Videoscopic Heller Myotomy with Intraoperative Endoscopy Promotes Optimal Outcomes

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ABSTRACT

Background and Objectives: Minimally invasive surgical techniques are applicable to achalasia, but the optimum approach to intraoperative assessment of adequacy of myotomy remains unestablished. We set out to show that videoscopic Heller myotomy with concurrent endoscopy ensures adequacy of myotomy while limiting postoperative clinically apparent reflux.

Methods: Seventy-eight consecutive patients with achalasia underwent videoscopic Heller myotomy with concomitant endoscopy between 1992 and 1998. Fundoplication was not routinely undertaken.

Results: Preoperative symptoms consisted of dysphagia (100%), emesis/regurgitation (68%), heartburn (58%), and postprandial chest pain (49%). Following myotomy, significant improvement \((P < 0.0001)\) was seen in dysphagia (43%), postprandial chest pain (13%), and emesis/regurgitation (9%) at a mean follow-up of 33 ± 2.2 months. Mean reflux score (scale 0 to 5) improved from 3.7 ± 0.3 to 1.5 ± 0.2 \((P < 0.0001)\). Improvement in symptoms was reported in 96% of patients. Fundoplication was used in 8 patients as part of hiatus reconstruction \((n = 6)\) or repair of esophageal perforation \((n = 2)\).

Conclusions: Intraoperative endoscopy during videoscopic Heller myotomy guides the extent and adequacy of myotomy. By utilizing a focused dissection with preservation of the natural antireflux mechanisms around the gastroesophageal junction and limiting the extent of myotomy along the cardia, postoperative reflux symptoms are minimized. We advocate concomitant endoscopy during Heller myotomy to guide myotomy and submit that routine fundoplication is clinically unnecessary.

Key Words: Achalasia, Heller, Videoscopy, Endoscopy.

INTRODUCTION

Achalasia is a relatively uncommon swallowing disorder characterized by poor relaxation of the lower esophageal sphincter mechanism with associated esophageal dysmotility. Progressive dysphagia is the hallmark of achalasia, with regurgitation, heartburn, and postprandial chest pain also being common.\(^1\) Therapy is aimed at reducing resting lower esophageal sphincter pressures. This can be done medically with calcium channel blockers\(^2\) and long-acting nitrates,\(^3\) endoscopically by balloon dilation\(^4,5\) and botulinum toxin (botox) injection,\(^6,7\) and surgically by Heller myotomy.\(^8,9\) Traditionally, Heller myotomy has been considered by nonsurgeons as a morbid procedure, but with the recent application of videoscopy, a resurgence has occurred in the frequency with which Heller myotomy is undertaken.\(^10,11\)

Although most would agree that surgical myotomy is superior to nonoperative therapy in providing long-term palliation of symptoms, no consensus has been reached regarding the ideal way to assess the adequacy of myotomy intraoperatively. Our experience with videoscopic Heller myotomy began in 1992. From the beginning, we have utilized intraoperative endoscopy to guide the extent of myotomy. We sought to review our experience with videoscopic Heller myotomy utilizing intraoperative endoscopy and establish endoscopic criteria for successful myotomy. We hypothesized that, by using this technique of intraoperative monitoring, favorable outcomes could be accomplished.

PATIENTS AND METHODS

Preoperative Assessment

Patients were referred for surgical consultation by their gastroenterologist or primary care physician. The diagnosis of achalasia was confirmed in all patients by barium esophagram and esophageal manometry studies. Findings of a dilated aperistaltic esophagus with distal narrowing (“bird’s beak”) on barium esophagram and incomplete relaxation of the lower esophageal sphincter with absent or uncoordinated esophageal contractions on manometry were considered diagnostic of achalasia.
Patients were asked to list their symptoms and grade heartburn symptoms on a scale of 0 (none) to 5 (continuous). The type of intervention, if any, prior to referral for surgical management of achalasia was noted.

**Operation**

Our techniques for thoracoscopic and laparoscopic Heller myotomy have been described previously.12 Briefly, thoracoscopy was undertaken using five 10-mm ports with the patient in the right lateral decubitus position. Laparoscopic Heller myotomy was similarly undertaken using five 10-mm ports with the patient in the supine position. Myotomy of the circular muscle fibers was completed using the 90°-angled hook cautery along the posterolateral (via thoracoscopy) or anterior (via laparoscopy) portion of the lower esophagus. The muscle fibers were then dissected laterally to create flaps allowing the esophageal mucosa to bulge outward. Great care was taken to minimize dissection around the lower esophagus so as not to disturb the natural antireflux mechanisms. An antireflux procedure was not routinely applied.

