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Original Article

Long-term outcomes of surgery for oesophageal achalasia

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ABSTRACT

Background: Long-term patient-reported outcomes following surgery for achalasia are lacking in the literature. The aim of this study was to evaluate both short- and long-term outcomes of the surgical management of achalasia.

Methods: A retrospective analysis was performed of all surgically managed achalasia cases from January 2004 to December 2017. Data collection included demographics, previous interventions, type of surgery performed, and postoperative outcomes. Long-term data collected by questionnaire included residual regurgitation, dysphagia, chest pain, heartburn, need for subsequent intervention, and overall satisfaction. Patients were divided into primary group (group P) and secondary group (group S) based on whether they had undergone a previous intervention.

Results: Ninety-one patients (male : female = 43 : 49; group P : S = 66 : 25) underwent surgery for achalasia. The median follow-up was 107 months (32–172 months). Twenty-five patients (27.5%) had previous interventions. Eighty-nine (97.8%) underwent Heller cardiomyotomy; the procedure was laparoscopic in 86 cases (97%) and open in three patients (3.3%). Two patients underwent stapled cardiomyotomy. The postoperative complication rate was 4.4%, and no complications were serious. There was no significant difference in length of stay between the groups. Short-term follow-up showed that most residual symptoms were mild. During long-term follow-up, the residual symptoms were mainly mild and did not differ between the groups. Furthermore, 72.9% of patients were satisfied or very satisfied with their symptoms post-surgery.

Conclusion: The peri-operative morbidity for the surgical management of achalasia is low and re-intervention is uncommon. Heartburn was not a major long-term sequela of myotomy. Though patients still experienced mild symptoms in the longer term, most were satisfied with their outcome.

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Keywords: Esophageal achalasia; Myotomy; Treatment outcome

Introduction

Achalasia is an uncommon oesophageal motor disorder characterized by its absence of oesophageal peristalsis and failure of relaxation of the lower oesophageal sphincter. Its incidence is estimated at 1 in 100,000 people. The majority of patients present with a combination of symptoms including dysphagia, regurgitation, heartburn, and chest pain.¹ While thought to have an autoimmune basis, it more likely has a multifactorial aetiology. Treatments have been directed at symptom alleviation rather than cure, targeting the spasms that occur in the lower oesophageal sphincter. Treatment modalities have progressed from pneumatic dilatation, botulinum injection, and surgical myotomy to, more recently, per oral endoscopic myotomy (POEM).^{1–3} The initial trans-thoracic Heller myotomy (THM) evolved to laparoscopic

Heller myotomy (LHM) in the early 1990s due to the technical limitations of THM and its higher failure rate related to incomplete distal myotomy.

For the last decade, LHM was considered the gold-standard method at most centres for the management of achalasia due to its low peri-operative morbidity and mortality.^{3,4} It was usually coupled with an anti-reflux procedure, although studies have reported mixed effectiveness of each anti-reflux procedure. Most studies have reported good functional results after LHM, but few have investigated long-term patient-reported outcomes.^{3,5} Gülpınar et al⁶ and Kummerow Broman et al⁵ demonstrated that POEM has been increasingly performed, but long-term results continue to be awaited.

The main aims of this study were (i) to review the outcomes of surgical management of achalasia and (ii) to evaluate the short-

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term and long-term symptoms post-surgery.

Methods

Ethics approval for this study was obtained from the Bellberry Human Research Ethics Committee (TGA HREC Code: EC00419). A retrospective analysis was performed for all consecutive cases of achalasia managed by a single surgeon (SA) from January 2004 to December 2017. The data collected included basic demographics, previous abdominal operations, previous interventions for achalasia prior to surgery, preoperative investigations (barium swallow, oesophageal manometry, upper gastrointestinal endoscopy, and computed tomography), type of surgery performed, length of stay and postoperative complications.

Surgical technique

Patients were instructed to consume nourishing fluids for 3 days prior to the procedure to minimize aspiration risk. LHM was performed using a 5-port approach in conjunction with on-table endoscopy performed by a gastroenterologist (BM or SE). The ports comprised a 12-mm supraumbilical Hasson entry, a 5-mm port in the right upper quadrant, an epigastric Nathanson retractor, and 5-mm and 10-mm ports in the left upper quadrant.

