

The Influence of Operation Technique on Long-Term Results of Achalasia Treatment

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Key Words: achalasia; dysphagia; laparoscopic Heller myotomy; Toupet fundoplication; Dor fundoplication.

Summary. Currently, the most effective therapy for achalasia is laparoscopic Heller myotomy with partial fundoplication. The aim of this study was to compare the long-term results between 2 different laparoscopic operation techniques in achalasia treatment.

Material and Methods. This was a retrospective study, where 46 achalasia patients were examined: 23 patients underwent laparoscopic Heller myotomy followed by the full gastric fundus mobilization, total hiatal dissection, and posterior Toupet (270°) fundoplication (group 1); other 23 patients underwent laparoscopic Heller myotomy with limited surgical cardia region dissection, not dividing the short gastric vessels and performing anterior partial Dor fundoplication (group 2). Long-term findings included the evaluation of postoperative dysphagia according Vantrappen and Hellemans and intensity of heartburn according the standard grading system.

Results. The patients in these 2 groups were similar in terms of age, weight, height, and post-operative hospital stay. The median follow-up was 66 months in the group 1 and 39 months in the group 2 ($P < 0.05$). Laparoscopic operation was effective in 82.6% of patients (excellent and good results) in the group 1; treatment was effective in 78.3% of patients in the group 2 ($P > 0.05$). Clinically significant heartburn was documented in 39% of patients in the group 1 and only in 13% of patients in the group 2 ($P < 0.05$).

Conclusions. According our study results, both laparoscopic techniques were similarly effective (82.6% vs. 78.3%) in achalasia treatment. Postoperative heartburn was significantly more common (39% vs. 13%) after laparoscopic myotomy, followed by the full gastric fundus mobilization, total hiatal dissection, and posterior Toupet (270°) fundoplication.

Introduction

Esophageal achalasia is the most commonly diagnosed primary esophageal motor disorder and the second most common functional esophageal disorder, which causes progressive dysphagia, regurgitation, and weight loss (1). Achalasia results from the irreversible destruction of esophageal myenteric plexus neurons causing aperistalsis and failed lower sphincter relaxation. The application of laparoscopic myotomy technique has allowed many surgeons and gastroenterologists to recommend surgery as the primary treatment (2–3).

Although dysphagia relief is maintained in 85%–100% of patients who underwent laparoscopic Heller myotomy (3), persistent dysphagia and postoperative gastroesophageal reflux (GER) are the most cited reasons for surgical failure. Furthermore, a randomized, controlled trial by Csendes et al. (4) reported that poor outcomes at 15.8 years after myotomy were the result of severe reflux disease but not of incomplete myotomy in 92% of patients. The SAGES year 2012 recommendations have empha-

sized that patients who undergo a myotomy also should have a fundoplication to prevent postoperative reflux and minimize treatment failure (3). The optimal type of fundoplication (posterior vs. anterior) has been debated till now. Additional evidence is needed to determine which partial fundoplication provides the best reflux control after myotomy. The aim of this study was to compare the long-term results between 2 different laparoscopic operation techniques (posterior vs. anterior fundoplication) in achalasia treatment.

Materials and Methods

This was a retrospective study, in which 46 patients with achalasia were examined. The patients were treated in the Clinic of Surgery, Hospital of Lithuanian University of Health Sciences, from January 1998 to December 2011. All patients gave their written informed consent, and the Local Ethics Committee approved the study (No. BE-2-44). Patients with the complaints of dysphagia usually arrived for a abdominal surgeon consultation in a consulting university clinic. After a radiological examination with barium contrast, esophagogastroduodenoscopy (EGD), and manometric studies, acha-

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lasia was diagnosed. The diagnosis of achalasia was confirmed by manometric analysis in all patients: elevated resting lower esophageal sphincter (LES) pressure (>45 mm Hg), incomplete LES relaxation after a swallow, and peristalsis in the smooth muscle portion of the body of the esophagus. When the diagnosis was confirmed, a consulting surgeon in detail explained laparoscopic surgery options, benefits, and risks to a patient. The main attention was given to patient's general condition, comorbidities, previous intra-abdominal operations, and patient's choice. The final decision was taken by consensus agreement.