**Intraoperative Endoscopy**

Endoscopy was undertaken per os by a gastroenterologist during videoscopy. Using "picture-in-picture," the operating surgeon was able to view both the operative field and the endoscopist's view simultaneously. The gastroesophageal junction was located endoscopically and used to guide the start of myotomy. With the endoscopist's guidance, myotomy was undertaken in a cephalad and caudal direction until the lower esophagus and sphincter (LES) were easily distended with gentle air insufflation through the endoscope. While myotomy was generously carried in a cephalad direction, the caudal extent was limited onto the cardia only to the extent that would allow easy opening of the LES by gentle insufflation and for the endoscope to be easily passed into the stomach. Myotomy onto the cardia beyond this was considered excessive and was avoided. The endoscopist would then slowly withdraw the endoscope through the myotomized segment using tactile feedback to determine the degree of relaxation of the lower esophageal sphincter. Myotomy was considered complete only after the surgeon could visualize distention of the lower esophagus with air insufflation, intraluminal transillumination by endoscopy along the myotomized segment, bright extraluminal transillumination by videoscopy along the myotomized segment, and, lastly, when the endoscopist reported easy passage of the endoscope into the stomach. Finally, the endoscope was used to insufflate the lower esophagus while the hiatus was filled with saline to look for bubbles, which would suggest a perforation.

**Postoperative Management and Follow-up**

In the early postoperative period, all patients underwent an esophagram with water-soluble contrast followed by thin barium to assess for both perforation and esophageal emptying. If no leak was seen and esophageal emptying was rapid, a liquid diet was started and advanced to soft mechanical diet before discharge the next day. Patients were then discharged on the first postoperative day with instructions to slowly increase their diet over 1 to 2 weeks. If esophageal emptying on a routine postoperative esophagram was slow, however, patients were allowed limited amounts of liquids until the edema along the myotomy resolved. Patients were then advanced to a soft mechanical diet and discharged with similar instructions to advance their diet over 1 to 2 weeks.

Patients were followed in the clinic or by telephone periodically. They were asked to, again, list their symptoms and grade their heartburn symptoms, if present. In addition, patients were asked to grade their outcome compared with their preoperative status as: excellent (complete or near-complete resolution of symptoms), good (greatly improved symptoms), fair (slightly improved symptoms), or poor (no improvement or worsened symptoms).

**Data Analysis**

All data were maintained in a computer database. Statistical analysis was completed with True Epistat (Epistat Services, Richardson, TX). Means were compared with the Student t test. Symptoms were compared with chi-square analysis.

**RESULTS**

Videoscopic Heller myotomy was undertaken in 78 patients ranging from the very young to the very old (Table 1). All patients complained primarily of dysphagia, although heartburn, regurgitation/emesis, and postprandial chest pain were also common (58%, 68%, and 50%, respectively). The vast majority of patients underwent either endoscopic dilation or botox injection prior to referral. Only 18 patients (23%) had never undergone these forms of therapy prior to surgery.
Myotomy was undertaken thoracoscopically in the first 11 patients but was abandoned for the less difficult and less morbid laparoscopic approach. Fundoplication was undertaken in 8 patients at the time of myotomy (Table 2). Toupet fundoplication was undertaken in 5 patients with large hiatus hernias in coordination with myotomy. Three additional patients had Dor fundoplications constructed. Two of these were completed as part of the repair of an esophageal perforation, and one was in a patient with a large hiatus hernia and patulous esophageal hiatus. Three additional patients underwent epiphrenic diverticulectomy at the time of myotomy, and 1 patient underwent concomitant cholecystectomy.

Complications occurred in 10 patients (13%). Five of these complications were esophageal perforations (Table 2). Three esophageal perforations occurred during thoracoscopy and required conversion to “open” for repair. Two of these 3 perforations were recognized by endoscopy at the time of myotomy and repaired. One perforation was discovered on routine postoperative esophagram and repaired immediately during a second operation. These perforations were approached through a limited “mini-thoracotomy” with port sites for exposure and assistance. Two perforations occurred during laparoscopy and were recognized immediately by endoscopy. The 2 perforations were repaired laparoscopically in coordination with a Dor fundoplication. No patients had sequelae from their esophageal perforations and were discharged on schedule.

One patient suffered an enterotomy at the time of laparoscopy. This was in a patient who had undergone previous thoracic, abdominal, and thoracoabdominal operations. The enterotomy was recognized in the early postoperative period and repaired. Although this patient had a prolonged hospital course, he was ultimately discharged in good condition without apparent sequelae. Four other patients each had a minor complication of transient renal insufficiency, pleura violation, nausea and vomiting, and urinary retention. No deaths occurred.

The mean length of stay was 3.1 days (Table 2) with a median of 2 days. This includes the patient with the prolonged hospitalization. This patient is clearly an outlier and if removed from the data, the mean length of stay falls to 2.4 days. Patients undergoing thoracoscopic Heller myotomy stayed an average of 5.6 days in the hospital compared to 1.8 days for patients undergoing laparoscopic Heller myotomy (not including the patient with a prolonged hospital stay).

