Fundoplication After Heller Myotomy: A Retrospective Comparison Between Nissen and Dor

Heller Miyotomisi Sonrası Fundoplikasyon: Nissen ve Dor Arasında Retrospektif Bir Karşılaştırma

Antonello Cuttitta1, Antonio Tancredi1,2, Angelo Andriulli1, Ermelinda De Santo3, Andrea Fontana4, Fabio Pellegrini4,5, Roberto Scaramuzzi1,6, Gerardo Scaramuzzi1

1Unit of General Surgery 2nd and Thoracic Surgery, IRCCS “Casa Sollievo della Soff erenza” Hospital, Viale Cappuccini, San Giovanni Rotondo, FG, Italy
2PhD School in Internal Medicine and Medical Therapy, Department of Internal Medicine and Medical Therapy, University of Pavia, Piazzale Golgi, Pavia, PV, Italy
3Unit of Gastroenterology, IRCCS “Casa Sollievo della Soff erenza” Hospital, Viale Cappuccini, San Giovanni Rotondo, FG, Italy
4Unit of Biostatistics, IRCCS “Casa Sollievo della Soff erenza” Hospital-Viale Cappuccini, San Giovanni Rotondo, FG, Italy
5Laboratory of Clinical Epidemiology of Diabetes and Chronic Diseases, Consorzio Mario Negri Sud-Via Nazionale, Santa Maria Imbaro, CH, Italy
6Graduate School of Medicine, Catholic University of the Sacred Heart - Largo Francesco Vito, Rome, Italy

Abstract

Objective: A retrospective comparison between Nissen and Dor fundoplication after laparoscopic Heller myotomy for achalasia.

Materials and Methods: From 1998 to 2004 a first group of 48 patients underwent Heller myotomy and Nissen fundoplication for idiopathic achalasia (H+N group). From 2004 to 2010 a second group of 40 patients underwent Heller myotomy followed by Dor fundoplication (H+D group). Some patients received a previous endoscopic treatment with pneumatic dilatation or endoscopic injection of botulinum toxin that provided them only a temporary clinical benefit. Changes in clinical and instrumental examinations from before to after surgery were evaluated in all patients. Clinical evaluation was carried out using a modified DeMeester symptom score system.

Results: Dor fundoplication treatment reduced both dysphagia and regurgitation severity scores significantly more than Nissen fundoplication (p<0.0001). Indeed, the incidence of dysphagia was significantly higher in patients treated with floppy-Nissen than in those treated with Dor fundoplication: by defining dysphagia as a DeMeester score equal to 3 (arbitrary cut-off), at the end of follow-up dysphagia occurred in 17.65% and 0% (p=0.037) of patients belonging to the H+N and H+D groups, respectively.

Conclusion: Heller myotomy followed by Dor fundoplication is a safe and valuable treatment. The procedure showed a lower incidence of postoperative dysphagia versus Nissen fundoplication and a negligible incidence of postoperative GERD in a long-term postoperative follow-up.

Key Words: Achalasia, Dysphagia, Fundoplication, Heller myotomy, Nissen-Dor comparison

Özet

Amaç: Akalazya için laparoskopik Heller Miyotomi sonrası Nissen ve Dor fundoplikasyon arasında bir retrospektif karşılaştırılmıştır.


Bulgular: Dor fundoplikasyon tedavisine Nissen fundoplikasyonunun daha fazla disfaji ve yetersizlik şiddet skorunu önemli (p<0.0001) ölçüde azaltmıştır. Sonunda, “disfajik” olarak değerlendirilenin De-Meester skorunun 3 (keyfi cut-off) alındığı bir hasta, değerlendiride, Dor fundoplikasyon ile tedavi edilenlere göre floppy-Nissen ile teda-vi edilen hastalarla disfaji insidansı oranı anlamla derecede daha yüksek bulunmuştur. Sırasıyla H+N ve H+D grubu grubundaki hasta lar %17.65 ve %0 (p=0.037) takip hasta dai (disfaji) olumuştur.

