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performed with these bougies with a diameter up to 60 F (2 cm) does not decrease the postoperative dysphagia rate [15, 16]. It is for those reasons that the use of bougie calibration is still debatable in our area.

Calibration can also be performed with tubes that have a narrower diameter, a softer structure, and more blunt tip. The use of such a tube can ensure a proper lumen diameter in the distal esophagus. The tissue edema and damage that can develop both during the application and dissection around the esophagus while the tube is in place can be decreased, and all these factors can be expected to decrease the duration and severity of the temporary dysphagia seen following fundoplication.

This prospective study was planned after considering that the 39-F (13 mm) diameter silicone orogastric tube that is used for gastric calibration during the sleeve gastrectomy surgery for morbid obesity conforms to the above features. Our aim was to determine the effect of using this orogastric tube for esophagus calibration during laparoscopic Nissen fundoplication on postoperative dysphagia.

Material and Method

Patients younger than 60 years who had presented or had been referred to our clinic between January 2009 and November 2010 complaining of reflux symptoms and were scheduled for laparoscopic Nissen fundoplication because of grade 2 or more advanced esophagitis with the Savary-Miller grading [17] and marked hiatus hernia on upper gastrointestinal system endoscopy, with no dysphagia symptom at any stage of the disease, with a history of proton pump inhibitor (PPI) use for 2 years or more, and with symptoms that resolved with PPI use but recurred when it was discontinued were included in this prospective study. The main reason we used these criteria for patient selection was the absence of pH monitorization or manometry tests at the time of the study in our clinic as it had been established in a rapidly developing region. We were unable to use preoperative pH monitorization or esophageal manometry, and we therefore only used the laparoscopic fundoplication surgery on patients with marked positive findings on endoscopy, no dysphagia, and known to have a good response to PPI treatment.

After we obtained the ethics committee consent required for the study from the authorized local ethics committee of the hospital, patients who had presented with a complaint of reflux and met the defined criteria were distributed into two groups of 25 patients each according to their order of presentation once informed consent was obtained and demographic information was recorded. The first patient in the study protocol and every patient with an odd protocol number afterwards according to the order of presentation at our clinic were included in group 1 where an orogastric tube

was used, while patients with an even protocol number were included in group 2 who underwent surgery without calibration. The same procedure was used for patients in both groups during surgery: the abdomen was entered directly from the supraumbilical port site and carbon dioxide was delivered until a pressure of 14 mm/Hg was obtained in the abdomen. After completing the placement of two 5 mm and two 10 mm diameter trocars, an 18-F nasogastric tube was inserted, the gastric content aspirated, and the nasogastric tube removed. Once this stage of the surgery was complete, group 1 patients received the 39-F silicone orogastric tube originally designed for gastric calibration during sleeve gastrectomy surgery (trade mark: AMI, production code: AGB 355). The tube was advanced to the middle section of the gastric corpus. The inflatable balloon section at the tip of this tube was not used. The hepatogastric ligament was dissected with the help of a Ligasure 5 mm (Valleylab-USA) and the right diaphragmatic crus was separated. The phrenoesophageal ligament was opened, exposing the esophagus. The vagus nerves were visualized and protected. The gastric fundus was freed by cutting two or three short gastric vessels. The defect in the diaphragm crus was repaired with an adequate number of intermittent 0/0 silk sutures. We then created a nonrigid (floppy) fundoplication 2–3 cm long with 2 or 3 intermittent 3/0 silk sutures with the first one placed to include the muscular layer of the esophagus as well, and the orogastric tube was removed. A suction drain was rarely placed from the left lateral port site. Group 2 patients underwent exactly the same procedure except the insertion and removal of the orogastric tube. All surgeries were performed by the same surgeon and the surgery duration recorded.

All patients were scheduled for discharge after receiving unrestricted oral food on the first postoperative day and undergoing the necessary evaluations for dysphagia on the second day. Postoperative follow-up went on for a year, and the patients were called for follow-up on the 7th day, and at the end of the 1st, 6th and 12th months. However, patients who did not have any problems on the 1-month follow-up were just called by phone. We planned to re-evaluate the fundoplication status with upper gastrointestinal system endoscopy if the reflux symptoms recurred or if the dysphagia symptom did not resolve within 2 months.

The presence and severity of dysphagia (Table 1) were evaluated by a dysphagia severity scoring (DSS) system used first by Patterson et al. and then modified by Somasekar et al. [10, 15]. The demographic information and the DSS values calculated at the time of follow-up of the patients were compared using the Mann–Whitney *U* test on the SPSS software version 14.0 and a *p* value less than 0.05 was considered significant. The nonparametric Mann–Whitney *U* test was used because the sample size was small, the scores were categorical data, and they often contained values as zero.

Table 1 Dysphagia severity scores [15]

Score	Dysphagia
0	No dysphagia.
1	Some solids only.
2	Most solids and no liquids.
3	Most solids and some liquids.
4	All solids and liquids.

