SCIENTIFIC PAPER

Minimally Invasive Management of Achalasia Cardia: Results From a Single Center Study

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ABSTRACT

Background: Since the performance of the first laparoscopic cardiomyotomy for achalasia cardia in 1991, the popularity of the minimally invasive approach for this troublesome disease has been growing. We present our experience of 226 patients who underwent laparoscopic cardiomyotomy and discuss the relevant issues.

Methods: A retrospective analysis was carried out of 226 patients who have undergone laparoscopic cardiomyotomy since 1993. The preoperative workup, surgical technique, and postoperative management are described.

Results: Patients included 146 males and 80 females; average age was 36.4 years (range, 6 to 85). Mean duration of symptoms was 1.4 years. Nearly half of the patients (112) had undergone prior pneumatic dilatation. In 20 patients, myotomy alone was done, 44 patients had a Dor's fundoplication, and 162 had Toupet's fundoplication. The average operating time was 96 minutes. Mean postoperative hospital stay was 2.2 days. Dysphagia was eliminated in 88.9% of the patients with an overall morbidity of 4.4% and nil mortality over a mean follow-up of 4.3 years.

Conclusion: Laparoscopic cardiomyotomy with Toupet's fundoplication is a safe and effective treatment of achalasia cardia. Dor's fundoplication is done selectively, especially when suspicion is present of mucosal injury.

Key Words: Achalasia cardia, Laparoscopic cardiomyotomy, Toupet's fundoplication, Dor's fundoplication.

INTRODUCTION

For nearly 250 years, achalasia cardia was known as cardiospasm, a misnomer for a disease wherein the lower esophageal sphincter (LES) is not in spasm but fails to relax. More than 300 years ago, Sir Thomas Willis described a patient suffering from dysphagia, which he deduced to be due to obstruction at the cardia. In 1672, he treated the patient by dilation using a sponge attached to a whalebone, thus recording the first successful treatment of this disease.[1] Over the years, the cause of this puzzling disease remained a mystery and, by consensus, it came to be known by the generic name of cardiospasm. Finally, in 1927, Sir Arthur Hurst[2] coined the term achalasia after demonstrating the failure of the LES to relax normally. Ernest Heller,[3] a German, did the first successful esophagomyotomy 241 years later on April 14, 1913. He described both anterior and posterior myotomy. In 1923, Zaaijer[4] modified the procedure by performing a single anterior myotomy, achieving the same successful results with reduced morbidity. The arrival of minimally invasive techniques in this field was heralded by the reports of Shimi et al[5] describing laparoscopic approach in 1991 and Pellegrini[6] describing the thoracoscopic approach in 1992. After this, several studies[7–9] have reported good results with laparoscopic cardiomyotomy.

We present our experience with laparoscopic cardiomyotomy in 226 patients. Our aim is to describe our technique, especially our use of the modified pericardiomyotomy scissors, present our results, and assess the effectiveness of laparoscopic cardiomyotomy.

METHODS

This is a retrospective analysis of 226 patients who have undergone laparoscopic cardiomyotomy since 1993 in our center. Preoperative workup included clinical evaluation, routine hematological tests, upper GI endoscopy, barium swallow, and manometry. On the night before surgery, a 14G Ryle's tube is inserted, and a wash is given with normal saline until the returning fluid is clear. After this, the patient is posted for surgery.

The procedure is carried out with the patient in the modified Lloyd Davies position such that the thighs are parallel

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to the ground and a reverse Trendelenburg is approximately 30 degrees. The patient position and the position of the personnel are depicted in **Figure 1**. After creating the pneumoperitoneum, the trocars are placed as shown in **Figure 2**. A 30-degree scope is placed through the supraumbilical port. The left lobe of the liver is lifted up by a blunt-tipped instrument inserted through the subxiphoid trocar. The stomach is retracted caudally through the left anterior axillary port. The tenuous window of Kustner is divided, and the right crus is identified. The crus is dissected from the esophagus, the peritoneum and phrenoesophageal membrane are divided, and the left crus is identified. For the patient undergoing a Dor fundoplication, the mobilization is limited to the lateral and anterior aspects. The anterior vagus nerve is identified and protected during the course of the dissection. The proximal esophagus is dissected for a distance of about 2cm to 3cm into the dilated segment of the esophagus in the posterior mediastinum.

