

# The role of intraoperative endoscopic guidance during laparoscopic repair of esophageal achalasia

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## Purpose

The aim was to assess the advantage of using intraoperative endoscopic guidance during laparoscopic repair of esophageal achalasia.

## Materials and methods

This was a retrospective study conducted at Ain Shams Specialized Hospitals that included 84 patients. A total of 42 patients had Heller cardiomyotomy procedure with dor fundoplication and another 42 patients had the same procedure with intraoperative endoscopic guidance.

## Results

Preoperative symptoms included dysphagia in 80 (95%) patients, regurgitation and vomiting in 60 (71.5%) patients, heartburn in 56 (66%) patients, and postprandial chest pain in 40 (49%) patients. Weight loss occurred in 42 (50%) patients. Overall, 72 (85%) patients had tried 2–3 pneumatic dilation. Mean lower esophageal sphincter pressure preoperatively was 33 and was 13.3 mmHg postoperatively (4.1–28.4). The operative time was 45±20 min in the endoscopic group and was 40 ±10 in the nonendoscopic guidance. Overall, 5 patients of the nonendoscopic group had perforation and one case of bleeding. Postoperatively, dysphagia was seen in one (2.25%) patient of the endoscopic group and four (9.5%) patients of the nonendoscopic group. Postprandial heart pain was seen in two (4.6%) patients of the endoscopic group and four (9.2%) patients of the nonendoscopic group. Moreover, 2 (4.6%) patients of the endoscopic group and four (9.5%) patients of the nonendoscopic group had postoperative regurgitation. Weight regain was seen in 19 (90%) patients of the endoscopic group and 17 (80%) patients of the patients of nonendoscopic group after 12-month follow-up.

## Conclusion

Heller cardiomyotomy with endoscopic guidance is very important not only as a guide to ensure adequate myotomy but also to limit the extent of the myotomy, thereby minimizing the postoperative reflux symptoms.

## Keywords:

achalasia, cardiomyotomy, dysphagia, endoscopy, Heller, myotomy

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## Introduction

Esophageal achalasia is the most well-known motility disorder, with an annual incidence of 1 in 100 000 [1]. It is characterized by the absence of peristaltic waves in the esophageal body with failure of relaxation of the lower esophageal sphincter (LES) in response to swallowing. The primary cause of achalasia is unknown [2].

The main symptoms of esophageal achalasia are dysphagia to both solid foods and liquids, regurgitation of undigested food, and postprandial chest pain. The diagnosis is confirmed by barium study, which may show dilated esophagus and characteristic parrot's peak sign, esophageal manometry, and upper gastrointestinal tract endoscopy [3].

Esophageal manometry shows aperistalsis along the body of the esophagus and increased LES pressure [4].

Esophageal achalasia could be managed with nonoperative treatment and surgical treatment [5]

Nonsurgical treatment includes the use of calcium channel blocker and botulinum toxin injection; however, such modalities do not offer complete resolution of symptoms [4].

Pneumatic balloon dilation is usually effective. However, the surgical methods are used if it fails to relieve symptoms. A 3–5% risk of esophageal perforation is refused by a lot of patients and in young patients who need multiple sessions of dilation [6].

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Heller cardiomyotomy is a highly effective procedure for relieving the symptoms of achalasia mainly dysphagia [7]. However, there is a controversy regarding the extent of the myotomy mainly the gastric extension with consequence postoperative reflux symptoms [8].

The possible causes of failure of cardiomyotomy are the gastroesophageal reflux and inadequate myotomy [9].

Intraoperative endoscopy seems to be highly beneficial and crucial in obtaining good results during Heller cardiomyotomy [10].

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### Aim

The aim was to assess the advantage of using intraoperative endoscopic guidance during laparoscopic repair of esophageal achalasia.

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### Materials and methods

This was a retrospective study at Ain Shams Specialized Hospitals that included 84 patients. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

A total 42 patients had Heller cardiomyotomy procedure with Dor fundoplication and another 42 patients had the same procedure with intraoperative endoscopic guidance.

Informed consent was obtained; the operation and the different possible complications were explained to the patients.