A Harmonic scalpel (Ethicon, Raritan, NJ, USA) was used to divide the lesser omentum to gain exposure to the right crus. The right crus of the diaphragm was dissected away from the lateral oesophagus; the cardio-oesophageal ligament was divided and the anterior aspect of the left crus was defined. The inferior margin of the left crus was identified from the right side, and a plane was established anterior to the pre-aortic fat pad. A Penrose drain was placed around the oesophagus for retraction and the adventitia was divided to expose the anterior vagal trunk, which was preserved in a vessel loop.

A formal endoscopy inspecting the oesophagus, stomach, and duodenum was performed and then all luminal contents were aspirated. Minimal air insufflation was used but increased as requested by the surgeon. The stomach was aspirated of air regularly to prevent over-distension and interference with the dissection. Myotomy was commenced above the gastro-oesophageal junction to the left of the vagus using blunt forceps to create a muscular window by separating the longitudinal and circular fibres until the mucosa was identified. This was aided by low-pressure insufflation by the gastroenterologist to allow the mucosa to pout. Once the correct plane was established, blunt dissection was continued superiorly, using the Harmonic scalpel with the inactive blade closer towards the mucosa to divide both the longitudinal

and circular muscle fibres simultaneously.

The dissection proceeded proximally until the endoscopist confirmed that the dilated oesophageal segment had been reached. Dissection of the spiral fibres at the cardia was completed, resulting in a 7- to 8-cm longitudinal myotomy. Using transillumination from the laparoscope, the adequacy of the myotomy could be readily ascertained, with residual muscle fibres seen and then further dissected. Endoscopy was also used to confirm a patulous lower oesophageal sphincter and intact mucosa at the end of the procedure. Anterior fundoplication was performed by suturing the gastric fundus to the left and right sides of the divided oesophageal muscle and the apex of the hiatus to provide mucosal protection and act as a partial anti-reflux procedure.

For revisional procedures, stapled cardiomyotomy was performed using a Endo GIA (Medtronic, Minneapolis, MN, USA) passed through a high gastrotomy, guiding the narrow stapler limb into the oesophageal lumen and the larger into the adjacent gastric fundus. Two staple cartridges were usually required to achieve an adequate myotomy length, which was then checked endoscopically and the gastrotomy closed with a continuous absorbable suture.

The patient had a contrast (gastrografin) swallow the following day to exclude a leak and assess oesophageal transit. Clear then nourishing fluids were commenced, and the patient was generally discharged on day 2 if progressing well.

Follow-up

Patients were initially followed routinely at 1 week. Some patients were seen at 3 months and beyond 12 months on an as-required basis. Our agreed practice was not to routinely follow patients either clinically or endoscopically in the longer term due to the low risk of malignancy cited in the literature. Postoperative oesophageal manometry or pH studies were not routinely performed.

A modified DeMeester survey questionnaire (Supplementary Fig. 1) designed to assess long-term postoperative symptoms was mailed to all patients. For recently treated patients, this was at least 18 months after the last LHM. The patients' addresses were checked prior to mailing the questionnaire, and further attempts were made by telephone to contact patients who did not return the questionnaire.

Statistical analysis

The patients were divided into two groups for comparison: primary (P), where there was no previous intervention for ach-

Fig. 1. Total number of cases of surgically managed achalasia by year.

lasia, and secondary (S), where previous intervention(s) had been performed for achalasia prior to the current presentation. The individual symptom score on the modified DeMeester symptom scoring system for dysphagia, chest pain, regurgitation, or heartburn was the endpoint for analysis. The scores were categorized into two groups; the first group comprised a score of 1 or less, which was considered to indicate good symptom relief; the second group comprised a score of 2 or above, which was considered to indicate poor symptom relief.

Statistical analysis was performed with the chi-squared test to compare the effect of the previous intervention for achalasia on the degree of symptom relief. A *P*-value of 0.05 or less was taken as indicating statistical significance.

Results

Basic demographics and preoperative investigations

In total, 91 patients underwent surgical management of achalasia during the study period (Fig. 1), comprising 43 males (47.3%) and 49 females (53.8%). The mean age was 43.2 ± 16.3 years (range, 14–81 years). Twenty-five patients (27.5%) had previous abdominal surgery. All patients underwent preoperative upper gastrointestinal endoscopic evaluations, at which achalasia was initially suspected in 68 cases (74.7%). Eighty-seven patients (95.6%) underwent preoperative oesophageal manometry and all

demonstrated features of achalasia. Eighty-one patients (89.0%) were assessed with a barium swallow, and 18 of them also had a computed tomography scan. All except one barium swallow showed features typical of achalasia.

