Original Article

Results of Short- and Long-Segment Cardioesophageal Myotomy for Achalasia

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ABSTRACT

Background/Aim: We report the results of a short- and long-segment cardiomyotomy for relief of the symptoms of achalasia. **Patients and Methods:** From 1997 to 2009, 41 patients (22 men, 19 women) with achalasia underwent cardiomyotomy. Patients were divided into 2 groups [short-segment group (SSG) and long-segment group (LSG)]. SSG include 22 patients with laparotomy and 8-cm short-segment myotomy and Dor fundoplication. LSG includes 19 patients with thoracotomy and 12-cm long-segment myotomy and Belsey partial fundoplication. **Results:** Median follow up was 48 months (range: 12–70 months). Postoperative dysphagia improved in 20 patients in SSG and in 17 patients in LSG ($P < 0.001$). Slow emptying sensation improved in 19 patients in SSG and in 16 patients in LSG postoperatively ($P < 0.001$). Heartburn was present in 2 patients in SSG and 3 patients in LSG postoperatively ($P = 0.179$). Radiologically, barium stasis decreased significantly from 88% to 25% in SSG and from 85% to 30% in LSG. The lower esophageal sphincter (LES) gradient decreased from 32 to 10 mmHg in SSG and from 34 to 14 mmHg in LSG ($P < 0.001$). **Conclusions:** Short-segment cardiomyotomy reduces the LES gradient and relieves obstructive symptoms.

Key Words: Achalasia, dysphagia, esophagus, fundoplication, gastroesophageal reflux

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The etiology of achalasia remains unknown for the vast majority of patients. As there is no effective treatment to correct the esophageal body motility, efforts to palliate dysphagia have involved disruption of hypertonic lower esophageal sphincter (LES) muscle.[1] Several surgical methods have been described to divide the LES with recent trends involving the utilization of minimally invasive techniques.[1] Heller first described a cardiomyotomy through an abdominal approach with both anterior and posterior LES muscle divisions.[1] Palliation of dysphagia remains the first goal of therapy as the motor dysfunction persists after the operation.[2] A modified Heller's myotomy is considered at present the most efficient long-term solution. It is often proposed as the firstline treatment.[3]

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When the esophagus was re-assessed after more than 10 years, diverticulum formation appears through the myotomized area over time, and its size is proportional to the length of the myotomy. This leads to a high re-operation rate (29%) either to take down the Nissen fundoplication or to perform an esophagectomy.[4] The main goal of the esophagogastric myotomy is to reduce the abnormal sphincter function by division of sling-and-clasp fibers. However, if left open, pathologic reflux will result. The addition of a fundoplication remains necessary to prevent such damage.[5] After the advent of minimally invasive technology, attempts at a pure thoracoscopic approach were problematic and commonly led to incomplete LES division even under endoscopic guidance.[6] More recently, laparoscopic myotomy with partial fundoplication has gained popularity for the treatment of achalasia.[7] Controversy still persists regarding the ideal length of myotomy to treat oesophageal achalasia.[2] The aim of this study was to show the functional results of a short- and long-segment esophagogastric myotomy and partial Dor fundoplication for the relief of symptoms of achalasia.

PATIENTS AND METHODS

Between October 1997 and September 2009, 41 patients (22 males, 19 females) with a median age of 41 years old (range: 19–77 years), had a clinical, radiologic, manometric, and endoscopic diagnosis of esophageal achalasia. Long-segment group (LSG) included 19 patients who underwent thoracotomy and 12-cm long-segment myotomy (10 cm over esophagus and 2 cm over stomach) and Belsey partial fundoplication and short-segment group (SSG) included 22 patients, which underwent a short-segment myotomy (6 cm over esophagus and 2 cm over stomach) and Dor fundoplication with laparotomy. Fifteen patients (68%) had undergone previous dilatations or botox injections before surgery. One patient with sigmoid esophagus underwent esophagectomy and was excluded from the study. Pre- and postoperative assessment included symptoms, esophageal emptying observation with barium esophagogram and manometric and endoscopic evaluation. Postoperative symptoms were assessed in all patients and the symptoms include (1) dysphagia; (2) slow emptying; (3) heartburn, regurgitation of fresh food; and (4) weight loss. In all patients a barium esophagogram was obtained under fluoroscopic control. Abnormal contractions, atony, largest transverse lumen diameter, barium stasis, abnormal outpouching of the mucosa in the myotomized zone and gastroesophageal reflux was assessed.