Data were acquired from a retrospective review of the records of patients who underwent Heller cardiomyotomy with intraoperative endoscopic guidance for esophageal achalasia and those who had the procedure without endoscopic guidance between February 2016 and March 2019. Preoperative patient characteristics such as age, sex, BMI, and comorbid conditions; operative factors such as operating time; and intraoperative and postoperative events such as bleeding and perforation were recorded.

### Surgical technique

The operation was done under general anesthesia. All the procedures were operated by the same

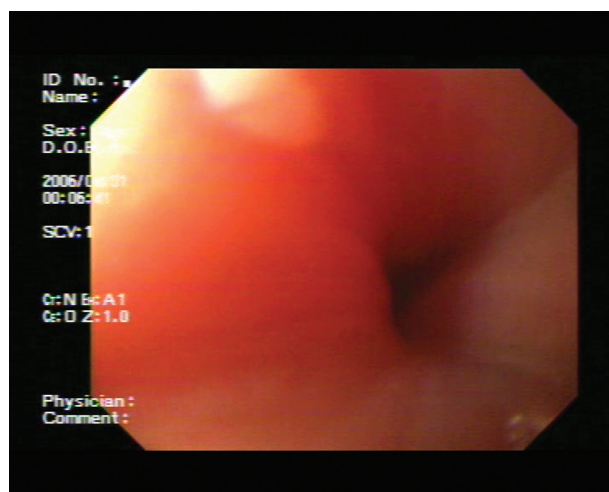
surgical and endoscopic team. The patient was in a supine position. We used the five ports technique. Abdominal insufflation was done. A 10-mm supraumbilical port was inserted at the junction of 2/3 and 1/3 of a line extending from the xiphisternum to the umbilicus.

Another three 5-mm ports were inserted under vision (1 on right subcostal at the midclavicular line and another two on the left subcostal at the midclavicular and the anterior axillary line). Finally, a 5-mm port was inserted just below the xiphisternum for liver retraction.

In cases with endoscopic guidance, the endoscopy was undertaken per os by an expert endoscopist. We had used a PENTAX endoscopy, USA. The outer diameter of the endoscopy is 10.1 mm. The endoscope was introduced under the vision and passed the gastroesophageal junction by gentle pressure assessing the stomach and the duodenum.

After complete aspiration of fluids and air of the stomach, the gastroesophageal junction was located endoscopically and was used as a guide to start the myotomy. Through endoscopic guidance, the lower esophagus and sphincter (LES) were easily distended with gentle air insufflation through the

Figure 1



Endoscopic view shows tight lower esophageal sphincter.