Significant improvement was seen in patients’ symptoms (Table 3). Dysphagia was seen in 32 patients (43%) following myotomy. This was described as mild and significantly better than preoperative dysphagia in 29 of these 32 patients. Three patients still complain of severe dysphagia unchanged from their preoperative status, although barium esophagram confirms adequate myoto-

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**Table 1.**
Patient Demographics.

| Male/Female | 43/35 |
| Mean age ± SEM (range) | 51 ± 2.2 (14-91) |

**Table 2.**
Intraoperative and Perioperative Data in Patients Undergoing Videoscopic Heller Myotomy.

| Thoracoscopic/Laparoscopic | 11/67 |
| Concomitant fundoplication | 8 (10%) |
| Conversion | 3 (4%) |
| Complications | 10 (13%) |
| Esophageal perforation | 5 (6%) |
| Length of stay (mean ± SEM) | 3.1 days ± 0.8 |

**Table 3.**
Symptoms Comparison Before and After Undergoing Videoscopic Heller Myotomy.

| Symptom | Preop | Postop | P |
| Dysphagia | 78 (100%) | 32 (43%) | < 0.0001 |
| Emesis/ regurgitation | 53 (68%) | 7 (9%) | < 0.0001 |
| Chest pain | 38 (49%) | 10 (13%) | < 0.0001 |
| Reflux score (mean ± SEM) | 3.7 ± 0.3 | 1.5 ± 0.2 | < 0.0001 |
Heartburn symptoms were noted in 40 patients (55%) postoperatively. Twenty-six of these patients (65%) also complained of heartburn symptoms prior to operation. Twenty-seven of the patients with postoperative heartburn symptoms (68%) described their heartburn as occurring, at most, weekly. Overall, only 7 patients (9%) required “antireflux” medications after myotomy. Eighteen patients complaining of heartburn prior to myotomy (40%) had complete resolution of these symptoms after operation. The mean reflux score improved significantly following myotomy (Table 3). Postprandial emesis/regurgitation and chest pain also improved significantly following videoscopic Heller myotomy.

Three patients in our series ultimately underwent esophagectomy and, therefore, were censored from follow-up analysis. Two of these patients had been lost to follow-up and were referred for esophagectomy by their gastroenterologists. While 1 of these 2 patients has had improvement in his symptoms, the other still complains of severe dysphagia. One patient with excessively prolonged emptying of the proximal esophagus following myotomy due to esophageal motor dysfunction underwent esophagectomy at our institution for persistent dysphagia. Although she states she is greatly improved from her preoperative status, she still complains of dysphagia and emesis.

Overall, 96% of patients state that they have had improvement in their symptoms at a mean follow-up of 33 months (Table 4). Three patients continue with symptoms unchanged from their preoperative status. Of these 3 patients, 1 underwent Heller myotomy thoracoscopically and 2 laparoscopically. These patients failed to have relief of dysphagia immediately following myotomy. Barium esophagram verified an adequate myotomy in all cases but poor esophageal motility. Two of these patients have undergone either botox injection or balloon dilation since myotomy without improvement. One patient had a poor result immediately following myotomy. He then underwent a single botox injection and remains symptom-free 4 years later.

**DISCUSSION**

The surgical management of achalasia has been well established for many years. Nonetheless, 2 major issues associated with myotomy have long been debated. These are which method of assessing the adequacy of myotomy intraoperatively is optimal and whether an antireflux procedure should routinely be added to myotomy. In this large series of patients with over 2 years of clinical follow-up, we have shown that good outcomes can be expected when myotomy is complete, and routine application of fundoplication is not necessary if intraoperative endoscopy is used to determine the adequacy and extent of myotomy.

Our patients generally consisted of middle-aged men and women with a long-standing diagnosis of achalasia. The vast majority of patients had been followed for some time by their gastroenterologists and underwent multiple episodes of balloon dilation, botox injection, or both without sustained improvement. While dysphagia continued to be the primary complaint of all patients, heartburn was also very common. Although pathologic gastroesophageal reflux in patients with severe achalasia is unlikely, heartburn symptoms can result from normal physiologic gastroesophageal reflux that cannot be cleared by the dysfunctional esophagus or by acidification of retained food particles within the esophagus. Nonetheless, many patients complained of severe heartburn and were on various “antireflux” medications (eg, proton pump inhibitors, H2 blockers, prokinetics) at the time of referral.