Sonuç: Heller miyotomi- Dor fundoplikasyon genel ve değerli bir tedavi yöntemiidir. Bu prosedür, postoperatif disfajiye karşı Nissen fundoplikasyon daha düşük bir insidans ve ihmal edilebilir bir oranda ameliyat sonrası uzun süresi bir takip de ameliyat sonrası GÖRH göstermiştir.

Anahtar Kelimeler: Akalazya, Yutma güçlüğü, Fundoplikasyon, Heller miyotomi, Nissen-Dor karşılaştırma

Received: Jul 23, 2011 / Accepted: Oct 24, 2011

Correspondence to: Antonio Tancredi MD, Unit of General Surgery 2nd and Thoracic Surgery-IRCCS “Casa Sollievo della Soff erenza” Hospital, Viale Cappuccini 1, 71013 San Giovanni Rotondo (Foggia), Italy Phone: +39 339 4830186 - +39 882 410273 Fax: +39 882 410813 e-mail: antoniotancredi@virgilio.it
doi:10.5152/eajm.2011.31
Introduction

Idiopathic achalasia is characterized by loss of LES (Lower Esophageal Sphincter) relaxation and failure of the esophageal body peristalsis after swallowing. Sir Thomas Willis in 1672 was the first to describe this condition in the medical literature and called it cardiospasm [1].

The most common symptoms are dysphagia, regurgitation of undigested food, unexplained chest pain, heartburn mimicking reflux, cough, and recurrent pneumonia. All of these symptoms can often become so debilitating that a severe weight loss can occur.

The standard instrumental exams, for a patient suspected for esophageal achalasia, consist of an upper gastrointestinal barium meal, esophageal manometry, upper endoscopy, and pH monitoring [2].

Though it is possibly the most studied and best described disease of esophageal motility, its etiopathogenesis remains speculative. It seems to be a neurodegenerative disorder affecting the function of the muscle of the oesophageal body and LES due probably to an idiopathic and irreversible loss of postganglionic inhibitory neurons in the Auerbach myenteric plexus with a consequent imbalance of cholinergic stimulation [3-5].

The pathological alterations of primary achalasia are well known. Typically, inhibitory nitrergic myenteric plexus neurons are lost, and degenerating neurons and ganglia are often surrounded by lymphocytes and eosinophils. Excitatory cholinergic innervation initially is relatively spared. Although, as mentioned above, its etiopathogenesis is not known, recently the possibility of an autoimmune explanation has been hypothesized [6, 7].

The first described treatment for achalasia was performed in London by Thomas Willis in 1674; he forcefully passed a piece of whalebone padded with a sponge through the LES [8].

In 2011, the debate about the therapeutic approach is still open. The only drug therapy seems to be insufficient instead, endoscopic dilation and endoscopic injection of botulinum toxin give good results, but only for a short time.

Since minimally invasive surgical techniques were introduced, most authors agree that the first-line therapy should be laparoscopic myotomy with fundoplication; but the discussion about the type of fundoplication (partial or complete) remains open.

This paper reports our experience with partial and total fundoplication after Heller myotomy.

Materials and Methods

From January 1998 to June 2010, 88 patients affected by oesophageal achalasia, after giving written informed consent, underwent laparoscopic Heller myotomy plus fundoplication at the Unit of General Surgery II - Thoracic Surgery of the IRCCS Casa Sollievo della Sofferenza Hospital - San Giovanni Rotondo (FG).

Three patients were excluded from the study because they were not eligible: one patient underwent emergency surgery for an esophageal perforation that occurred during endoscopic dilatation, another patient was reoperated on after a few months for an esophageal diverticulum that was diagnosed during the follow-up (undiagnosed initially), and the last patient required an immediate laparotomy conversion for visceral adherences secondary to previous abdominal interventions.

Among the remaining 85 patients, 48 were operated on from 1998 to 2004 and underwent laparoscopic Heller myotomy plus Nissen total fundoplication (H+N group), while 37 patients were operated on from 2004 to 2010 and underwent laparoscopic Heller myotomy plus Dor hemifundoplication (H+D group).

In 2004, after six years of experience with Nissen fundoplication, we decided to perform Dor instead of Nissen because our patients had a higher incidence of dysphagia from Dor than reported by some authors in the medical literature. Therefore, this was a retrospective study, without a research project, not double-blind and not randomized, meaning it therefore did not need ethical approval [9-11].