Myotomy is carried out over the left side of the anterior aspect of the esophagus, beginning 1cm to 2cm cranial to the cardia. Longitudinal muscle can easily be dissected by using a curved dissector. The inner circular muscle is identified carefully and dissected from the mucosa by blunt dissection. A modified Sugar Baker Pericardiomyotomy Scissor is fashioned with a protective boot for preventing mucosal injury. We have found it extremely convenient for carrying out the cardiomyotomy once the correct plane is identified **(Figure 3)**. The myotomy is extended onto the proximal esophagus 2cm to 3cm above the dilated portion and distally onto the stomach approximately 0.5cm to 1cm. Extension beyond this increases the incidence of reflux. Gastric myotomy is more difficult to perform as the mucosa and outer muscular layers are thinner and there are more bridging vessels than the esophagus, which are highly prone to bleeding and perforation. In cases of perforation of the esophageal mucosa, interrupted stitches with 4–0 Vicryl are used. A myotomy of 0.5cm on the stomach is ideal.

Once the myotomy is completed, the muscular edges are separated laterally for approximately 40% of the circumference. If mucosal injury is suspected, a leak can be

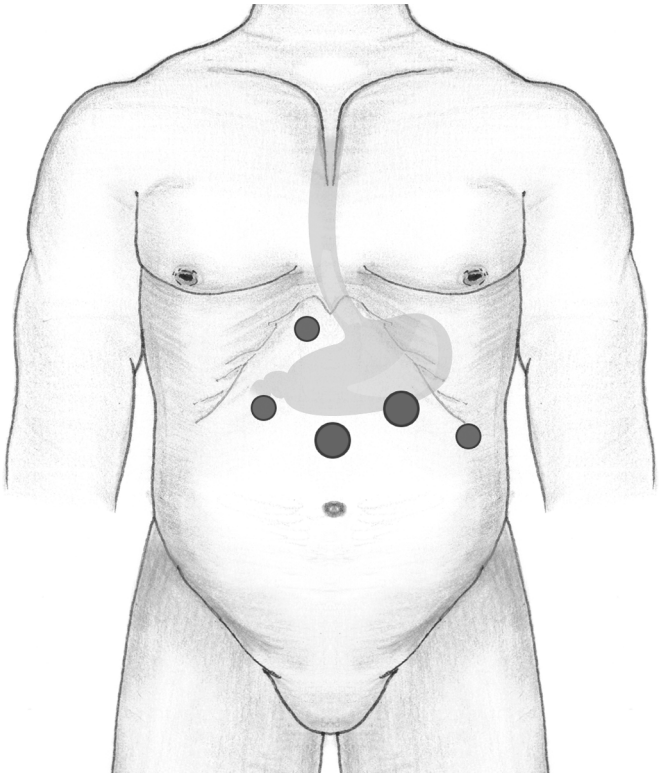

Figure 2. Port positions. Red: 10-mm ports. Green: 5-mm ports. Midline supraumbilical port for camera; left hypochondrium port for right-hand working; right hypochondrium port for left-hand working; epigastric port for liver retraction; left anterior axillary port for stomach retraction.

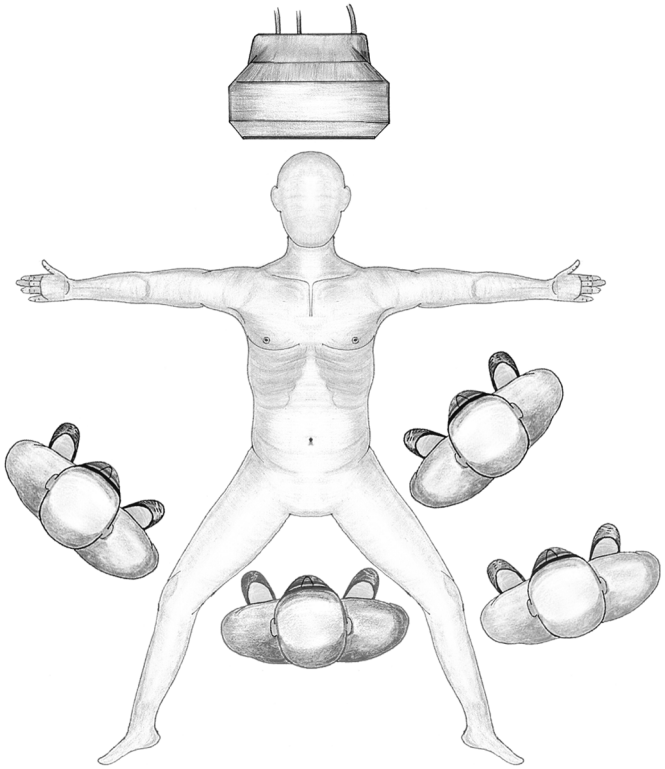

Figure 1. Patient position and team position. A: Operating surgeon. B: Assistant surgeons. C: Nursing assistant.

