

Long-term functional results after laparoscopic surgery for esophageal achalasia

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Abstract

Background: Evidence on the long-term outcome of laparoscopic Heller–Dor surgery is limited. The aim of this study was to assess the long-term outcome of achalasic patients after surgery, particularly in relation to the radiologic preoperative stage of the disease.

Methods: Sixty-eight patients with achalasia were assessed clinically and by esophageal radiology, manometry, and 24-hour ambulatory esophageal pH monitoring before and at 3 months, 1, 1 to 3, 3 to 5, and 5 to 8 years after a laparoscopic Heller–Dor procedure.

Results: At 1 year after surgery the symptom score was significantly lower than the preoperative score ($P < .001$), and a satisfactory clinical outcome was seen in more than 90% of the patients with stage I, II, and III disease at the preoperative radiologic assessment. Only 50% of stage IV patients reported satisfactory results. An adequate opening of the lower esophageal sphincter (LES) and LES resting pressure of less than 8 mm Hg was achieved in all patients, and esophageal emptying was accelerated significantly ($P < .001$). At the consecutive follow-up evaluation (1–8 y), a satisfactory outcome was maintained in all stage I, II, and III responders. Stage IV patients with initially unsatisfactory results reported a worsening of symptoms ($P < .02$). Patients with pseudodiverticulum had a higher symptom score ($P < .01$). LES opening and resting pressure remained at levels of the 1-year follow-up evaluation. Esophageal emptying remained satisfactory in stage I, II, and III responders, but deteriorated in stage IV nonresponders and in 6 of the 10 patients with a pseudodiverticulum.

Conclusions: A satisfactory outcome of the laparoscopic Heller–Dor procedure in stage I, II, and III achalasic patients seems to last. Stage IV nonresponders tend to deteriorate over time. The development of pseudodiverticulum is associated with an increased symptom score. © 2007 Excerpta Medica Inc. All rights reserved.

Keywords: Esophageal achalasia; Laparoscopy; Heller Myotomy–Dor; Hemifundoplication; Long-term outcome; Esophageal emptying

Heller's myotomy has been the procedure of choice for the treatment of esophageal achalasia [1]. The transthoracic [2–4], the thoroscopic [5,6], the transabdominal [7], and the laparoscopic [6,8–12] approaches all have been applied. Recently, the latter approach has been widely preferred

because it offers results that are equal to those after open surgery, but with a faster recovery and less immediate postoperative morbidity.

Cardiomyotomy effectively relieves dysphagia and regurgitation in approximately 95% of patients with achalasia, provided that the postoperative lower esophageal sphincter (LES) resting pressure decreases substantially to less than 10 mm Hg above the intragastric pressure, preoperative esophageal body dilation is not excessive, distortion of the

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distal esophagus is absent, and the postoperative maximum width of the esophagus does not exceed 40 mm [1,9,12–15]. Furthermore, it has been reported that improvement of dysphagia after myotomy for esophageal achalasia seems to last for periods exceeding 15 years [4,7,11]. However, there is still a substantial percentage of patients who develop some degree of dysphagia, despite an initial improvement after surgery. This has been attributed to stasis as a result of esophageal obstruction, food retention in a pseudodiverticulum, or dilatation and distortion of the distal esophagus within the frame of the degenerative process of the disease [1–4,7]. The aim of the present study was to assess the long-term effect of laparoscopic esophageal myotomy with anterior hemifundoplication on dysphagia, esophageal emptying, and esophageal body configuration in patients with esophageal achalasia. In addition, an effort was made to identify any possible correlation between functional outcomes and preoperative imaging findings.

Patients and Methods

Patients with esophageal achalasia, undergoing laparoscopic Heller myotomy and Dor fundoplication at the surgical departments of different institutions during a 12-year period (1993–2005), were followed-up. The preoperative diagnosis was based on clinical presentation, barium swallow, upper alimentary endoscopy, and esophageal manometry. Some of the patients had previously had 1 or more sessions of pneumatic dilation. The surgical technique by the laparoscopic approach has been described previously [12].