All patients were followed before and after the surgery, both with a clinical evaluation and instrumental examinations.

Clinical evaluation was carried out at baseline and after the surgery (pre-post), using a modified DeMeester symptom scoring system (Table 1), in which each patient was evaluated according to the presence of three symptoms: dysphagia, regurgitation and heartburn. For each symptom, a score from

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>dysphagia</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Occasional transient episodes</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Require liquids to clear</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Impaction requiring medical attention</td>
</tr>
<tr>
<td>heartburn</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Occasional brief episodes</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Frequent episodes requiring medical treatment</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Interference with daily activities</td>
</tr>
<tr>
<td>regurgitation</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Occasional episodes</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Predictable by posture</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Interference with daily activities</td>
</tr>
</tbody>
</table>
0 to 3 was attributed, depending on its severity. Then, for each patient, a clinical score equal to the sum of its the symptom scores was finally assessed, and the reduction of each symptom severity after the surgery was then investigated.

The instrumental examinations were: an upper gastrointestinal barium meal, esophagogastroduodenoscopy (EGDS), esophageal stationary manometry, and pH monitoring. Among these instrumental exams, only the variation/behavior of the esophageal stationary manometry was investigated, due to the large number of missing data.

The follow-up was performed at our outpatient clinic for surgery and endoscopy.

One month after surgery and then every year, patients were invited to undergo upper gastrointestinal barium meal, EGDS with esophageal stationary manometry and then an ambulatory visit during which they were evaluated according to the DeMeester symptom scoring system.

All patients were also invited to undergo esophageal pH monitoring during the first year after surgery.

Patients who had not returned to the clinic were contacted by telephone, asked about their health conditions and assessed according to the DeMeester symptom scoring system.

Statistical methods
Patients' baseline characteristics are reported as the mean±standard deviation (SD) or frequencies and percentages for continuous and categorical variables, respectively. Missing data counts were also reported and baseline comparisons between the H+N and H+D groups were performed using chi-square test for categorical variables and the Mann-Whitney U-test for continuous variables.

Each symptom severity reduction was assessed by the difference in the mean DeMeester scores before and after the surgery. To investigate whether each symptom-specific severity reduction would be more accentuated in the H+D group than H+N group, these pre-treatment vs. post-treatment differences compared between the two groups by repeated-measures ANOVA models, adjusted for the following covariates: baseline severity score, symptoms duration and presence of: thoracic pain, weight loss, endoscopic dilatations and use of botulin at baseline.

Furthermore, to confirm robustness of the results, a Propensity Score (PS) matching analysis of observational data was also used to create groups of H+N-treated and H+D-treated units that have similar characteristics, in terms of covariates mentioned above, so that comparisons can be made within these matched groups. PS is defined as the conditional probability of receiving treatment given a set of relevant observed covariates. A common method used for creating stratum of patients with similar PS is to compute the logit of the estimated PS and then use a greedy-matching algorithm (like “greedy 5 to 1") to match subjects using calipers that were defined to have a maximum width of 0.2 standard deviations of the logit of the estimated propensity score [12, 13].

Finally, difference in esophageal stationary manometry means between H+D and H+N groups, measured from the baseline visit over un-equally spaced follow-up time, was evaluated in a subgroup of matched patients, by repeated-measures ANOVA.

A p value <0.05 was considered statistically significant. All analyses were performed using SAS Release 9.1 (SAS Institute, Cary, NC, USA).

Results
Preoperative, intraoperative and postoperative evaluations were performed systematically in all patients. Unfortunately, the follow-up sometimes was very difficult to ascertain, as this was a retrospective study.

Clinical follow-up was either ascertained for outpatients who agreed to be reassessed, or by telephone interview, for patients who refused to return to the clinic.

Twenty-four patients were lost to clinical follow-up, because of changes of residence or of phone numbers, and then clinical follow-up was ascertained for 61 patients of 85.