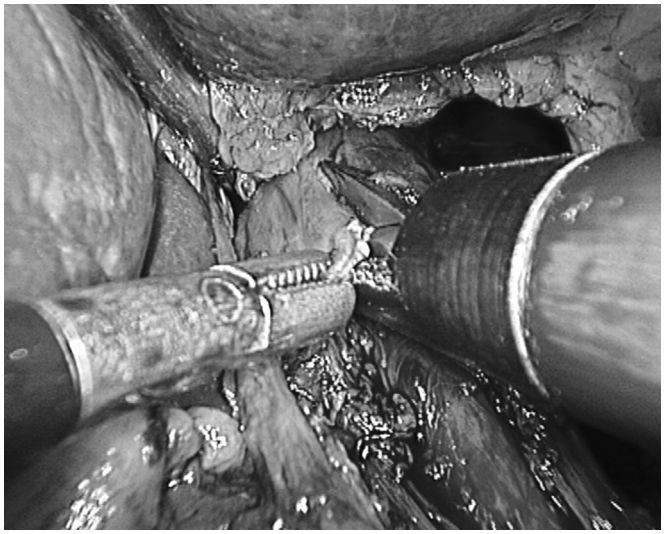

Figure 3. The cardiomyotomy being performed using the modified pericardiotomy scissors.

checked for by instilling air into the esophagus while submerging it in water used for irrigation.

If the hiatal opening is wide or crural division has been performed to approach the esophagus in the mediastinum, crural repair is carried out using polypropelene 1–0 sutures.

After this, an antireflux procedure is performed, our choice being either a modified Toupet fundoplication (270° posterior fundoplication, **Figure 4)** or a Dor fundoplication (180° anterior fundoplication).

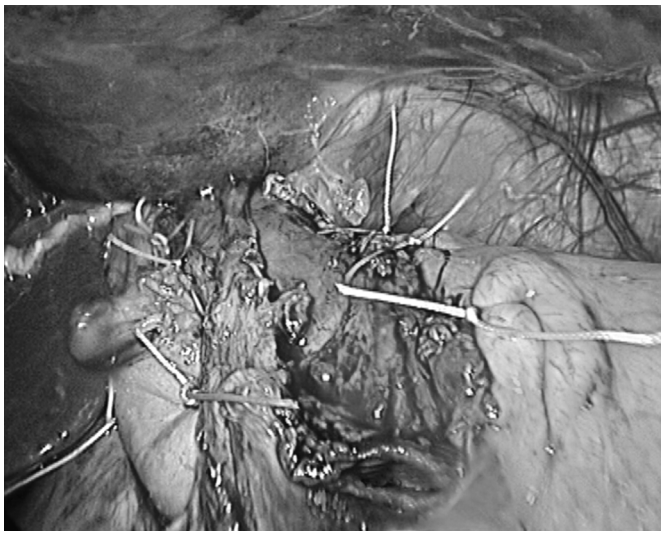

Figure 4. Toupet's fundoplication.

Postoperatively, a dye study using sodium meglumine diatrizoate (Gastrografin) is conducted in select patients after 24 hours to rule out a suspected mucosal leak. If the mucosa is intact, the Ryles tube is removed, and the patient is started on oral fluids, being discharged the next day. Avoidance of extreme activity (eg, lifting and pushing) is advised for 1 month to prevent herniation of the partial wrap through the mediastinum.

The patients were followed up by weekly attendance in the outpatient department for 4 weeks followed by fortnightly visits until 12 weeks after surgery. At each visit, a detailed history was obtained regarding the improvement in the patient's preoperative symptoms. A manometry was performed on the 12th visit. If the manometry was satisfactory, the patient was asked to attend the outpatient department on an as needed basis.