Primary or secondary intervention

Of the 91 patients, 66 (72.5%) were categorized into group P and 25 (27.5%) into group S. The median age in group P was 41 years (interquartile range [IQR], 29–55 years); the median age in group S was 45 years (IQR, 31.5–56.5 years) (*P* = 0.372).

In group S, 15 patients had previous pneumatic dilatation only, three had pneumatic dilatation with a botulinum injection, three had a botulinum injection only, and four had pneumatic dilatation followed by myotomy surgery (Table 1).

Manometric sub-types of achalasia

Group P

Based on the Chicago classification, type 2 was the most common (*n* = 40, 60.6%) followed by type 1 (*n* = 8, 12.1%) and type 3 (*n* = 6, 9.1%). There were 12 patients (18.2%) whose type could not be classified (Fig. 2).

Group S

Type 2 was the most common (*n* = 16), followed by type 1 (*n* = 3) and type 3 (*n* = 1), with five patients unable to be classified (Fig. 3).

Perioperative details

Eighty-six patients (94.5%) successfully underwent LHM without conversion. Of these, two cases had simultaneous hiatus hernia repair and one had a revision of anterior fundoplication. Three patients underwent open Heller myotomy (3.3%) with anterior fundoplication. Two patients had a previous history of laparotomy and one was a revisional myotomy. Two patients (2.2%) underwent open stapled cardiomyotomy, with one patient having previously had a thoracic myotomy 46 years ago (Fig. 4).

The overall complication rate in this study was 4.4%. There were two intra-operative complications: one case of aspiration during anaesthesia induction causing pneumonia and one case of a small mucosal injury seen in a male patient undergoing revision of a previous myotomy with fundoplication. The small mucosal

Table 1 Previous Interventions for Achalasia Prior to the Surgical Intervention for Achalasia at Our Institution

Procedure	Number	Comment
Previous intervention for achalasia	25	-
Pneumatic dilatation only	15	Median of 2 previous pneumatic dilatations (range, 1–4)
Pneumatic dilatation and botulinum injection	3	-
Botulinum injection only	3	Median of 2 previous injections (range, 1–2)
Pneumatic dilatation followed by surgery	4	2, transthoracic myotomy 1, open abdominal myotomy 1, laparoscopic Heller myotomy

Fig. 2. Primary group (group P) with its subclassification and follow-up results.

Fig. 3. Secondary group (group S) with its subclassification and follow-up results.

Fig. 4. Types of surgical intervention performed for achalasia and its subsequent re-interventions.

tear was observed in the lower oesophagus after the initial dissection and was immediately repaired laparoscopically. The defect was confirmed to be closed endoscopically and air insufflation showed no further leak. There were two postoperative complications: one case of pneumonia and one case of wound infection; both were managed conservatively with antibiotics.

Postoperative contrast swallows did not identify a perforation or leak in any case and there was no peri-operative mortality. The overall mean length of stay was 2.5 ± 1.0 days (range, 2–7 days). The length of stay in group P was 2 days (IQR, 2–2.25 days) and in group S was 2 days (IQR, 2–3 days) ($P = 0.099$).

Follow-up at 1 week and 3 months

Group P

All patients ($n = 66$, 100%) attended the 1-week follow-up. Forty-three patients (65.2%) reported resolution of symptoms and 23 patients (34.8%) still had mild residual symptoms. At the 3-month follow-up, 40 patients attended the clinic; of these, 21 (52.5%) still had mild residual symptoms (Fig. 2).

Group S

All patients attended the 1-week follow-up. The majority of

Fig. 5. Overall patient-reported level of satisfaction.

patients ($n = 20$, 80.0%) reported resolution of symptoms. At the 3-month follow-up, 17 patients attended the clinic and only 29.4% were symptom-free (Fig. 3).

Long-term patient-reported outcomes

Overall satisfaction

The questionnaire was completed and returned by 48 of 91 patients (52.7%). Further attempts to contact the remaining 43 patients by telephone were unsuccessful. Of these, 23 (47.9%) were very satisfied, 12 (25.0%) satisfied, eight (16.7%) neutral, two (4.2%) dissatisfied, and 3 (6.3%) very dissatisfied (Fig. 5). The following describes the subgroup analysis (Fig. 2, 3).