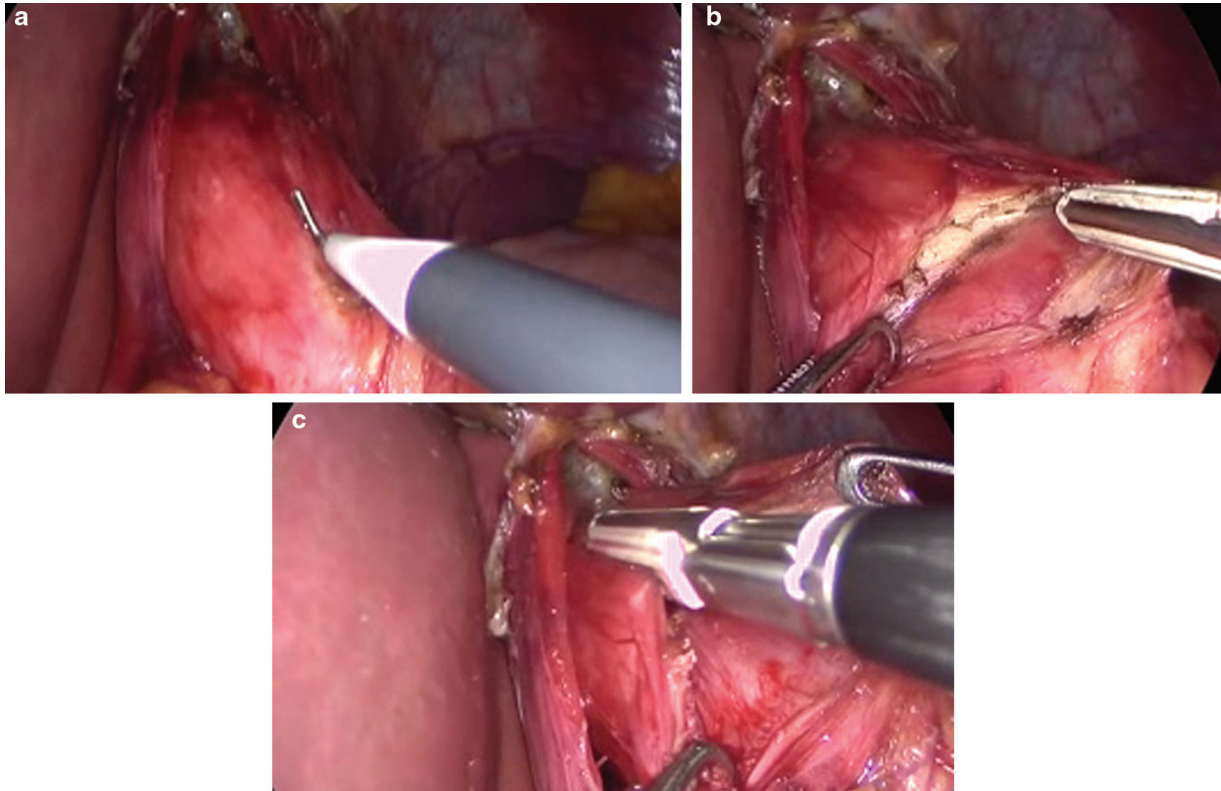
Figure 2



Dissection of the esophagus.

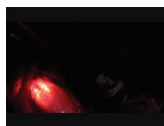
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Figure 3



(a,b,c) Myotomy of the lower esophageal sphincter using hook, ligasure, and blunt dissection.

Figure 4



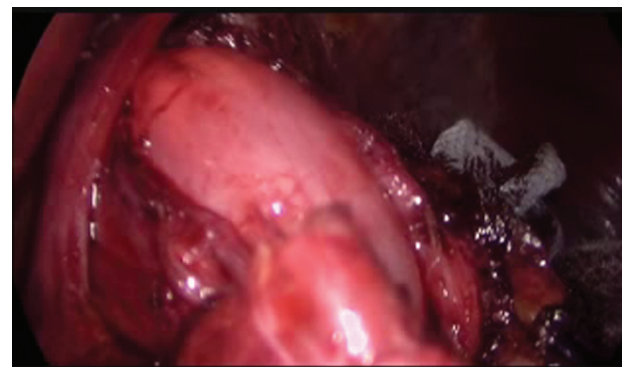
Endoscopic intraluminal transillumination along the myotomized segment.

endoscope. Dissection of the esophagus was done after freeing the phrenoesophageal membranes, and the esophagus was held using a tape (Figs 1 and 2).

The myotomy was done proximally to the esophageal part and distally along the gastric part. The myotomy was done firstly using a hook diathermy and bipolar ligasure device through muscle splitting followed by blunt dissection with bulging of the underlying mucosa (Figs 3–5). Each edge of the splitted muscle fibers was sutured to the corresponding crus of the diaphragm to ensure permanent bulging of the mucosa of the myotomized segment (Fig. 6).

Although myotomy was generously carried out to the esophageal part up to 5 cm, the distal extent was limited to the 2 cm through the cardia in the cases

Figure 5



Endoscopic assessment of the myotomized segment.

that we had not used the endoscopic guidance; however, in the cases where we had endoscopic guidance, we extended till that would allow easy opening of the LES by gentle insufflation and the passage of the scope easily to the stomach. Myotomy of the cardia beyond this was considered excessive and was avoided.

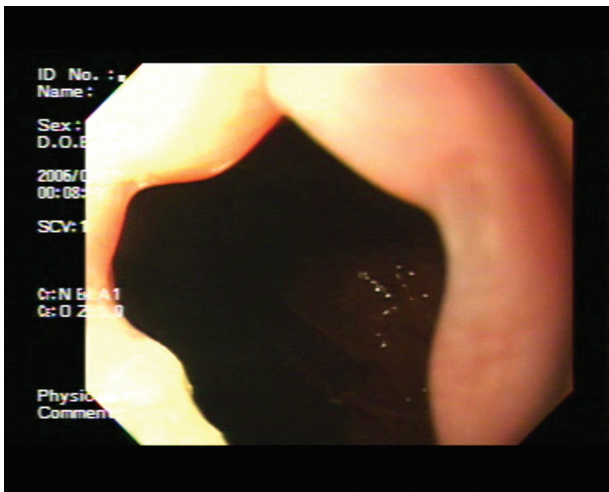
The scope was then withdrawn slightly and then advanced again to ensure the adequacy of myotomy with the intraluminal transillumination of the scope along the myotomized segment and with the

Figure 6



Suturing the splitted muscle to the crus of the diaphragm.