RESULTS

Since 1993, 226 patients have been treated for achalasia cardia with the laparoscopic method. The patient characteristics are detailed in **Table 1**. Ten of our patients were below the age of 14 years. Nearly half of our patients had prior pneumatic dilatation on more than 2 occasions. Seventy-five percent (84 patients) of these had early recurrence of dysphagia within 4 weeks to 16 weeks, while

Table 1.
Patient Characteristics

Age (years)	
Range	6–85
Mean	36.4
Sex Distribution (M:F)	146:80
Presenting symptoms	
Dysphagia	26 (100%)
Reflux of food in the mouth	184 (81.4%)
Heartburn	124 (54.9%)
Chest pain	84 (37.2%)
Respiratory complications	34 (15%)
Duration of symptoms	
Range	2 mos to 3 years
Mean	1.4 years
Preoperative LES pressure (mm Hg)	
Range	50–108
Mean	72
Prior pneumatic dilatation	112 patients

the remaining patients did not even have any temporary relief of dysphagia after the dilatation. Around 15% of the patients presented with respiratory complaints like chronic cough, wheezing, asthma, and recurring pneumonia.

The operative details, morbidity, and mortality are summarized in **Table 2**.

Anterior (Dor's) wrap was performed in the early days of our series. However, we found that Toupet's wrap gives better symptomatic relief against postoperative reflux symptoms and now perform Dor's wrap selectively in patients with suspected mucosal injury.

The postoperative course is described in **Table 3**.

All the patients were successfully treated by laparoscopic Heller's myotomy with satisfactory relief of dysphagia. In 5 patients, mucosal injury was immediately noticed and repaired by a laparoscopic hand-sewn technique using 4–0 polygalactin. Dor's fundoplication was done in all these patients to protect the suturing. There was difficulty in mobilizing the esophagus, associated with periesophageal inflammation in 4 patients. In the patients who had undergone previous dilatation, due to the fibrosis at the cardia, dissection was difficult, especially in getting the submucosal plane during myotomy.

One patient had dysphagia in the immediate postoperative period. Endoscopy and barium meal study revealed a paraesophageal hiatus hernia. Relaparoscopy done on the fifth postoperative day confirmed the diagnosis. This patient had a long segment of hugely dilated esophagus. The anterior cruciate ligament was divided to access the anterior mediastinum so that the cardiomyotomy could be carried out. However, at the end of the procedure, the crura were not approximated. Reduction of the gastric fundus and narrowing of the hiatus was done by approximating the crura anteriorly with 1–0 prolene. This relieved the dysphagia completely, and the patient has remained symptom-free since then.

Table 2.
Operative and Postoperative Details

Surgery Performed	
Myotomy alone	20
Toupet	162
Dor	44
Mean Operating Time (minutes)	
After endoscopic dilatation	108
Without endoscopic dilatation	82
Overall	96
Hospital Stay (days)	
Range	2–10
Mean	2.2

Table 3.
Postoperative Course

Postoperative Relief of Dysphagia	201 (88.9%)
Follow-up	
Range	1 mo–6 years
Mean	4.3 years
Morbidity	10 (4.4%)
Wound infection	3
Mucosal injury	5
Paraesophageal hiatus hernia	1
Mucosal blow-out	1
Mortality	0

One patient had a bout of severe vomiting and retching on the second postoperative day, 20 hours after resumption of a liquid diet. Thereafter, the patient had a bout of hematemesis. Careful endoscopy revealed a small Mallory-Weiss tear in the lower esophagus. The patient was managed conservatively with intravenous antibiotics and hyperalimentation for one week. A water-soluble dye study after one week revealed the absence of a leak, and the patient made a subsequent uneventful recovery. We advise all our patients to have a soft semi-solid diet for one month. Postoperative dysphagia to solids was found in 10 patients (4.42%), who responded to conservative management with continuance of a semi-solid diet for a period of 3 months postoperatively, at the end of which all patients tolerated a normal diet.

Twelve weeks after surgery, 176 (79%) patients attended follow-up and underwent manometry. There was complete relief of achalasia by manometry in all these patients. The remaining patients (n=50) were contacted by telephone and interviews were conducted. A further 14 patients complained of some degree of dysphagia, especially to solids, bringing the total incidence of postoperative dysphagia to 25 (11.1%). However, objective assessment of their dysphagia by manometry could not be carried out.