The instrumental follow up was incomplete and was not systematically ascertained, one reason was that some patients lived far away from the clinic and therefore preferred to stay in the hospitals of their country, another reason was that some patients refused to undergo invasive exams. As some troubles occurred on getting all clinical and instrumental measures during follow-up, statistical analyses for investigation of symptoms severity reduction were performed on a subsample of 49 patients, whereas statistical analysis for investigation of difference in esophageal stationary manometry variation between the two groups, was performed on a smaller subsample of 15 propensity-score matched patients, including only full-cases among the 49 patients.

Preoperative data
Statistical analyses were performed on the final study sample of 49 patients, 21 men (42.9%) and 28 women (57.1%) and baseline characteristics were reported on Table 2. The overall mean age was 44.82±14.70 years and no significant difference was observed between H+D group (46.47±14.67 years) and H+N group (41.71±14.67 years), p value=0.275. The overall mean symptoms duration was 3.90±3.54 years and the differences between the H+D group (3.54±3.97 years) and H+N group (4.57±2.53 years) reached the borderline sig-
The esophagogastroduodenoscopy ruled out a malignancy in all patients. The upper gastrointestinal barium meal was diagnosed as an esophageal achalasia in all patients. The average diameter of oesophagus was 5.12±0.71 cm in group H+N and 5.12±1.1 cm in H+D group (p value=0.902). Oesophageal manometry ascertained in all patients the typical signs of achalasia: synchronous contractions after swallowing, absence or alteration of peristalsis of the oesophageal body and an uncoordinated or absent LES relaxation. The mean LES pressure was 33.96±13.89 mmHg in H+N group and 38.32±17.84 mmHg in H+D group (p value=0.584). pH monitoring did not detect reflux disease in any patient. Baseline clinical DeMeester mean scores for dysphagia were 2.76±0.44 in H+N group and 2.88±0.34 in H+D group, for global severity were 5.59±1.06 in H+N group and 5.41±1.27 in H+D group, in both cases no significant difference was observed between the two groups. However, a borderline statistical non-significant difference was found by comparing DeMeester mean scores for regurgitation: 2.12±0.70 in H+N group and 2.09±0.53 in H+D group (p value=0.061). Before surgical treatment, 6 patients (12.3%) underwent endoscopic pneumatic dilatation of LES (3 patients in the H+D group and 3 patients in H+N group) and 11 patients (22.4%) underwent endoscopic injection of botulin toxin (4 patients in H+D group and 7 patients in H+N group), with a significant difference was significant (p value=0.022).

In all of these patients a recurrent dysphagia occurred for some a few months and for someone and for others after undergoing these treatments.

**Intraoperative data**

All operations were performed laparoscopically without conversion to laparotomy (apart from the aforementioned patient who was excluded from the study).
The overall average duration of the interventions was 104 minutes (range of 86-135 minutes), and specifically it was 106 minutes (range of 90-135 minutes) in H+N group versus 100 minutes (range 86-132 minutes) in H+D group.

Blood loss was negligible and transfusions were not used. No patient died during the procedure whereas there were two cases of intraoperative microperforations in H+D group and one case in H+N group; in all three cases the diagnosis was made in course of the intraoperative digestive endoscopy and it was performed an intraoperative suture of the perforation without sequelae on the outcome of the treatment.

**Postoperative data**

The overall average hospitalization was 5.47 days (range of 2-11), it was 4.83 days (range of 2-11) in H+D group and 5.98 days (range of 3-11) in H+N group.

There were not major postoperative complications.

**Follow-up**

The overall mean of follow up for all patients was 75 months (range of 4-142, median 81 months), while it was 31.2 months (range of 4-70, median 28 months) for H+D group and 107.8 months (range of 76-142, median 112 months) for H+N group.

The upper gastrointestinal barium meal showed a reduction in the average oesophageal diameter of about 2 cm in both groups and a smoother passage of barium from the esophagus into the stomach; this result was not statistically evaluable because of reasons already mentioned.

The oesophageal pH monitoring showed two cases of gastro-oesophageal reflux in H+D group (successfully treated with H+ pump inhibitors) and no cases in H+N group, keep in mind that these data were not comparable.