Group P

In group P, 32 of 66 (48.5%) patients completed the questionnaire. Only four patients had further interventions, consisting of endoscopic dilatation ($n = 2$) (including one with open revision myotomy) and requiring oral medications ($n = 2$).

The median (IQR) modified DeMeester scores were 2 (2–2) for dysphagia, 1 (1–1.5) for chest pain, 1 (1–2) for regurgitation, 1 (1–1) for heartburn, and 4 for overall satisfaction.

Group S

In group S, 16 of 25 (64.0%) patients completed the question-

Table 2 Effect of Previous Interventions for Achalasia on Individual Symptom Improvement after Surgical Management of Achalasia

Scale	Group P	Group S	OR (95% CI)	P-value
Dysphagia score (<i>n</i> = 36)			3.38 (0.742–15.35)	0.11
≤ 1 (<i>n</i> = 14)	8 (57.1)	6 (42.9)		
> 1 (<i>n</i> = 22)	18 (81.8)	4 (18.2)		
Chest pain score (<i>n</i> = 32)			3.13 (0.32–30.79)	0.31
≤ 1 (<i>n</i> = 11)	1 (9.1)	10 (90.9)		
> 1 (<i>n</i> = 21)	5 (23.8)	16 (76.2)		
Regurgitation score (<i>n</i> = 35)			0.60 (0.139–2.59)	0.49
≤ 1 (<i>n</i> = 13)	5 (38.5)	8 (61.5)		
> 1 (<i>n</i> = 22)	6 (27.3)	16 (72.7)		
Heartburn score (<i>n</i> = 36)			0.95 (0.14–6.53)	0.96
≤ 1 (<i>n</i> = 14)	2 (14.3)	12 (85.7)		
> 1 (<i>n</i> = 22)	3 (13.6)	19 (86.4)		

Values are presented as number (%). A few of the symptom score components were not filled out by the study subjects.

Group P, primary group; Group S, secondary group; OR, odds ratio; CI, confidence interval.

naire. Three patients underwent further interventions, including endoscopic dilatation (*n* = 1), endoscopic dilatation and botulinum injection (*n* = 1) and esophagectomy (*n* = 1).

The median modified DeMeester scores were 2 (1–2) for dysphagia, 1 (1–1) for chest pain, 2 (1–2) for regurgitation, 1 (1–1) for heartburn, and 4 for overall satisfaction.

There were no statistically significant differences in all components of the modified DeMeester scores in both groups: dysphagia (*P* = 0.183), chest pain (*P* = 0.283), regurgitation (*P* = 0.754), and heartburn (*P* = 0.684).

Analysis of the effect of the previous procedure on patient-reported symptom relief

Group P was found to have a good rate of improvement in symptoms of dysphagia (57.1%) when compared to group S (42.9%) (*P* = 0.11). For chest pain, group S revealed a 90.9% rate of improvement versus 9.1% in group P following surgery (*P* = 0.31). For regurgitation, group S had a 61.5% rate of improvement as compared to the rate of 38.5% in group P (*P* = 0.49). In terms of heartburn, group S achieved an 85.7% rate of improvement versus 14.3% in group P (*P* = 0.96). However, there were no statistically significant differences in patient-reported symptom relief according to whether a previous procedure was performed (Table 2).

Overall post-surgery interventions

Four of the 86 patients (4.7%) who underwent LHM had received prior endoscopic dilatation and/or botulinum injection. One of these patients also subsequently underwent open revision myotomy. None of the patients that underwent open myotomy needed further intervention. One of the two patients who underwent stapled cardiomyotomy developed squamous cell carcinoma some years later and underwent curative esophagectomy (Fig. 4).

The median follow-up period was 107 months (range, 32–172 months) in this study.

Discussion

This long-term retrospective study demonstrated that LHM as

a surgical intervention for achalasia carries very low morbidity. In long-term follow-up, only 5.5% of patients required further intervention and the majority were satisfied with their postoperative outcomes.

This study provides important findings of long-term data on symptom relief resulting from surgical management of achalasia, addressing a long-standing gap in the literature. With other new endoscopic interventions such as POEM being increasingly used, it is paramount that the results of this study are used as part of the discussion with patients on the choice of intervention for the management of achalasia.