DISCUSSION

Achalasia is a rare disease with an incidence of around 1 in 100 000 reported in the West.[10] Achalasia is often not

diagnosed until several years after the first symptoms are noted. Due to the slow progress of the disease, the symptoms are often confused with gastroesophageal reflux disease or simple dyspepsia and treated accordingly. In our series, the mean duration of symptoms was 1.4 years. On the other hand, Wong et al[11] reported a lag period of 2.6 years, and Arber[12] reported a delay of 4.4 years in his series, attributing it to the rarity of the disease. A patient may present with a wide range of symptoms, depending on the stage of disease at the time of diagnosis. Nearly all of these complaints are related to the progressive obstruction of food and liquids at the gastroesophageal junction. More than a third of our patients also presented with atypical respiratory complaints. Similar presentations have been documented in the literature.[13,14] In addition, malignant obstruction, gastroesophageal reflux disease stricture, diffuse esophageal spasm, and nutcracker esophagus can mimic achalasia.[15,16]

Various modalities of treatments have been advocated for achalasia. Pharmacotherapy with nitrates and calcium-channel blockers has limited value due to inconsistent and short-lived action.[17,18] With botulinum toxin, 50% of the patients relapse within 1 year.[19,20]

Esophageal dilation affords substantial relief of dysphagia after 1 year.[21] However, repeated dilatation is often necessary. Moreover, by 5 years, more than 50% of patients have relapsed.[22,23] Furthermore, several authorities have confirmed the increased difficulty in performing cardiomyotomy in patients who have received botulinum toxin injection or have undergone pneumatic dilatation.[24–26]

In a small sample of 12 patients, Dolan et al[27]reported a slightly longer operative time in patients who had undergone previous pneumatic dilatation compared with those who had not but found that no difference existed in the complication rate or in clinical outcome between the 2 groups. Since the performance of the first laparoscopic cardiomyotomy in 1991, several large series have proven the efficacy of this approach.[8,28,29] As compared with open surgery, laparoscopic Heller myotomy has comparable success rates with less early impairment to quality of life, especially in terms of physical functioning and pain.[30]

Moreover, the open approach entails a perioperative mortality of 1.2%, and the laparoscopic approach consistently achieves a zero mortality rate.[31] Thoracoscopic cardiomyotomy was reported by Pellegrini in 1992, followed by several series.[32–34] However, the laparoscopic approach has proved to be more popular with the disadvantages of thoracoscopy being a high rate of persistent dysphagia, secondary GERD, greater postoperative pain, and longer hospital stay.[35,36]

Technical difficulties include the necessity of working orthogonal to the longitudinal axis of the esophagus, inability to determine the exact length of myotomy on to the cardia exactly, inability to visualize the gastroesophageal junction, necessity of performing the surgery with the patient in the lateral decubitus position with double-lumen tube anesthesia, and placement of a chest drainage tube, which prolongs the operative time.[37,38] A contentious issue has been the necessity of adding an antireflux procedure. In a retrospective review of 95 patients who underwent a laparoscopic Heller myotomy without an antireflux procedure, dysphagia was reported in an unacceptably high number of 14% of patients.[9]

In contrast, Gupta et al[39] reported good outcomes with laparoscopic cardiomyotomy alone, with a low incidence of postoperative dysphagia and heartburn. In a meta-analysis of laparoscopic cardiomyotomy with or without fundoplication from 1991 to 2001, the data of 532 patients from 15 studies were analyzed. The difference in the rate of gastroesophageal reflux diagnosed in postmyotomy pH studies in wrapped and nonwrapped patients was not significant (7.9% vs. 10%, respectively; $P=0.75$). Also no significant difference existed in the incidence of postmyotomy GER symptoms in wrapped and nonwrapped patients (5.9% vs. 13% respectively; $P=0.12$).[40] Bloomston et al[41] selectively applied fundoplication in 21 of 100 patients undergoing laparoscopic Heller myotomy. Preoperative symptoms were similar for both groups of patients who had significant improvement following myotomy with or without fundoplication. In addition, no significant differences occurred in postoperative dysphagia or heartburn. Overall improvement was seen in 86% of patients undergoing myotomy with fundoplication and in 97% without fundoplication. Based on their experience, the authors recommended selective application of fundoplication during laparoscopic Heller myotomy for optimal outcomes. Thus, some authors still do not recommend adding an antireflux procedure to cardiomyotomy.[9,42]