Videoscopic Heller myotomy proved to be safe with only 1 patient suffering a major complication, and no deaths occurred. Although esophageal perforation is certainly not a trivial complication, no patient had sequelae or prolongation of their hospital stay as a result of esophageal perforation. Hospital stays were longer at the beginning of our experience owing mostly to utilization of the thoracoscopic technique, which required a period

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**Table 4.**

| Postoperative Outcome | Months F/U (mean ± SEM) | 33 ± 2.2 |
|-----------------------|-------------------------|---------|
| Excellent             |                         | 48 (66%)|
| Good                  |                         | 14 (19%)|
| Fair                  |                         | 8 (11%) |
| Poor                  |                         | 3 (4%)  |

Excellent = complete or near-complete symptom resolution; good = symptoms greatly improved; fair = symptoms slightly improved; poor = no improvement/worsening of symptoms
of tube thoracostomy drainage. In addition, physician reluctance to discharge patients too soon made for longer hospital stays early in our experience. Currently, patients rarely spend more than 24 hours in the hospital following laparoscopic Heller myotomy.

Significant improvement in symptoms occurred in 96% of patients following myotomy. Dysphagia, which occurred in all patients prior to myotomy, was greatly reduced following operation. While some patients (43%), when specifically queried, agreed that they had minimal residual dysphagia, nearly two thirds of patients stated that they had nearly complete resolution of their symptoms (ie, excellent outcome). Heartburn was the most common complaint in patients following myotomy. The majority of these patients had these symptoms prior to myotomy and state that it is much improved from their preoperative status. Few patients had heartburn on a daily basis, and fewer still required medical therapy for heartburn.

Heller myotomy has long been shown to be efficacious in improving dysphagia. When no form of intraoperative esophageal monitoring is used, the greatest concern is leaving the patient with an inadequate myotomy. Therefore, extensive dissection of the lower esophagus and aggressive myotomy well onto the cardia is generally undertaken. This destroys the natural gastroesophageal antireflux mechanisms making an antireflux procedure a necessary part of the operation. Which antireflux procedure is most efficacious (Toupet or Dor fundoplication) is another debate entirely and will not be addressed here. Selective use of fundoplication, on the other hand, has been utilized when some form of intraoperative assessment of adequacy of myotomy is used.

Intraoperative esophageal manometry was first described by Hill in 1978 and was beneficial in improving outcomes following Heller myotomy. Increases in abdominal pressure (such as during laparoscopy), however, can distort the information obtained from pressure transducers. In addition, it is difficult to extrapolate how changes in intraluminal esophageal pressures will equate to physiologic changes.

Intraoperative endoscopy during Heller myotomy has been reported previously. We feel that this technique offers several advantages over manometry. By insufflating air through the endoscope, the surgeon is able to visualize the distention of the lower esophagus and determine whether the extent of myotomy is adequate. In addition, by transilluminating the myotomized segment with the videoscope (ie, from the outside in) and with the endoscope (ie, from the inside out), residual bands of circular muscle fibers missed at myotomy can be addressed. Endoscopy plays a valuable role in localizing the gastroesophageal (GE) junction before, during, and after myotomy. Localizing the GE junction prior to myotomy makes it possible to limit the dissection at and around the esophageal hiatus, thus leaving some of the natural antireflux mechanisms intact. Localizing the GE junction during and after myotomy is always helpful, especially during a difficult case. Any blood in the operative field can quickly obscure visualization of the GE junction by the videoscope. Thus, the endoscope allows the surgeon to stay oriented throughout the operation and recognize the orientation of the myotomy relative to the GE junction and, more importantly, the cardia. Next, the endoscope assists in the intraoperative surveillance for esophageal perforations both directly, by visualization of light shining through the perforation, and indirectly, by the appearance of bubbles in the operative field during insufflation by the endoscope while the myotomized segment is under water. Finally, endoscopy allows immediate feedback from the gastroenterologist as to the ease of passage of the endoscope across the lower esophageal sphincter.

Before considering a videoscopic Heller myotomy technically successful, we require that 4 crucial criteria be met prior to the patient leaving the operating room. First, the lower esophageal sphincter mechanism must distend easily with gentle insufflation by the endoscope. Second, the myotomized segment must transilluminate brightly as seen by both the videoscope and the endoscope. Third, the endoscope must pass easily into the stomach. And last, evaluation for perforation must be performed directly, by viewing with the endoscope, and indirectly, by insufflating with the endoscope while the myotomized segment is under water watching for bubbles with the videoscope. Although it is tempting to rely upon the endoscopist to determine adequacy of myotomy, verification of the above criteria by the operating surgeon is essential.

We believe that intraoperative endoscopy is crucial in obtaining good outcomes following videoscopic Heller myotomy. Its use provides assurance of adequate myotomy while minimizing postoperative reflux symptoms without the routine application of fundoplication. Above and beyond the data presented here, the use of intraop-
operative endoscopy facilitates a good working relationship between gastroenterologist and surgeon, thus improving the overall quality of care provided to the patient.

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