Figure 8



Postmyotomy endoscopic view with relaxed lower esophageal sphincter.

extraluminal transillumination of the laparoscopy seen through the endoscope (Fig. 6).

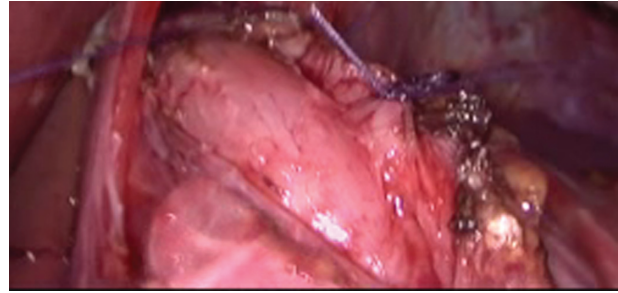
Air bubble test was done using the air insufflation of the scope and immersion of the gastroesophageal junction on saline, and if any perforation was detected, suturing the site of perforation was done with two stitches of vicryl 4-0 (Fig. 7–9).

In cases where we had no endoscopic guidance, the dissection was done over a Bougie size of 32 F. The air bubble test was used using a Bougie. Finally, dor fundoplication was done as an antireflux procedure after mobilization of the fundus of the stomach and ligation of the short gastric vessels.

#### Postoperative management and follow-up

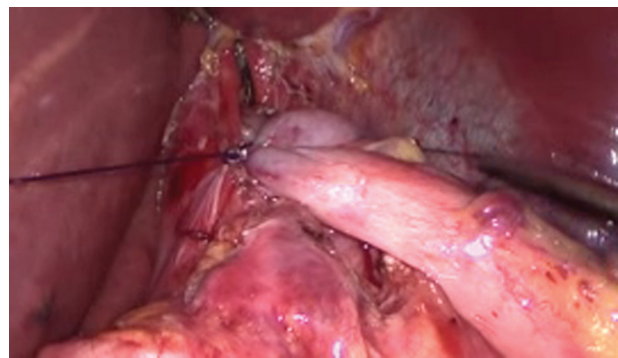
Gastrograffin swallow contrast study was done on the first postoperative day to assess the esophageal emptying and detect any perforations.

Figure 7



Air bubble leak test after immersion of the lower esophageal sphincter on saline.

Figure 9



Partial anterior wrap fundoplication.

The patients were discharged on a liquid diet for 4 days then shifted to soft diet over 1–2 weeks, and then solid diet gradually over 2 weeks.

Follow-up for 12 months was done. The follow-up schedule was twice per month for 2 month then monthly for 4 months then every 2 months for 6 months. Our follow-up was based on Eckardt Symptom Score (Table 1).

#### Statistical analysis

Median Dysphagia scores and Eckardt Symptom scores were compared for the two groups (Heller without endoscopic group and Heller with endoscopic group using Wilcoxon rank-sum tests). We calculated the proportion of patients who complained of dysphagia, reflux symptoms, heartburn, and dysphagia.

#### Results

The study involved 84 patients who underwent Heller cardiomyotomy with intraoperative endoscopic guidance for esophageal achalasia. Overall, 55% were female. The mean age was  $39.7 \pm 14$  years (range: 23–49 years) Table 2.

**Table 1 Eckardt Symptom Score greater than or equal to 4 is indicated as failure of symptom relief (treatment failure) and a score less than or equal to 3 was indicated as treatment success**

Score	Dysphagia	Regurgitation	Retrosternal pain	Weight loss (kg)
0	None	None	None	None
1	occasional	occasional	Occasional	10
2	Daily	Daily	Daily	5–10
3	Each meal	Each meal	Each meal	10

The scoring system is defined as 0=none, 1=occasionally, 2=daily, and 3=each meal for signs/symptoms and 0=none, 1=less than 5 Kg, 2=5–10 kg, and 3=more than 10 kg for recent weight loss (6 months).