All surgical patients were divided into 2 groups. The first group (23 patients), treated during 1998–2005, underwent laparoscopic Heller myotomy followed by the full gastric fundus mobilization, total hiatal dissection, and posterior Toupet (270°) fundoplication. The second group (23 patients), treated during 2006–2011, underwent laparoscopic Heller myotomy with limited surgical dissection of cardia region, not dividing the short gastric vessels and performing anterior partial Dor fundoplication.

Postoperative investigations included the assessment of hospital stay, early dysphagia, and intraoperative and postoperative complication rates. A careful clinical assessment was performed by interviewing each patient before and late after surgery. The effectiveness of achalasia treatment was rated according to Vantrappen and Hellemans (5) (Table 1). Heartburn was graded according the standard grading system (Table 2).

Excellent (0) and good (I) classes were considered as efficient treatment, while moderate (II) and poor (III), inefficient treatment. Heartburn was

considered clinically significant when the heartburn grade was II or III.

Operative Techniques. The patient was placed in a lithotomy position with the surgeon standing between the legs. Five trocars were placed, and the liver was retracted to the patient's right side. The authors of this article performed all the operations.

Myotomy and Posterior Toupet Fundoplication. The esophageal hiatus was fully dissected mobilizing the esophagus circumferentially, separating from the mediastinal structures and crura, followed by the full mobilization of the gastric fundus. This included the division of the phrenoesophageal, gastrophrenic and gastrosplenic ligaments with short gastric vessels. The anterior and posterior vagus nerves were identified and left against the esophagus. Any epiphrenic fat pad was resected, and myotomy was performed with an ultrasonic hook, 6–8 cm in length on the anterior surface of the esophagus. The myotomy extended 1.5–2 cm beyond the gastroesophageal junction. If a perforation occurred, the mucosal edges were re-approximated with interrupted 4–0 Vicryl sutures tied intracorporally. This was followed by underwater insufflations in order to check the possible suture leakage. Finally, posterior Toupet (270°) fundoplication was performed: positioning the leading edge of the fundus to the right of the esophagus, which was then sutured to the right side of the esophageal myotomy over length of 3 cm, suturing the anterior fundus to the left side of the esophageal myotomy over length of 3 cm, and securing the wrap to the right and the left crura with separate gastrocrural sutures.

Myotomy and Posterior Dor Fundoplication. The anterior limited dissection of the esophageal hiatus was performed: separating the esophagus from the mediastinal structures and the crura, with the clear identification of the anterior vagal nerve, but leaving the lateral and posterior phrenoesophageal attachments intact. The short gastric vessels were not divided. The fat pad from the anterior esophagus was removed. The myotomy was performed with an ultrasonic hook, 6–8 cm in length on the anterior surface of the esophagus. The myotomy extended 1.5–2 cm beyond the gastroesophageal junction. If a perforation occurred, the mucosal edges were re-approximated with interrupted 4–0 Vicryl sutures tied intracorporally. This was followed by underwater insufflations of the perforation. Finally, anterior Dor fundoplication was performed: suturing the left anterior fundus to the left side of the myotomy and the left crus of the diaphragm; and positioning of the leading edge of the fundus, along the greater curvature, anterior to the esophagus over the myotomy and suturing it to the right side of the myotomy and the right crus of the diaphragm.

Table 1. Classes on the Effectiveness of Achalasia Treatment

Class	Dysphagia
Excellent (0)	Completely free of symptoms
Good (I)	Occasional (less than once a week) dysphagia or pain of short duration defined as retrosternal hesitation of food lasting from 2–3 s to 2–3 min and disappearing after drinking fluids
Moderate (II)	Dysphagia more than once a week lasting less than 2–3 min and not accompanied by regurgitation or weight loss
Poor (III)	Dysphagia more than once a week or lasting 2–3 min or longer or accompanied by regurgitation or weight loss

Table 2. Standard Grading System for Heartburn

Grade	Heartburn
0	None
I	Minimal, episodic; no treatment is required
II	Moderate, controlled with medication
III	Severe, interferes with daily activity or not controlled with medication

Statistical Analysis. The Fisher exact test was used to compare the success and complications rates of different treatment modalities. The patient's age, achalasia anamnesis, hospital stay, and follow-up period between the groups were compared using the unpaired Mann-Whitney *U* test. $P < 0.05$ was considered significant.