Postoperative outcomes were assessed by responses to a standardized questionnaire for symptoms by telephone or outpatient clinic interview, barium swallow, and estimation of esophageal emptying, esophageal manometry, pH monitoring, and, if necessary, endoscopy. Outcomes assessment was performed at 3 months, 1 year, and within 3 to 5 years, 6 to 8 years, and 8 to 10 years postoperatively.

The clinical follow-up evaluation was focused on dysphagia, regurgitation, heartburn, and substernal pain. The incidence of each symptom was graded according to the proposal by Johnson and De Meester [16] as follows: grade 0, absence of the symptom; grade 1, occasional episodes of the symptom reported to occur less than once weekly; grade 2, frequent episodes of the symptom reported to occur more than once weekly; and grade 3, persisting daily symptoms. A score of 0 to 2 was considered excellent, 3 to 5 was considered good, 6 to 8 was considered fair, and 9 to 12 was considered poor. Excellent/good results were satisfactory, whereas fair/poor results were considered as failures.

Barium swallow for the assessment of esophageal configuration and emptying was performed in all patients as follows: with the patient in the upright position a solid bolus of bread with barium paste of 6 to 8 g of total weight was chewed and swallowed. The normal esophageal emptying time for the solid bolus was defined as less than 15 seconds [17]. Thereafter, the patients swallowed 150 to 200 mL of suspension of barium sulphate (.45 g/mL), and with the full-column technique maximal esophageal body width, gastroesophageal junction configuration, and the opening and the presence of pseudodiverticulum or stenosis were

assessed. Depending on the esophageal diameter measured at a point 8-cm cephalad to the LES and the esophageal body configuration, the disease was staged as follows: grade I, diameter less than 4 cm; grade II, diameter of 4 to 6 cm; grade III, diameter greater than 6 cm; grade IV, s-type esophageal body of any diameter, or large-bowel type of esophagus [12]. From 1998 onward, esophageal emptying also was assessed on several occasions with a timed barium esophagogram [18]. According to that technique, patients swallowed the amount of suspension of barium sulphate they could tolerate without regurgitation (150–250 mL) over 45 to 60 seconds in the standing position. The length of the barium column over the gastroesophageal junction at 5 minutes after the end of barium consumption was measured. In normal subjects, barium has completely emptied out of the esophagus by that time point.

Esophageal manometry and pH monitoring data were assessed according to standard definitions [19].

Statistical analysis

Unless otherwise stated, all values are expressed as medians (range). Comparisons between preoperative values and several postoperative values of the variables were performed by applying the Mann–Whitney test for paired values, as appropriate. The clinical outcome curve was constructed according to the Kaplan–Meier method. *P* values of less than .05 were considered statistically significant.

Results

Of the 92 patients subjected to Heller's myotomy and Dor's fundoplication for esophageal achalasia, 68 completed the battery of follow-up tests, and were included in the study. There were 33 male and 35 female patients with a median age of 40 years (range, 10–80 y). All of them were assessed at 3 months and 1 year; 56 were assessed for 1 to 3 years; 35 were assessed for 3 to 5 years; 23 were assessed for 5 to 8 years; and 4 were assessed for more than 8 years postoperatively. According to the preoperative esophagogram, 26 patients were classified as stage I, 24 as stage II, 12 as stage III, and 6 as stage IV (Table 1).

Mortality was nil and morbidity was insignificant, with the exception of 1 patient who developed a late leak as a result of a desloughing scar at the anterior aspect of the lower esophageal mucosa after a thermal injury at surgery. The patient was treated conservatively with success. Another 4 patients developed atelectasis and lung infection, who also were treated with success (total morbidity, 7.5%). All but the 5 patients who developed complications were discharged on the second or third postoperative day.