There were no postoperative complications that were classified beyond Clavien-Dindo II. The oesophageal perforation rate was extremely low in this study (1%) as compared to rates reported in the literature (1.5%–17.5%).^{3,6,7} This reaffirms the safety of LHM for achalasia in combination with on-table endoscopy. The need for repeated interventions post-LHM was uncommon in our study, with an overall rate of 5.5% (pneumatic dilatation 4.4% and revision of myotomy 1%). The results are similar to the rates of 2%–10% reported in the literature.^{5,8} The reasons for recurrence of achalasia include incomplete myotomy (either by incomplete division of fibres or fibrosis of the edges of the myotomy), the presence of a decompensated “sigmoid-shaped” mega-oesophagus preoperatively, reflux, or a tight fundoplication.⁹

It has been suggested that an anti-reflux procedure is required concurrently with Heller myotomy to prevent postoperative reflux.^{3,10,11} The best type of anti-reflux procedure remains controversial, with each having its advantages and disadvantages,^{10–12} and currently the choice is dependent on the institution.⁴ Total fundoplication is less favoured due to the long-term risk of dysphagia.¹¹ Some believe that posterior partial fundoplication ensures that the edges of the myotomy remain separated. In this study, anterior fundoplication was used, as it is thought to provide protective coverage of the exposed mucosa and is easier to perform. In this study, the long-term follow-up did not reveal a significant difference in residual heartburn between the two groups.

Different questionnaires or scores have been used in the literature^{5,8} to assess treatment outcomes. Nevertheless, most have focused on symptoms of dysphagia, reflux, heartburn, and chest pain, using instruments such as Likert-scale questionnaires, simple

“overall experience” items, and questions on symptom resolution (poor, fair, good, and excellent). In this study, we used the modified DeMeester questionnaire, which is simple and focuses on quality of life. In our study, patients with previous endoscopic or surgical interventions for achalasia were shown to have better improvement in chest pain, regurgitation, and heartburn. In contrast, dysphagia improved three times as often in group P. In contrast, Rosemurgy et al⁸ showed that patients with previous myotomy ($P = 0.02$) or abdominal surgery ($P = 0.01$) are more likely to be dissatisfied with the outcomes of LHM.

Kummerow Broman et al⁵ showed in a long-term follow-up study that the majority of patients still had some degree of dysphagia (median dysphagia score 4), as also shown in our study (median dysphagia score 2). Other symptoms were also mild, in keeping with Rosemurgy’s study, which showed that 81% of patients reported “excellent” or “good” symptom resolution after LHM.⁸ It may be difficult for patients to differentiate between different symptoms, or they may have a combination of symptoms.⁵ Regardless, the residual long-term symptoms are likely to be attributed to persistent oesophageal aperistalsis.

In our study, 72.9% of patients were “satisfied” or “very satisfied” with their overall experience. This is in keeping with a study of 647 patients, which reported that 67% of patients were satisfied, 8% were dissatisfied, and 25% were neutral. Perry et al⁷ reported a 91% satisfaction rate with robotic Heller myotomy. The satisfaction rate was slightly lower in our study, which could be explained by the lower response rate, the inclusion of other surgical interventions for achalasia (e.g., revision open Heller myotomy and stapled cardiomyotomy), and the fact that the questionnaire was not directly comparable to other studies.

Our study has some limitations. As it was retrospective, the preoperative symptom score was not available, which precluded a direct comparison with the symptom score of the long-term survey. Apart from the routine follow-up 1 week postoperatively, follow-up thereafter was only conducted as needed, which distorted our ability to detect residual symptoms. Similar to other studies,⁵ there was difficulty obtaining follow-up of the full cohort of patients despite attempts to contact them via telephone. Nevertheless, the long follow-up and questionnaire based on patient-reported symptom scale provided valuable data on patients’ quality of life after initial surgery.

In conclusion, surgical intervention for achalasia, particularly LHM guided by on-table endoscopy, was associated with a low rate of peri-operative morbidity, and repeated interventions were uncommon. The long-term follow-up showed that most patients still experienced a wide range of mild symptoms, but most showed significant improvements and were satisfied with their treatment outcomes.

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Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

Supplementary Materials

Supplementary data is available at <https://doi.org/10.18528/ijgii210031>.

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