The preoperative symptoms were mainly dysphagia to solids and fluids in 80 (95%) patients, regurgitation and vomiting of undigested food in 60 (71.5%) patients, heartburn in 56 (66%) patients, and postprandial chest pain in 40 (49%) patients. Weight loss occurred in 42 (50%) patients. A total of 72 (85%) patients had tried two to three pneumatic dilation, four (4.7%) patients had tried botulinum toxins, and 12 patients had refused any balloon pneumatic dilation to avoid any possibility of perforations. Esophageal manometry and pH metry were done before and 6 months after whenever the patient was symptomatic.

The mean LES pressure preoperatively was 33 mmHg, whereas the mean LES pressure was 13.3 mmHg postoperatively (4.1–28.4). The operative time was 45±20 min using the intraoperative endoscopy, and was 40±10 without endoscopic guidance. All cases were done laparoscopically by the same team. The mean hospital stay was 2 days.

Intraoperative esophageal perforation had occurred in seven patients. Five patients of Heller cardiomyotomy without endoscopic guidance and two cases of Heller cardiomyotomy with endoscopic guidance were sutured with two stitches of vicryl 4-0.

One patient of the nonendoscopic group had postoperative bleeding that necessitated laparoscopic exploration. Bleeding of one of the short gastric vessels was detected and secured with a bipolar ligasure device after the blood clots were aspirated (Table 3).

Significant improvement was seen in symptoms mainly dysphagia. Only one (2.25%) patient of the endoscopic group complained of dysphagia 3 months postoperatively.

Gastrograffin swallow study was done. It showed the free passage of the contrast along the gastroesophageal

**Table 2 Demographic data of the patients**

Male : female	29 : 23
Age (years)	39.7±14 (range: 23–49)
Previous pneumatic dilation [n (%)]	60 (71.5)
Previous injection botulinum toxins [n (%)]	4 (4.7)

**Table 3 Operative time and complications**

	Endoscopic group [n (%)]	Nonendoscopic group [n (%)]
Operative time	45±15 min	40±10
Perforation	2 cases (detected and repaired intraoperatively)	5 cases (detected and repaired intraoperatively)
Bleeding	1 (2.3)	None
Conversion to open	None	None
Reoperation	1 (bleeding) (2.3)	3 (persistent dysphagia) (7.1)

junction; however, upper gastrointestinal tract endoscopy showed grade 1 reflux esophagitis that was managed through medical management with marked relief of symptoms. Three patients of the nonendoscopic group had dysphagia within the first 3 months and another patient at 12 months. One of them refused any further management in our department, and the other three had remyotomy, as they refused the risk of perforation during pneumatic balloon dilation when it was suggested.

Postprandial heart pain was markedly improved; only two (4.6%) patients of the endoscopic group had complained of postprandial chest pain, whereas four (9.2%) patients of the nonendoscopic group had postprandial chest pain. Two (4.6%) patients of the endoscopic group and four (9.5%) patients of the nonendoscopic group had postoperative regurgitation. Three patients had heartburn. Weight regain was seen in 19 (90%) patients of the endoscopic group and 17 (80%) patients of the patients of nonendoscopic group after 12-month follow-up (Table 4).

## Discussion

Esophageal achalasia could be managed either by medications such as calcium channel blockers or endoscopic by botulinum toxin injection; however, such modalities of management had not showed satisfactory results. Pneumatic balloon dilation was highly recommended; however, the patients need multiple sessions of dilations to achieve a satisfactory result, and it carries a risk of esophageal perforation [11], which was not accepted by some patients.