Follow-up evaluation at 3 months and 1 year postoperatively

At 3 months postoperatively the median symptom score decreased significantly as compared with the preoperative value (median, 1 [range, 0–5] vs median, 5.5 [range, 2–6]; *P* < .001). The symptom score was improved further at the 1-year postoperative follow-up evaluation (median, 0 [range, 0–5], *P* < .001 vs the preoperative value), and only 1 stage I patient, 1 stage II patient, 1 stage III patient, and 2 stage IV patients reported improvement but were not fully satisfied with the outcome, although 1 additional stage IV

Table 1

Distribution of the patients according to the radiologic stage of the disease and the length of the follow-up period, and symptomatic outcome at different follow-up time points

	1 y	1–3 y	3–5 y	5–8 y	>8 y
Stage I	26 (25 S, 1 F)	23 (22 S, 1 F)	13 (13 S)	6 (6 S)	—
Stage II	24 (23 S, 1 F)	18 (17 S, 1 F)	12 (12 S)	9 (8 S, 1 F)	2 (2 S)
Stage III	12 (11 S, 1 F)	10 (10 S)	7 (7 S)	5 (5 S)	2 (2 S)
Stage IV	6 (3 S, 2 F, 1 P)	5 (2 S, 2 F, 1 P)	3 (1 S, 1 F, 1 P)	3 (1 S, 1 F, 1 P)	—
Total	68	56	35	23	4

F = fair outcome; P = poor outcome; S = successful outcome.
The clinical outcome is shown in parentheses.

patient reported no improvement at all and thus poor outcome (Table 1). Substernal pain but not dysphagia or regurgitation was the primary complaint in the stage I, II, and III failed cases. Regurgitation was the primary complaint in stage IV patients with fair or poor results. Reflux-like symptoms were not reported by any patients. Thus, at 1 year after surgery, the overall success rate was 91.2%; the success rate in stage I patients was 96.2%, in stage II patients was 95.3%, in stage III patients was 91.7%, and in stage IV patients was 50%. In all patients, and irrespective of the clinical outcome, the LES resting pressure decreased to less than 8 mm Hg at 3 months postoperatively and remained unchanged at the 1-year postoperative assessment (3 [range, 0–8] mm Hg vs 39 [range, 24–72] mm Hg preoperatively; $P < .001$) (Fig. 1).

At the esophagogram, esophageal emptying, as expressed by both the length of the stagnating barium column and the bread bolus transit time, was accelerated significantly as compared with the preoperative values ($P < .001$). At the 1-year radiologic assessment, esophageal emptying

was improved further so that barium column length and bolus transit were even shorter in a significant manner as compared with both the preoperative state ($P < .001$) and at 3 months postoperatively ($P < .001$ and $P = .03$, respectively). Patients with fair or poor outcomes at 1 year after surgery showed a significantly increased esophageal transit time and length of esophageal barium column as compared with those with a successful outcome (median transit time, 105 [range, 51–150] s vs 51 [range, 11–150] s, $P = .005$; median barium column length, 7.8 [range, 4.5–15.1] cm vs 3.3 [range, 0–13.8] cm, $P = .005$, respectively) (Table 2).

Also, esophageal diameter was reduced significantly at 3 months as compared with the preoperative state ($P < .001$), and was reduced further at 1 year postoperatively (3 m vs 1 y state, $P = .02$). All but 1 patient with an esophageal diameter greater than 40 mm Hg had a fair or poor outcome. In addition, the LES opening was increased in all patients both at the 3-month and 1-year assessment as compared with the preoperative state ($P < .001$), irrespective of the symptomatic outcome. No significant differences were ac-