During manometry four specific esophageal areas' pressures were recorded. These areas include (1) upper esophageal sphincter, (2) proximal and (3) distal half of the esophageal body, and (4) LES. Endoscopic examinations were performed in all patients. Mucosal lesions were recorded and include (1) metaplasia, (2) ulcer, (3) stricture, and (4) erosion. Nineteen patients were operated through the 7th intercostal space with left posterolateral thoracotomy. The lower esophagus was mobilized and both vagi were protected. The cardia and the whole gastric fundus were mobilized into the distal chest. The longitudinal and circular muscle of esophagus was incised over the last 10 cm of the esophagus and extended 2 cm on the gastric wall musculature. The myotomized muscle was freed from the mucosa over 50% of the circumference, lateral edge of myotomized muscle fixed to partial pleura allowed eversion of a muscle flap to avoid re-closure of the myotomy. A partial Belsey fundoplication was performed. Partial fundoplication was created with complete coverage of the myotomized area. Twenty-one patients were operated through high median laparotomy. Abdominal portion of esophagus was mobilized and both vagi nerve were protected. The longitudinal and circular muscles of the esophagus were incised over the last 4 cm of the esophagus and extended 2 cm on the gastric wall musculature and Dor fundoplication was performed. With a flap of stomach, myotomized area coverage was performed for prevention of diverticula formation.

RESULTS

A total of 41 patients (22 male and 19 female) underwent laparotomy and thoracotomy for achalasia. Dysphagia presented in all patients. Thirty-two patients (79%) experienced an average weight loss of 12 kg before the time of surgery. Patients' characteristics are summarized in Table 1. Fifteen patients (68%) underwent previous dilatations (10 patients) or botox injections (5 patients) before surgery. There was no operative mortality. Two patients (11%) required reoperation (bleeding, $n = 1$; and gastric herniation, $n = 1$). Six patients experienced minor postoperative morbidity (atelectasis, $n = 2$; atrial tachyarrhythmia, $n = 2$, and wound infection, $n = 2$). The median hospital stay was 6 days (range: 4–8 days). The median follow up was 24 months (range: 8–48 months). Postoperative assessments include clinical, radiologic, manometric, and endoscopic evaluation. Postoperative dysphagia improved in 20 patients in SSG and in 17 patients in LSG ($P < 0.001$). Slow emptying sensation improved in 18 patients in SSG and in 16 patients in LSG postoperatively ($P < 0.001$). Heartburn occurred in 2 patients in SSG and 3 patients in LSG postoperatively ($P = 0.179$).

Stasis was reported in 38 patients before the operation. Radiologically, barium stasis decreased significantly from 88% to 25% in SSG, and from 85% to 30% in LSG. The diameter of esophagus was 4 cm (range: 3–6 cm) in SSG and

Table 1: Patients characteristics and preoperative data

Variables	Laparotomy (*n* = 22)	Thoracotomy (*n* = 19)	All (*n* = 41)
Age (years)			
Median	45	48	46
Sex			
Male	11	11	22
Female	11	8	19
Symptom duration (years)	5	4	3
Symptoms			
Dysphagia to solids	21	19	40
Dysphagia to liquids	12	8	20
Weight loss	18	14	32
Regurgitation	16	14	30
Nocturnal or postprandial cough	9	8	17
Aspiration pneumonia	2	1	3
Sigmoid esophagus	0	1	1
Previous intervention			
Botox injection	3	2	5
Pneumatic dilatation	5	5	10
Heller's myotomy	1	1	2

5 cm (range: 3–7 cm) in LSG preoperatively and decreased to 33 cm (range: 2–4 cm) in SSG and 4 cm (range: 3–5) in LSG postoperatively ($P = 0.001$). The LES gradient decreased from 32 to 10 mmHg in SSG and decreased from 34 to 14 mmHg in LSG ($P < 0.001$). Endoscopy and biopsy demonstrated grade one esophagitis in 4 patients in SSG and in 6 patients in LSG. Body weight increased significantly after the myotomy in SSG [preoperative: 60 kg (range: 40–85 kg), postoperative: 68 kg (range: 50–92 kg)] and in LSG [preoperative: 58 kg (range: 42–82 kg), postoperative: 64 kg (range: 52–88 kg)] ($P = 0.001$). No diverticular formation could be observed in the myotomized zone. Comparison of short- and long-term functional results and symptoms improvement is shown in Table 2.