Results

The mean age for group 1 and group 2 patients was 45.6 (25–57) and 44 (29–59) years, respectively, with similar age and gender distribution between the groups. The surgery duration was also similar between the groups and the calibration performed with the orogastric tube in group 1 did not cause a significant increase. The postoperative DSS revealed a certain degree of dysphagia in 10 (40 %) of group 1 and 16 (64 %) of group 2 patients during the 1-year follow-up (Table 2). The DSS values on the postoperative 2nd day, 7th day, and at the end of the 1st month in group 1 were significantly lower than group 2 values while there was no difference between the groups for values at the end of the 6th and 12th months (Table 3).

The suction drains placed in two patients in group 1 and one patient in group 2 were removed 8 h after the surgery. All patients were discharged on the postoperative 2nd day as planned and no patient developed a surgical complication. A patient in group 1 had new dysphagia symptom at the 6th month of follow-up. A diagnosis could not be made with endoscopy and fluoroscopy, and the esophageal manometry performed later was also found to be normal. This patient had no weight loss and was the only patient who still complained of dysphagia on the 12th month of follow-up in our study. Dysphagia “mainly against solid food” continued in only three patients in group 2 at the end of 6 months and all recovered by the end of the 12th month.

Upper gastrointestinal system endoscopy was repeated at various times of follow-up in three patients from group 1 and

Table 3 Summary of the results

	Group 1 (n, 25) orogastric tube	Group 2 (n, 25) control	p value
Mean age	45.6 (27–57)	44.0 (29–59)	>0.05
Gender (F/M)	12/13	14/11	>0.05
Mean duration of surgery (min)	51.6	50.8	>0.05
Mean DSS			
Postop. 2nd day	0.44	1.20	0.014, <0.05
Postop. 1st week	0.12	1.16	<0.01
Postop. 1st month	0.08	0.76	0.030, <0.05
Postop. 6th month	0.08	0.40	>0.05
Postop. 12th month	0.08	0.00	>0.05

four patients from group 2 as the epigastric burn symptom recurred. Four of these patients were found to have *Helicobacter pylori* positive gastritis. Two had normal endoscopy findings. All patients undergoing repeat endoscopy were found to have an intact fundoplication, but the last patient from group 2 showed a herniated gastric fundus above the diaphragm over a paraesophageal defect. This patient decided to undergo the recommended surgery at a later time. Symptoms of not being able to belch and gas bloat were present in three patients in group 1 and two patients in group 2 and medication was used to control these symptoms.

Discussion

Dysphagia is encountered commonly following laparoscopic Nissen fundoplication but is only evaluated as a postoperative complication if persistent. The more frequent use of minimal invasive procedures at present has increased patient expectations regarding the postoperative recovery period. The inability to eat solid food, even for a limited period, has a negative effect on the patient's quality of life and satisfaction. Postoperative temporary dysphagia is still somewhat common but the rate of persistent dysphagia of 23 % following Nissen fundoplication in the past has been decreased to 3 % thanks to the revolutionary modification of DeMeester et al. on the original procedure. It is difficult to determine which of these modifications that include decreasing the fundoplication length from 4 to 1 cm, dissecting the short gastric vessels and freeing the fundus and increasing the 36-F catheter used for calibration to 60 F has been more effective in decreasing dysphagia [16].

The most hotly debated modification is the dissection of short gastric vessels, and there is no consensus on whether it is needed [18–20]. It is known that tying these vessels causes symptoms such as bloating, not being able to belch, and excessive flatulence instead of recurring reflux symptoms.

Table 2 Dysphagia severity scores (DSSs) in group 1 and group 2 respectively (n 25/25)

DSS	2nd day	1st week	1st month	6th month	12th month
0	16/9	22/11	23/15	24/22	24/25
1	7/8	3/3	2/3	0/0	0/0
2	2/2	0/7	0/5	1/3	1/0
3	0/6	0/4	0/2	0/0	0/0
4	0/0	0/0	0/0	0/0	0/0
Mean DSS	0.44/1.20	0.12/1.16	0.08/0.76	0.08/0.40	0.08/0.00

Although it is possible to perform a loose fundoplication without dissecting the short gastric vessels, we felt it would be better to free the fundus by dissecting two or three gastric vessels for the safety of the fundoplication in our study. DeMeester et al. had limited the length of the fundoplication to 1 cm, but the fundoplication length recommended for children weighing less than 15 kg is 2 cm [21]. We also do not feel a length of 1 cm is safe in our practice and keep fundoplication length at 2–3 cm.