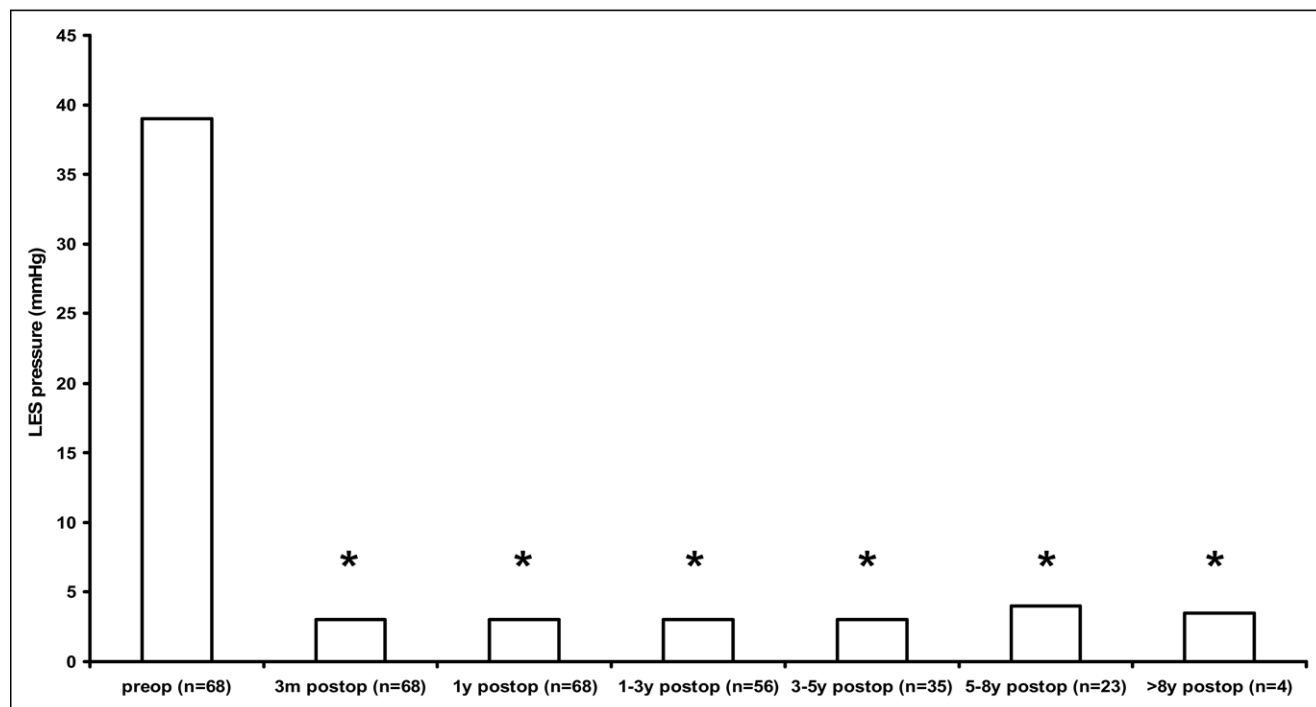


Fig. 1. LES resting pressure, as assessed by manometry before surgery and at the different postoperative time intervals.

Table 2
Data derived from the esophagogram preoperatively and at the different postoperative time periods

	Esophageal diameter, mm	LES opening, mm	Barium column length, cm	Esophageal transit, s
Preoperatively	48.5 (15–85)	2 (1–4)	9.5 (4–24)	96 (28–320)
3 mo postoperatively	24.5 (10–80)	7 (4–12)	4.5 (0–15)	61 (14–185)
1 y postoperatively	24.5 (12–75)	7 (4–12)	3.9 (0–15.1)	55 (11–150)
1–3 y postoperatively	23 (11–75)	7 (4–11)	3.2 (0–17.1)	55 (18–180)
3–5 y postoperatively	24 (14–78)	8 (5–11)	3.3 (0–18)	45 (16–200)
5–8 y postoperatively	30 (9–70)	8 (5–12)	5.9 (0–15.5)	48 (9–170)
>8 y postoperatively	24.5 (16–30)	7(6–10)	4 (2.1–4.7)	21.5 (18–27)

Values expressed as the median (range).

counted in the LES opening diameter between the 3-month and the 1-year measurements (Table 2).

On the 3-month postoperative esophagogram, 10 patients showed a pseudodiverticulum at the level of the upper part of the esophageal myotomy (2 stage I, 2 stage II, 2 stage III, and 6 stage IV). The pseudodiverticulum was shown constantly in the same patients at the 1-year esophagogram. In 4 of these patients the diverticulum emptied simultaneously with the barium column in the esophageal lumen. In the remaining 6 patients, barium stagnated in the diverticulum long after the clearance of the esophageal body, and that was associated with a fair or poor outcome in 4 patients.