Tables 3 reported, for each group: 1) estimated mean scores of symptoms severity before (pre) and after (post) the surgery along with standard errors, carried out from adjusted repeated measures ANOVA models 2) the differences between pre and post within patients means and finally the differences between the two groups of such adjusted mean scores difference. Dysphagia and regurgitation severity scores were significantly more reduced after the surgery by Heller myotomy plus Dor emifundoplication treatment than Heller myotomy plus Nissen total fundoplication treatment, whilst no statistical evidence suggested to prefer one of the two treatments to better reduce heartburn severity scores.

Indeed, Dor emifundoplication treatment reduced dysphagia symptom of 1.15±0.20 scores more than Nissen total fundoplication (p value <0.0001). Dor emifundoplication also reduced regurgitation symptom of 0.86±0.19 scores than Nissen total fundoplication (p value<0.0001) but no one treatment was favourite to the other in reduction of heartburn symptom (p value=0.1513).

Furthermore, defining as “dysphagic” a patient which had a DeMeester score greater than or equal to 2 (arbitrary cut-off), a significant difference of dysphagia prevalences after the surgical intervention between patients treated with Dor emifundoplication and patients treated with Nissen total fundoplication was found: among all 32 patients belonging to H+D group, only 6.25% had dysphagia after the treatment whilst among all 17 patients belonging to H+N group, 82.35% had dysphagia after the treatment. Comparison between these two proportion was assessed by Fisher Exact Test (p value<0.0001). The same was observed by defining as “dysphagic” a patient with DeMeester score equal to 3: among all patients, only 3 of these had dysphagia disease and they all belonged to H+N group (so 3/17=17.65% of patients belonging to H+N group had the disease against 0% of patients with disease belonging to H+D group). Comparison were also significant (p value=0.037).

The patients with DeMeester score equal to 2 , with their compliance, don’t underwent any therapy, they undergo only a regular follow up. Instead, of the three patients with DeMeester score equal to 3, two had benefit by endoscopic dilatation, while the third refused any treatment.

Table 4 reported means and standard deviations of oesophageal stationary manometry, along with mean time in months from baseline measurement, for each propensity score matched group. As these measurements were not taken for all patients at the same equally-spaced time fractions over the follow-up, the repeated measurements ANOVA model employed for statistical analysis accounted both for intrinsic correlation within patient measurements and also for time discrepancy.
The overall mean of manometry follow up for selected matched patients was 19.9 months (range of 1.1-42.9, median 14 months), while it was 28.8 months (range of 12.1-42.1, median 36 months) for H+D group and 12.2 months (range of 1.1-42.9, median 5.4 months) for H+N group.

The model estimated a significant mean manometry reduction of 22.62 mmHg, along with standard error (S.E) of 2.72 mmHg and \( p < 0.0001 \), for patients belonging to H+D group and also a significant mean manometry reduction of 13.21 mmHg, along with S.E. of 4.72 mmHg and \( p = 0.016 \), for patients belonging to H+N group. However, the estimated difference between the two groups of the mean manometry difference from baseline and after 24 months was not significant: 5.15 mmHg, CI 95%=[-16.72, 6.41] mmHg and \( p = 0.389 \) (Fig. 1).

**Study limitations**

The absence of randomization and the large time-lag from the older and the newer treatment represented the major limitations to the present study.

Unfortunately it was not possible to randomize patients because for six years we performed the Nissen fundoplication and then, not satisfied with the results, we started to performing Dor (following the directions of some authors).

The large difference of follow-up time (twelve years) between the first cases of Nissen and the last of Dor is another limitation of this study because the most recent cases have had less time to develop a complication and in twelve years several technologies and materials can be improved and it may have had a bearing on the result. Furthermore, in twelve years, techniques of diagnosis and/or screening and indications to surgery or endoscopic treatment can be modified and therefore the conditions of patients at the time of surgery may have been different: this too may have had its weight on the results.

Although all the statistical analyses performed were designed to manage unbalances between groups and unequally-spaced measurements, lack of randomization however still remained the most serious matter. Therefore, interpretation of the results and their validation to the general population must be considered carefully.