Results

From January 1998 to December 2011, 46 patients with achalasia were treated: 23 underwent Heller myotomy plus posterior Toupet fundoplication (group 1) and 23 underwent Heller myotomy plus anterior Dor fundoplication (group 2). The patients' general characteristics are summarized in Table 3.

Heller myotomy with Toupet or Dor fundoplication was the initial treatment in all 46 patients, and they had had no achalasia treatment before. All surgeries were completed by employing a laparoscopic technique. The results of perioperative follow-up are summarized in Table 4.

The complete information to assess the clinical efficiency of achalasia treatment was available for all 46 patients who were followed up for a mean of

65.7 months in the group 1 and 38.8 months in the group 2 ($P < 0.05$).

Laparoscopic myotomy plus posterior Toupet fundoplication was effective in 82.6% of patients (good and excellent results), while laparoscopic myotomy plus anterior Dor was effective in 78.3% of patients ($P > 0.05$).

More than one-third (39%) of patients after myotomy and posterior Toupet fundoplication and 13% of patients after myotomy and anterior Dor fundoplication had clinically significant heartburn (grade II–III) ($P < 0.05$).

Discussion

The goal of achalasia surgery is to alleviate the distal esophageal obstruction by the division of circular muscle fibers comprising the LES. Since the early 1990s, myotomy has mostly been accomplished laparoscopically.

Treatment success in achalasia has usually been defined based on symptom improvement (6). Comparisons across studies are difficult because the definitions of success vary from strict criteria (symptoms once per week or less) (7) to more liberal endpoints such as a 50% decrease in symptoms or the lack of need for repeat treatment (8). Our definition of efficient achalasia treatment (dysphagia occurring less than once a week or retrosternal pain lasting up to 2–3 minutes) was chosen because it is a reasonable endpoint. This descriptive symptom classification system has been proposed and used by several authors (5, 7).

During the past 17 years, the high success rate of laparoscopic Heller myotomy for achalasia has brought a shift in practice, and surgery has become the preferred treatment option chosen by most gastroenterologists and other referring physicians (9). The results of uncontrolled, retrospective, and randomized controlled clinical trials have shown that laparoscopic Heller myotomy is effective in 80%–90% of patients (3). Our study results also demonstrate that surgical treatment (laparoscopic Heller myotomy with both fundoplication techniques) offers good long-term results. Our rates of symptomatic dysphagia improvement after laparoscopic Heller myotomy (78.3%–82.6%) are acceptable and comparable to those reported in the literature.

Esophageal myotomy performed alone induces gastroesophageal reflux in a large percentage of patients because of interruption of the LES mechanism (10). Arguments for and against the addition of fundoplication after Heller myotomy have been discussed for many years. A meta-analysis by Campos et al. reviewed 39 observational studies reporting on 3086 patients after laparoscopic myotomy

Table 3. General Characteristics of the Study Population

Parameter	Group 1 (n=23)	Group 2 (n=23)	<i>P</i>
Age, years	50.3 (19–67)	48.5 (20–65)	NS
Gender, n (%)			
Male	10 (43.5)	13 (56.5)	NS
Female	13 (56.5)	10 (43.5)	NS
Duration of achalasia, months	60.1 (3–240)	61.7 (6–259)	NS
Follow-up, months	65.7 (25–130)	38.8 (12–88)	<0.05
ASA score	1.9 (1–3)	1.8 (1–3)	NS
Dysphagia before treatment (classes), n (%)			
II	1 (4.3)	2 (8.7)	NS
III	22 (95.7)	21 (91.3)	NS
Heartburn before treatment, n (%)	1 (4.3)	2 (8.7)	NS

Values are median (range) unless stated otherwise.
NS, not significant.

Table 4. Perioperative Follow-up Results

Parameter	Group 1 (n=23)	Group 2 (n=23)	<i>P</i>
Hospital stay, days	5.1 (4–10)	4.8 (2–25)	NS
Operating (manipulation) time, min	130 (125–180)	125 (115–165)	NS
Mucosal perforation during operation, n (%)	4 (18.2)	1 (4.3)	<0.05
Postoperative complications, %	0	0	NS
Early dysphagia (intra-hospital), %	0	0	NS

Values are median (range) unless stated otherwise.
NS, not significant.

and helped answer this question (11). They found that even though the rate of symptom improvement after myotomy was not influenced by the addition of fundoplication, the incidence of postoperative GER symptoms was clearly higher when no fundoplication was performed (31.5% vs. 8.8%; $P=0.001$). Furthermore, the analysis of articles that reported objective data (24-hour pH monitoring) corroborated these findings showing a 41.5% rate of abnormal reflux when no fundoplication was added compared with a rate of 14.5% when it was performed ($P=0.01$).