DISCUSSION

Esophageal motility disorders are uncommon and usually present with dysphagia or its sequelae as regurgitation and aspiration or atypical noncardiac chest pain.[8] The goal of treatment is palliative and include pharmacotherapy, pneumatic dilatation, botulinum toxin injection, and esophageal myotomy. There have been several surgical methods described for the treatment of achalasia.[9] Treatment of achalasia with surgery remains a balance between relief of dysphagia and destruction of antireflux barrier.[10] More recently there has been a trend toward using minimally invasive techniques. In recent years the procedure has been modified by the abdominal approach and minimally invasive laparoscopic and thoracoscopic approaches. Laparoscopic myotomy (cardiomyotomy) should be considered the first-line treatment of patients with achalasia.[10] Some controversies exist about the extensiveness of myotomy of the esophagus and stomach.[2] Limitation of gastric myotomy to prevent or mitigate gastroesophageal reflux may have no beneficiation of dysphagia.[11] An aggressive myotomy that destroys the entire LES is most likely to improve esophageal emptying in patients with achalasia. Extending the myotomy for 3 cm onto the stomach is superior to a lesser myotomy.[12] Arain and colleagues[13] report that higher LES resting pressure is associated with better relief of dysphagia after myotomy; however, they did not perform postmyotomy manometry. Also, in contrast to Bonavina and colleagues,[14] we found that prior pneumatic dilatation adversely affects the adequacy of myotomy. Oelschlager and associates demonstrated that extending myotomy 3 cm over stomach reduces the postoperative pressure on the LES with no significant difference in reflux when added an antireflux procedure.[12] However, they noted that 1.5 cm myotomy onto the cardia with Dor fundoplication is associated with higher postoperative LES pressure.

Table 2: Comparison of short- and long-term functions and symptom improvement

	Short-segment myotomy	Long-segment myotomy	All (*n*)
Dysphagia improved (*n*)			
< 6 Months	20	17	37
Long term	18	15	34
Heartburn present (post operation) (*n*)			
< 6 Months	2	3	5
Long term	3	5	8
Regurgitation present (post operation) (*n*)			
< 6 Months	3	4	7
Long term	4	6	10
Slow emptying stasis (*n*)			
Improved (post operation)			
< 6 Months	18	16	34
Long term	20	17	37
Esophagitis present (post operation) (*n*)			
< 6 Months	4	6	10
Long term	5	7	12

Ellis noted that long myotomy led to reflux and concluded that fundoplication in a patient with poor esophageal body motility was necessary.[15] Dor fundoplication added to myotomy reduces the risk of pathologic gastroesophageal reflux. Heller's myotomy is the surgical treatment of choice for achalasia. Controversy still exists regarding the length of the gastric portion of the myotomy, and if fundoplication should be performed to protect the esophagus from gastroesophageal reflux.

In a meta-analysis of 21 studies from 1992 to 2000 Lyass *et al.*[16] compared 532 patients who underwent laparscopic myotomy. In 69 patients Heller's myotomy was performed without fundoplication. There was no significant difference in the severity of gastroesophageal reflux symptoms. Postoperative dysphagia occurred in 1.5% of the patients without fundoplication and 3.2% of the patients with fundoplication. Finley and colleagues reported 24 patients who underwent laparoscopic Heller's myotomy without fundoplication that had greater improvement in esophageal clearance time.

Rice *et al.*[17] in a study found that 88 patients with fundoplication and 61 patients without fundoplication had higher LES pressure postoperatively. There has been some disagreement over the length of the gastric portion of the myotomy. Laparoscopy allows good access for longer gastric portion myotomy. Historically some surgeons prefer a 5 cm myotomy to preserve the sling fibers.

The aim of minimizing postoperative reflux was reported in a large study by Oelschlager *et al.* comparing short- with long-segment myotomy.[12] This study compared a group

of patients who had 1–2 cm short gastric myotomy with Dor fundoplication to a group that had a 3 cm long gastric myotomy with toupet fundoplication. This study showed that the 3 cm myotomy group had less postoperative dysphagia. For the length of myotomy over esophagus we found one report that compared long-segment myotomy over esophagus with short segment myotomy. They found that when treating achalasia, with myotomy, shortened length of myotomy despite the reduction of the LES gradient, relieves obstructive symptoms and improves esophageal emptying. Complete coverage of the myotomized zone by the fundus prevents diverticular formation. We reviewed reports of some authors about short or long cardio esophageal myotomy and including Khajanche *et al.* in 121 patients. A 5- to 6-cm long myotomy was performed on the distal esophagus with 2 cm extension onto the stomach with toupet fundoplication. Dysphagia and reflux were present in 9% and 33% patients, respectively.[18] In a report by Patti *et al.*, where 102 patients underwent myotomy extending 1–2 cm onto the gastric wall, 11% of the patients experienced dysphagia with Dor fundoplication, but none reported reflux.[19] In a study by Richards *et al.*[20] in 16 patients who had undergone laparoscopic Heller's myotomy without concomitant antireflux procedures, myotomy extended 1 cm onto the stomach without fundoplication. Dysphagia and reflux were present in 12.5% and 41% patients, respectively.[20] In summary, our study showed that patients with achalasia treated by a short myotomy and Dor fundoplication have reduction in the LES gradient, relief of the obstructive symptoms, and improvement in esophageal emptying as long-segment cardiomyotomy, and complete palliation of dysphagia. Full protection against postoperative reflux remains the main goal when treating achalasia.