### Table 3. Adjusted comparisons of dysphagia, heartburn and regurgitation mean scores before (PRE) and after (POST) the surgery among all unmatched patients (n=49)

<table>
<thead>
<tr>
<th>Treatment group</th>
<th>PRE (DeMeester)</th>
<th>POST (DeMeester)</th>
<th>Score difference within treatment</th>
<th>( p ) value*</th>
<th>Difference between treatment means</th>
<th>( p ) value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dysphagia score</td>
<td>DOR 2.99±0.12</td>
<td>0.93±0.11</td>
<td>-2.08±0.12</td>
<td>&lt;0.0001</td>
<td>1.13±0.12</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Heartburn score</td>
<td>NISSEN 0.47±0.14</td>
<td>0.61±0.14</td>
<td>-0.14±0.23</td>
<td>0.5330</td>
<td>0.41±0.28</td>
<td>0.1513</td>
</tr>
<tr>
<td>Regurgitation score</td>
<td>DOR 2.23±0.09</td>
<td>0.23±0.09</td>
<td>-2.00±0.11</td>
<td>&lt;0.0001</td>
<td>0.86±0.19</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>(DeMeester)</td>
<td>NISSEN 2.21±0.11</td>
<td>1.07±0.11</td>
<td>-1.14±0.16</td>
<td>&lt;0.0001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Means estimated and \( p \)-values calculated from repeated measure ANOVA models, adjusted for baseline DeMeester score, symptoms duration and presence of: acalasia, thoracic pain, weight loss, endoscopic dilatations and use of botulin at baseline

### Table 4. Oesophageal stationary manometry means and follow-up time from baseline measurement, for each propensity score matched group

<table>
<thead>
<tr>
<th>Treatment group</th>
<th>Measurements</th>
<th>Number of patients (n=15)</th>
<th>Mean follow-up times (months)*</th>
<th>Oesophageal stationary manometry means±SD (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOR</td>
<td>Baseline</td>
<td>7</td>
<td>0</td>
<td>39.2±19.35</td>
</tr>
<tr>
<td></td>
<td>1°</td>
<td>7</td>
<td>1.32</td>
<td>16.8±5.43</td>
</tr>
<tr>
<td></td>
<td>2°</td>
<td>7</td>
<td>15.4</td>
<td>11.7±3.67</td>
</tr>
<tr>
<td></td>
<td>3°</td>
<td>4</td>
<td>23.4</td>
<td>12.0±2.27</td>
</tr>
<tr>
<td></td>
<td>4°</td>
<td>4</td>
<td>34.7</td>
<td>11.5±1.29</td>
</tr>
<tr>
<td></td>
<td>Baseline</td>
<td>8</td>
<td>0</td>
<td>34.4±14.4</td>
</tr>
<tr>
<td>NISSEN</td>
<td>1°</td>
<td>8</td>
<td>3.27</td>
<td>20.9±5.55</td>
</tr>
<tr>
<td></td>
<td>2°</td>
<td>3</td>
<td>27.2</td>
<td>18.6±3.21</td>
</tr>
</tbody>
</table>

*Estimated mean follow-up times in months from patient’s baseline measurement and the next ones. SD=Standard Deviation
This study confirms previously known results and its specific contribution is given by the evaluation of the two treatments effectiveness in patients with the rare condition of achalasia. [9, 10, 14-25].

Discussion

One hundred years after the first attempts in the treatment of idiopathic achalasia, the most effective therapeutic strategy is still a controversial topic in the medical literature.

The first point widely debated consists in choice of pneumatic endoscopic dilatation or endoscopic injection of botulinum toxin versus surgery.

The second point of debate consists in the better surgical technique to use; in fact if the extramucosal myotomy remains the only standard procedure to reset the lower esophageal sphincter pressure, is still not definitively established whether it is always necessary associate an antireflux procedure after the myotomy and, in affirmative case, if a partial or total fundoplication is the better choice.

Regarding the necessity of a fundoplication, almost all authors agree on the importance to do always an antireflux fundoplication after esophageal myotomy because it has been shown that the myotomy alone imparts a high incidence of postoperative GERD and high risk of Barrett’s esophagus [14].

Instead conflicting opinions still remain about the choice of a partial fundoplication (Dor/Toupet) or a complete one (Nissen/Rossetti-Nissen) after the myotomy.