Long-term follow-up evaluation

The overall median symptom score at the 3-, 5-, 8-, and more than 8-year follow-up remained significantly lower than the preoperative values, and at the level of that reported at the first year postoperatively. No significant worsening or improvement of clinical outcome was reported at any interview time point, apart from 1 stage II patient who reported significant improvement of substernal pain episodes by 3 to 5 years after surgery, and 2 stage III and IV patients who reported frequent reflux-like symptoms, both of which were already not satisfied with the initial outcome of the surgery (Table 1). The overall and stage-related success rates at 8 years, as shown by the projected Kaplan–Meier curves, were 85, 96, 100, 92, and 50, respectively (Fig. 2).

The LES resting pressure was measured at less than 8 mm Hg constantly in all patients at all times of measurement (Fig. 1). Also, at all times of assessment, esophageal emptying and esophageal body diameter remained constantly lower than the preoperative values and at levels similar to those at the 1-year follow-up evaluation. Similarly, the LES opening remained at the 1-year level at all later measurements. On the contrary, esophageal emptying, as assessed by the barium column length at the 1 to 3, 3 to 5, and greater than 8-year follow-up evaluation remained at the levels of the 1-year assessment, but increased significantly at the 5 to 8 year follow-up evaluation ($P = .02$), although it remained well below the preoperative values ($P < .001$) (Table 2). The temporary deterioration of esophageal emptying was not associated with symptomatic worsening, and it probably reflected the fact that relatively more stage III and IV patients were included in the 5 to 8 year follow-up group. Patients with pseudodiverticulum that emptied slowly tended to show an increased symptomatic score for regurgitation, irrespective of the final outcome. In

13 patients complaining of occasional heartburn, esophageal pH monitoring showed esophageal acidity changes compatible with food stagnation and acidification of esophageal contents and not true reflux in 7 patients, all of whom were classified as either stage III or IV at the preoperative evaluation. Of the 3 stage IV patients with a poor or fair outcome, 1 patient had esophagectomy and was excluded from further follow-up evaluation, and the remaining 2 patients refused any further intervention; they stayed on a soft diet and followed instructions for postural physiotherapy to achieve emptying of the esophagus and avoid aspiration episodes.

Comments

Failure of laparoscopic Heller’s myotomy with Dor’s fundoplication to achieve symptomatic relief in patients with achalasia has been attributed to an inadequate or incomplete division either of the circular musculature of the lower esophagus or more frequently of the oblique muscle fibers on the stomach, just distal to the gastroesophageal junction. Presence of a tortuous, S-shaped mega-esophagus at preoperative evaluation and a tight fundoplication are additional causes of immediate postoperative failure [2,20–22].

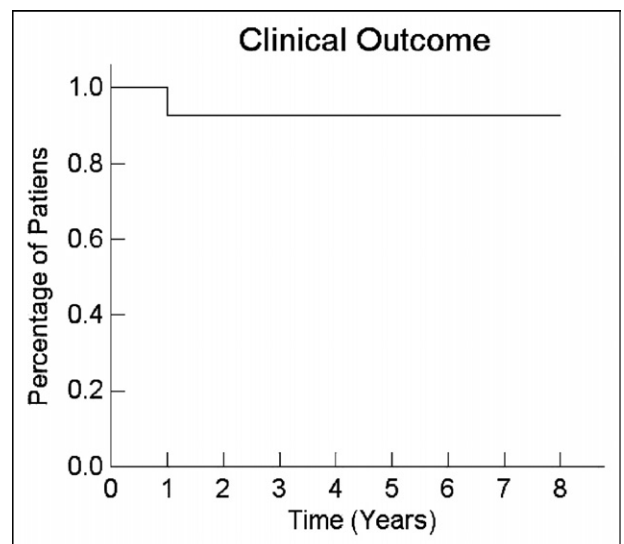


Fig. 2. The projected Kaplan–Meier curve for symptomatic outcome at 8 years. At 8 years after surgery, 85% of all patients are expected to report a satisfactory outcome.