However, pathologic gastroesophageal reflux can occur in more than 50% of cases when a long myotomy (>2 cm on the anterior gastric wall) has been carried out.[43–45]

Given the concern of postoperative reflux and the relative ease of adding an antireflux procedure, it seems prudent and reasonable to propose that all laparoscopic Heller cardiomyotomies should be accompanied by an antireflux procedure.[46] Yet, more controversy surrounds the choice of wrap-Dor or Toupet. The advantages of the Toupet

procedure are that it prevents the reapproximation of the myotomy and may be better than an anterior fundoplication in preventing postoperative GERD. On the other hand, proponents of Dor's fundoplication procedure argue that it is easy to perform, protects the anterior esophagus following myotomy and leaves the posterior anatomy intact. Moreover, it has been suggested that a Toupet procedure may increase the incidence of postoperative reflux secondary to retroesophageal dissection, and increase the likelihood of postoperative dysphagia due to angulation of the posterior esophagus. Balaji et al,[47] while reporting a multiinstitutional comparison of different fundoplication techniques, suggested that the Dor anterior fundoplication was associated with less heartburn and a decreased prevalence of persistent dysphagia. Oelschlager et al[48] compared Dor versus Toupet fundoplication along with an extended myotomy with the latter and found a higher incidence of postoperative dysphagia with Dor's fundoplication and suggested that this was due to the covering of the myotomy site with the wrap, which could lead to adhesion formation and recurrent obstruction. On the other hand, Hunter et al[49] found no symptomatic reflux difference in patients who underwent either of the two wraps. In the absence of randomized trials comparing the 2 wraps, the choice of the antireflux procedure will remain a moot issue. Recently, Rossetti et al[50] reported excellent results with a total fundoplication (360-degree Nissen Rossetti wrap) with no chemical reflux and 2.2% persistence of dysphagia on long-term follow-up. Though initially we preferred the Dor wrap because of its technical ease, we now almost exclusively perform the Toupet wrap unless there is a suspicion of mucosal injury.

Postoperative dysphagia was found in 11.1% of our patients, all of whom responded to conservative management. The incidence of this complication in the literature varies from 3.4% to 17% when a long cardiomyotomy and an antireflux procedure have been performed.[51–54] The mucosal injury rate in our series was 2.2%, all the patients having had at least 2 prior sessions of pneumatic dilatation. Dissection was difficult in the submucosal plane in all the 5 patients due to fibrosis. The injury was recognized intraoperatively and repaired in all patients followed by a Dor fundoplication. None of these patients had any subsequent morbidity. Mucosal tear rates reported in literature vary from 4% to 14%.[41,52,54,55] We have found the modified pericardiotomy scissors with an insulated protective boot very useful for safe and hemostatic division of the muscle fibers. Once the correct submucosal plane is obtained by blunt separation of the overlying muscle fibers, it is a simple matter to insert the pericardiotomy scissors and further extend the myotomy. Its rounded blunt tip gently strips the mucosal from the muscular layer, and the protective boot shields the mucosa while the muscle can be cauterized and cut.

Taskin et al[56] reported intraoperative balloon-dilatation assisted cardiomyotomy, claiming that balloon dilation makes myotomy easier because it separates the muscle fibers. Robotic surgery has already been adapted for this procedure. The main advantages of robot-assisted laparoscopic surgery are the availability of 3-dimensional vision and easier instrument manipulation than can be obtained with standard laparoscopy. Disadvantages include the large diameter of the instruments (8mm) and the limited number of robotic arms (maximum, 3). The learning curve to master the robot was performance of 10 or more robotic procedures. In addition, in contrast to human operators, robots can malfunction necessitating conversion.[57–59]

CONCLUSION

Our preferred approach for esophageal achalasia is a laparoscopic Heller myotomy and partial Toupet fundoplication. We have found the modified pericardiotomy scissors very useful for rapid, safe, and hemostatic division of muscle fibers, as borne out by the low incidence of mucosal injury in our series. This has been found to be effective in relieving dysphagia and has a low incidence of postoperative reflux. In our series, we have found the laparoscopic approach to be associated with low morbidity, nil mortality, and a short hospital stay. We found it to provide satisfactory symptomatic relief and consider it the treatment of choice for this disabling disease.

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