A first group of authors choose a 360° plication claiming to have a statistically insignificant recurrence rate of dysphagia, and almost no incidence of GERD [26-29]. Rossetti and collaborators stress that a total Nissen fundoplication only when performed by an experienced surgeon, in a reference centre for functional esophageal surgery, has a very low risk of dysphagic complication and equivalent to that of Dor fundoplication [28, 29].

Instead, a second group of authors, on the assumption that the achalasia is a functional esophageal disease characterized by reduced or absent peristaltic activity and thus a lack of propulsion of food bolus during swallowing, believes that an 360° fundoplication could adversely impact the effects of myotomy because too restrictive and then it could lead to recurrence of dysphagia. Moreover, they contend that Dor fundoplication, providing the anchoring of the gastric fundus on the myotomy edges, ensures their proper opening and a correct healing, besides protecting the mucosa [9, 10, 14-25].

Finally, while acknowledging, in some cases, a greater tendency of Dor fundoplication to develop postoperatively GERD, they point out that it is negligible, and we add that this complication can be treated with good patient compliance with medical therapy (proton pump inhibitors or anti H2), instead the recurrence of dysphagia generally requires an endoscopic treatment or even a re-do.

Therefore, this second group of authors choose to give the patients a low risk of GERD in exchange for a near certainty of resolution of the main problem, rather than having the almost certainty of not having the complication of GERD, but expose the patients to a significant risk to have a recurrence of dysphagia with important psychological consequences.

The literature shows that the recurrence of dysphagia is caused in 33% of cases by an incomplete myotomy, in 27% by a scar fibrosis shrinkage, in 13% by a too narrow fundoplication [30].

In our Unit, according with Del Genio, the problem of incomplete myotomy is overcome by performing intraoperative manometry after the myotomy, then we make sure that the pressure of the LES is zero before starting to make the fundoplication. Moreover the intraoperative endoscopy provides the certainty of an accurate muscular dissection. In fact, single transverse muscle bundles are more easily detected when esophagus is distended by endoscopic insufflation [31].

To avoid a too tight fundoplication, in the Nissen group we done an intraoperative manometry so we had a pression not over 35 mmHg; instead for Dor fundoplication, we did not perform manometry after the antireflux procedure because it is an emifundoplicatio then the risk that is too tight is very small.

In addition, our data indicate that the difference between the pressures of the two fundoplications is not statically significant (p=0.38), and even if after about two years, the Nissen average pressure is 18 mmHg and the Dor average pressure is 12 mmHg, this fact should not lead no difference between the two procedures.

Based on this premise, the miotomy fibrous scar and the periesophageal fibrosis could explain the different incidence of dysphagia in the two procedures.

So it could be argued that the best result of Dor compared to the Nissen is probably not due to the fact that the Nissen lead a major pressure at the LES, instead it is because Dor fundoplication is characterized by a smaller dissection in the hiatal region and provides an anchorage of the margins of the myotomy, and then it keeps them apart during healing, preventing excessive scar shrinkage [11, 32].

According with others authors, we deem that idiopathic achalasia is a surgical expertise [33, 34].

We maintain that the endoscopic pneumatic dilatation and endoscopic injection of botulinum toxin are alternative or complementary treatments to surgery and must be reserved for patients who decline the operation or for whom surgery is contraindicated, or for postoperative recurrence of dysphagia [33, 34].

Based on our combined experience, Heller-Nissen from 1998 to 2004 and currently (since 2004) Heller-Dor, we maintain that the Dor fundoplication is the first-line treatment for patients undergoing Heller myotomy for achalasia and we
believe it is important in the choice in favour of Dor the fact that the GERD (its most frequent complication) is treatable pharmacologically and with good patient compliance, instead are much more complex to manage patients with recurrent dysphagia (the most frequent complication of Nissen).

Conflict of interest statement: The authors declare that they have no conflict of interest to the publication of this article.

References

1. Roll GR, Rabl C, Ciovica R, Peeva S, Campos GM. A controversy that has been tough to swallow: is the treatment of achalasia now digested? J Gastrointest Surg 2010; 14: 33-45. [CrossRef]
16. Roll GR, Rabl C, Ciovica R, Peeva S, Campos GM. A controversy that has been tough to swallow: is the treatment of achalasia now digested? J Gastrointest Surg 2010; 33-45. [CrossRef]