However, based on consecutive esophageal contrast and manometric studies, inadequate myotomy or tight hemifundoplication was not observed in any of the failures in the present series. In stage I, II, and III patients who were considered as failures, frequent and persisting substernal pain was the cardinal complaint. Substernal pain is a symptom usually reported in young patients with a short history of the disease. Substernal pain is attributed to the degenerative process of the disease, and settles gradually by time [23]. Besides, substernal pain is a common complaint even after a successful pneumatic dilatation [24]. Unsatisfactory results after surgery in 3 of the 6 stage IV patients of the present series could be attributed to inability of the dilated and tortuous esophagus to empty its contents by gravity, despite an adequate lower esophageal opening. However, it is proposed that laparoscopic myotomy should be offered to that subset of patients as the first, low-risk, minimally invasive surgical option because approximately half of them gain benefit. Esophagectomy is reserved for the nonresponders, who remain under the risk of regurgitation, aspiration, and episodes of pulmonary infections and fibrosis [21,22].

As shown by the findings of the present study, within a 3-month time after a Heller–Dor surgery, a significant improvement in the symptom score, a dramatic decrease in the LES resting pressure, an adequate opening of the LES, and an acceleration of the esophageal emptying are achieved. Those changes improve further by 1 year postoperatively, by which time patients report the best functional results. Symptomatic and laboratory gradual improvement by the first year postoperatively may reflect settlement of the postoperative edema at the gastroesophageal junction, and a more adequate emptying of the esophagus.

Reports on the long-term outcome after myotomy for achalasia are conflicting. Heller's myotomy, when performed through a thoracotomy, was associated with a success rate of around 50% after a more than 10-year follow-up period [25,26], whereas Torbey et al [27] reported an even worse success rate of 33% after a follow-up period of 4 years. When Heller's myotomy is performed through a laparotomy, a success rate of 85% to 94% was reported after a mean follow-up period of 5 to 14 years [7,25,28,29]. The discrepancy between the 2 approaches could be attributed to the addition of an antireflux procedure, most commonly of the Dor's type, in the laparotomic one. Postoperative development of gastroesophageal reflux may explain the unsatisfactory late outcome after either approach.

Two studies have reported on the long-term outcomes of laparoscopic myotomy [22,30]. Bloomston et al [30] had satisfactory results in 85% of patients after a 3-year follow-up period, which was not significantly different from the 89% in the same series of patients at the first year postoperatively. In their series, Dor's anterior fundoplication was added only selectively. Constantini et al [22] reported good and excellent results after the laparoscopic Heller–Dor procedure in 85% of patients after a 6-year follow-up period, with only a slight deterioration over time.

According to the present series, in achalasic patients with preoperative stage I, II, and III disease, a well over 90% success rate was achieved after laparoscopic Heller–Dor surgery by the end of the first year postoperatively, and that

rate was maintained after an 8-year follow-up period. On the contrary, patients with dilated, tortuous, not adequately emptying esophagus, and who initially gained no significant benefit from myotomy, tended to have increased symptomatic discomfort over time, possibly as a result of food stagnation and acidification, esophagitis, regurgitation, and aspiration. Therefore, late recurrence of symptoms was not observed in any of the patients who responded favorably to myotomy and fundoplication.

Recurrence of dysphagia, regurgitation, and heartburn in achalasic patients after a successful myotomy is attributed to fibrotic constriction of the myotomy edges, development of gastroesophageal reflux with further impairment of esophageal motility, or continuous degeneration of the esophageal musculature [2,21]. An additional factor of failure is possibly the development of a pseudodiverticulum at the oral part of esophageal myotomy that lies in the mediastinum and is not covered by the fundoplication. Such a diverticulum may empty poorly and provoke regurgitation.

In conclusion, the laparoscopic Heller–Dor procedure seems to achieve satisfactory long-term results in achalasic patients with preoperative stage I, II, and III disease. Significant imaging and manometric improvement is accomplished in all patients and in the long term, irrespective of the symptomatic outcome. Patients with distorted esophageal body and those who develop a poorly emptying pseudodiverticulum postoperatively may fail to respond favorably to myotomy and possibly deteriorate by time.

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