The use of wide calibration esophageal bougies, the other modification suggested by DeMeester et al., has been widely accepted [10, 11]. However, the use of these bougies 2 cm in diameter can cause esophageal and gastric perforation at a rate close to 1 % [12, 13]. A study querying the need for these bougies to decrease persistent dysphagia by Mathavan et al. has studied fundoplication without bougies in 123 cases. Temporary dysphagia was seen in 24 % of the patients while dysphagia requiring dilatation treatment was present in 4 %, and these rates were comparable to those from series where a calibration bougie was used [22]. Somasekar et al. compared 40 cases where calibration bougies were used with 42 cases without this modification in a more recent study and found no difference in the rate of temporary dysphagia. They reported dysphagia at varying degrees in all patients in both groups on the 2nd day. The dysphagia rate had decreased to 60 and 51 %, respectively, in the group with and without calibration at the end of 12th week while no patient had dysphagia at the end of the first year [15].

We believe that the similar rate of dysphagia with and without bougie use is due to the edema that develops in the distal esophagus in both conditions. The edema that develops in fundoplication without bougie application may be due to the surgical manipulation around the area. The edema in cases with a bougie is partially due to the insertion and removal of the bougie and partially to the pull and push stress of the surgical manipulations. The presence of a rigid substance within the lumen may increase the effect of this external pressure.

We found significantly decreased postoperative transient dysphagia rate in the group where we used a soft tube 39 F (13 mm) in diameter compared to the group with no calibration on the 2nd day and at the end of the first week and first month. We believe that the dominant factor in this decrease was the tube structure rather than the tube diameter.

The insertion of the tube did not have a significant effect on surgery duration. The tube could be safely and easily placed into the esophagus in all patients due to its soft structure and blunt tip. The tube is a good guide for the physician during the surgery as the surgeon can feel its presence, and it is sufficiently hard to ensure that the fundoplication is of a proper width. It bent slightly to indicate that a certain force limit had been exceeded and therefore prevented the application of excessive pressure on the esophagus during

surgical manipulation. Because of the same reasons, we preferred to insert the tube before beginning the esophageal dissection. The presence of this soft tube did not cause any difficulty while performing esophageal dissection, and no risky position occurred while pulling the gastric fundus towards the esophagus.

The reason we chose the tube diameter as 39 F in this study was that we had it available and thought that a 13-mm diameter could be appropriate for esophagus calibration. The most appropriate diameter for calibration can of course actually be different, and more advanced studies that will provide an individualized ideal diameter for each case may be required.

We believe the weakest point of our study was our inability to perform pH monitorization and esophageal manometry. We therefore could only include patients with marked endoscopic findings where we had carefully queried the lack of dysphagia in the history. We believe pH monitorization and manometry should be standard for patient selection and currently use these tests routinely in the preoperative period.

In addition, the message of this study could be much more convincing if we could compare the use of this soft tube with the routine calibration bougies, but the use of calibration bougies is debated at our area and unfortunately neither of the authors of this study has ever used it routinely at their past practices.

We placed a suction drain postoperatively in three cases in our series. The common reason was the surgeon's anxiety regarding a minor hemorrhage during the dissection of the short gastric vessels, although hemostasis had been achieved.

We started unrestricted oral food to our patients on the first postoperative day but suggested that the patient should not take solid food in case of dysphagia. The reason for this approach was to determine and record the presence of dysphagia against solid food. Although we did not let our patients receive solid food for at least a week before we conducted this study, we saw that half the patients had no problems with solid food intake. We therefore do not restrict solid food after surgery now and only tell patients not to take solid food if they feel discomfort.

We called the patients for postoperative follow-up on the 7th day, and this may be a little early for a meaningful comparison. The reason for this approach was the necessity to see the patients on the 7th day to remove the sutures anyway. Our study included a total of 50 patients, and endoscopy was repeated in seven patients during the 1-year follow-up due to epigastric burn that indicated recurrence of reflux symptoms and in one patient because of the recurrence of dysphagia at the 6th month. The endoscopic appearance of the fundoplication was intact in all these patients, but there was paraesophageal hernia in one patient, most probably because the sutures placed on the hiatal crus had not been

successful. We did not have dysphagia of a severity requiring treatment in any patient in our series during follow-up.

Conclusion

This prospective study where we investigated the use of a soft calibration tube, which we see as an alternative to using an esophageal bougie, to decrease the dysphagia following laparoscopic Nissen fundoplication revealed that the calibration method we used significantly decreased the dysphagia incidence, especially in the early postoperative period. The absence of any dysphagia in 64 % of the group where we used a soft calibration tube is an important result, taking into account the series where some degree of dysphagia was seen in almost every patient.

We believe that the success of the method in decreasing temporary dysphagia is due to the soft and elastic structure of the silicone tube used ensuring proper calibration and absorbing (by bending) the external pressure on the esophagus before the force used goes over a certain limit during the surgery and therefore decreasing pressure-dependent edema development in the esophagus.

Temporary dysphagia compromises the patient satisfaction and comfort of minimal invasive procedure, where the expectations are continuously increasing. We therefore feel that it is important to prevent this symptom although it gradually resolves in the majority of the patients. However, the method used to prevent it must also be safe and easy. We believe that the method we used to decrease postoperative dysphagia has these features and that its use in larger series could be beneficial.

Conflict of interest The authors of this manuscript have no conflicts of interest or financial ties to disclose.

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