The optimal antireflux procedure, which accompanies laparoscopic myotomy has become, therefore, the principal controversy in surgery for achalasia. The type of fundoplication is the subject of debates till now. Anterior 180° Dor fundoplication, posterior 270° Toupet fundoplication, and loose Nissen fundoplication have all been proposed. Despite the fact that laparoscopic Nissen fundoplication is the gold standard therapy for patients who require surgery due to GER disease, a 360° wrap is usually considered a contraindication in patients with achalasia because of the underlying esophageal aperistalsis. In a randomized, controlled trial, laparoscopic myotomy with Dor fundoplication was equally as effective as myotomy with “floppy” Nissen fundoplication in reflux control, but dysphagia rates were significantly higher in the later group (2.8% vs. 15%, respectively; $P<0.001$), leading the authors to conclude that partial (Dor) fundoplication can be the preferred method for GER control after myotomy (12).

Two types of partial wrap are commonly employed in achalasia patients after Heller myotomy: the posterior 270° Toupet fundoplication and the anterior 180° Dor fundoplication. GER-related outcomes after Heller myotomy and partial fundoplication, however, have been reported less systematically than the improvement or resolution of dysphagia symptoms. A multicenter, randomized, controlled trial that compared myotomy outcomes after Dor versus Toupet fundoplication found that at 6-month follow-up of 47% of patients, no significant differences existed between 2 groups regarding dysphagia improvement and reflux control (13). Nevertheless, Dor fundoplication was associated with a higher percentage of patients reporting abnormal reflux than Toupet fundoplication, but this difference did not reach statistical significance due to the small sample size. The data of longer follow-up and a greater percentage of patients observed from this trial may provide more clear evidence for the superiority of Toupet fundoplication.

Our study results demonstrated that 39% of pa-

tients had postoperative clinically significant heartburn after myotomy and Toupet fundoplication versus only 13% after myotomy and anterior Dor fundoplication. The results are controversial because many surgeons have reported excellent results after myotomy and Toupet fundoplication, both with relief of dysphagia and low rates of postoperative reflux (14, 15). We think that a surgical approach influenced such a high rate of postoperative heartburn in the Toupet group. We always performed a total hiatal dissection, completely dividing the phrenoesophageal ligament, which acts as an anchor for the LES mechanism. We also divided the short gastric vessels and fully mobilized the cardia to perform this fundoplication. Importantly, the evidence from the literature on antireflux surgery suggests that Toupet fundoplication may be superior to Dor fundoplication for the long-term control of reflux (16–18).

On the other hand, Simic et al. (19) found that Dor fundoplication in the setting of a complete hiatal dissection had a higher degree of abnormal esophageal acid exposure (23.1%) than that of a limited hiatal dissection (8.5%). While performing myotomy and anterior Dor fundoplication, we always performed only a limited hiatal dissection, leaving the untouched gastrosplenic ligament and short gastric vessels, so the rate of clinically significant heartburn (13%) is comparable with the results published by Simic et al. (19).

The weakness of our study is that it was a retrospective one but not a randomized clinical trial. Considering the nature of this study, the patients were not randomized, but assigned to one of the groups (laparoscopic myotomy and Toupet or Dor fundoplication) according the treatment period. After analyzing our treatment results in the Toupet group, we started to perform the Heller-Dor operation with a limited surgical dissection of the cardia. Considering this, the cohort of these 2 groups was not homogenous: the follow-up period in the Toupet group was significantly longer than that in the Dor group.

Conclusions

According our study results, both laparoscopic techniques (myotomy + posterior Toupet or anterior Dor) were similarly effective (82.6% vs. 78.3%) in achalasia treatment. Postoperative clinically significant heartburn was significantly more common (39% vs. 13%) after laparoscopic myotomy, followed by the full gastric fundus mobilization, total hiatal dissection, and posterior Toupet (270°) fundoplication.

Statement of Conflict of Interest

The authors state no conflict of interest.

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