REFERENCES

1. Kesler KA, Tarvin SE, Brooks JA, Rieger KM, Lehman GA, Brown JW. Thoracoscopy-assisted Heller myotomy for the treatment of achalasia: results of a minimally invasive technique. Ann Thorac Surg 2004;77:385-92; discussion 391-2.
2. Almarhabi Y, D'Journo XB, Chen LQ, Martin J, Ferraro P, Duranceau A. A short 4-cm oesophageal myotomy relieves the obstructive symptoms of achalasia. Eur J Cardiothorac Surg 2009;36:894-900.
3. Csendes A, Braghetto I, Burdiles P, Csendes P. Comparison of forceful dilatation and esophagomyotomy in patients with achalasia of the esophagus. Hepatogastroenterology 1991;38:502-5.
4. Topart P, Deschamps C, Taillefer R, Duranceau A. Long-term effect of total fundoplication on the myotomized esophagus. Ann Thorac Surg 1992;54:1046-51; discussion 1051-2.
5. Chen LQ, Chughtai T, Sideris L, Nastos D, Taillefer R, Ferraro P, *et al*. Long-term effects of myotomy and partial fundoplication for esophageal achalasia. Dis Esophagus 2002;15:171-9.
6. Richards WO, Torquati A, Holzman, MD, Khaitan L, Byrne D, Lutfi R, *et al*. Heller myotomy versus Heller myotomy with Dor fundoplication for achalasia: A prospective randomized double-blind clinical trial. Ann Surg 2004;240:405-12; discussion 412-5.
7. Stewart KC, Finley RJ, Clifton JC, Graham AJ, Storseth C, Inculet R. Thoracoscopic versus laparoscopic modified Heller myotomy for achalasia efficacy and safety in 87 patients. J Am Coll Surg 1999;189:164-9; discussion 169-70.
8. Zaninotto G, Costantini M, Portale G, Battaglia G, Molena D, Carta A, *et al*. Etiology, diagnosis, and treatment of failures after laparoscopic Heller myotomy for achalasia. Ann Surg 2002;235:186-92.
9. Wolf AS, Wright CD. Esophageal Motility Disorders. In: Shields MD, Thomas W, LoCicero J, Reed CE, Feins RH. General Thoracic Surgery. 7th ed. Philadelphia: Lippincott Williams & Wilkins; 2009. p. 1887
10. Bonavina L. Minimally invasive surgery for esophageal achalasia. World J Gastroenterol 2006;12:5921-5.
11. Schuchert MJ, Luketich JD, Landreneau RJ, Kilic A, Gooding WE, Alvelo-Rivera M, *et al*. Minimally invasive esophagomyotomy in 200 consecutive patients: factors influencing postoperative outcomes. Ann Thorac Surg 2008;85:1729-34.
12. Oelschlager BK, Chang L, Pellegrini CA. Improved outcome after extended gastric myotomy for achalasia. Arch Surg 2003;138:490-5; discussion 495-7.
13. Arain MA, Peters JH, Tamhankar AP, Portale G, Almogy G, DeMeester SR, *et al*. Preoperative lower esophageal sphincter pressure affects outcome of laparoscopic esophageal myotomy for achalasia. J Gastrointest Surg 2004;8:328-34.
14. Bonavina L, Incarbone R, Antoniazzi L, Reitano M, Peracchia A. Previous endoscopic treatment does not affect complication rate and outcome of laparoscopic Heller myotomy and anterior fundoplication for oesophageal achalasia. Ital J Gastroenterol Hepatol 1999;31:827-30.
15. Ellis FH Jr. Long esophagomyotomy for diffuse esophageal spasm and related disorders: an historical overview. Dis Esophagus 1998;11:210-4.
16. Lyass S, Thoman D, Steiner JP, Phillips E. Current status of an antireflux procedure in laparoscopic Heller myotomy. Surg Endosc 2003;17:554-8.
17. Rice TW, McKelvey AA, Richter JE, Baker ME, Vaezi MF, Feng J, *et al*. A physiologic clinical study of achalasia: Should Dor fundoplication be added to Heller myotomy? J Thorac Cardiovasc Surg 2005;130:1593-600.
18. Khajanchee YS, Kanneganti S, Leatherwood AE, Hansen PD, Swanström LL. Laparoscopic Heller myotomy with Toupet fundoplication: Outcomes predictors in 121 consecutive patients. Arch Surg 2005;140:827-33; discussion 833-4.
19. Patti MG, Molena D, Fisichella PM, Whang K, Yamada H, Perretta S, *et al*. Laparoscopic Heller myotomy and Dor fundoplication for achalasia: Analysis of successes and failures. Arch Surg 2001;136:870-7.
20. Richards WO, Clements RH, Wang, PC, Lind CD, Mertz H, Ladipo JK, *et al*. Prevalence of gastroesophageal reflux after laparoscopic Heller myotomy. Surg Endosc 1999;13:1010-4.

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