**Table 4 Preoperative symptoms and the improvement post-operatively**

Preoperative symptoms	Number of patients preoperatively [n (%)]	Follow-up after 6 months Heller with endoscopy (n=42) [n (%)]	Follow-up after 12 months Heller with endoscopy (n=42) [n (%)]	Follow-up after 6 months Heller without endoscopy (n=42) [n (%)]	Follow-up after 12 months Heller without endoscopy (n=42) [n (%)]
Dysphagia	40 (95)	No cases	1 (2.25)	3 (7.1)	4 (9.5)
Regurgitation	30 (71.5)	1 (2.25)	2 (4.6)	3 (7.1)	3 (7.1)
Heart burn	28 (66)	1 (2.25)	2 (4.6)	3 (7.1)	4 (9.2)
Weight loss	21 (50)	1 (2.25)	2 (4.6)	3 (7.1)	4 (9.5)

According to the results of a study by Torres-Villalobos and Martin-Del-Campo [12], medical treatment of achalasia is associated with a high rate of recurrence and failure. Laparoscopic Heller cardiomyotomy is highly recommended to be the first option for the patients who had achalasia.

Laparoscopic Heller cardiomyotomy is highly recommended for esophageal achalasia; however, there is always a debate concerning the extent of the myotomy proximally and distally, the need for antireflux procedure, and whether such procedures had an antireflux effect or just used as a serosal patch to support the myotomized segment.

In USA, most of the surgeon do total 360 antireflux procedure with Heller cardiomyotomy; however, it causes long-term dysphagia [8].

In concerning the value of antireflux procedure with Heller myotomy for prevention of gastroesophageal reflux, there is a controversy regarding the effect of partial fundoplication for patients with normal motility and medically refractory gastro esophageal reflux disease (GERD) [13].

Our study included 84 patients, where 42 patients had Heller cardiomyotomy procedure with Dor fundoplication and another 42 patients had the same procedure with intraoperative endoscopic guidance. Overall, 55% were female. The mean age was 39.7 ±14 years (range: 23–49 years).

The preoperative symptoms were mainly dysphagia to solids and fluids in 80 (95%) patients, regurgitation and vomiting of undigested food in 60 (71.5%) patients, heartburn in 56 (66%) patients, and weight loss in 42 (50%) patients. A total of 72 (85%) patients had tried two to three pneumatic dilation, four (4.7%) patients had tried botulinum toxins, and 12 patients had refused any balloon pneumatic dilation to avoid any possibility of perforations. Esophageal manometry and pH metry were done before and 6 months after whenever the patient was symptomatic.

Our results in the nonendoscopic group showed marked improvement of dysphagia and regurgitation in up to 90 and 93%, respectively. The results are consistent with Hunter *et al.* [14], who evaluated the results of myotomy with fundoplication in 40 patients. Dysphagia and regurgitation improved in 36 (90%) and 38 (95%) patients.

Our result showed marked symptomatic improvement than Mirsharifi *et al.* [15], who showed the symptoms improved in 74.2% of the patients with myotomy and fundoplication and remained unchanged in 25.8% of the patients.

Ellis had concluded that the persistent symptoms after myotomy is incomplete division of muscle fibers or healing by fibrosis at the site of the myotomy [9].

Our results on the endoscopic group showed marked improvement of dysphagia, up to 98%, and regurgitation, up to 96%.

The reflux symptoms in our nonendoscopic group was 9.5% after 12 months of follow-up, which is highly comparable to the study of Falkenbach and colleagues who showed 14.5% of abnormal reflux symptoms.

The abnormal reflux symptoms in our endoscopic group was only 4.5% and the results emphasize the advent of the usage of intraoperative endoscopy.

Kiudelis *et al.* [16] searching for the best anti-reflux procedure with Heller cardiomyotomy had showed upto 35% of reflux symptoms for the patients who had Heller cardiomyotomy with Dor fundoplication as compared with 11% for those who had Toupet fundoplication.

The abnormal reflux symptoms in our endoscopic group were seen in only 4.5% and the results emphasize the advent of the usage of intraoperative endoscopy.

In our study, we used intraoperative endoscopy to assess the extent of the myotomy along the gastric part so the extent was limited to achieve satisfactory

results without affecting the antireflux function and so no need for total fundoplication and if partial fundoplication was done as antireflux procedure, it is supported with the endoscopic guided limited myotomy of the gastroesophageal junction by doing unnecessary more myotomy.

We use the light of the scope to show intraluminal transillumination of the myotomized segment which ensures complete myotomy. Air insufflation of the scope was also used for the leak test after immersion of the myotomized segment on saline.

Our results had showed better results of achalasia cardiomyotomy with intraoperative endoscopy. The same was confirmed by Bloomston *et al.* [10], who concluded that intraoperative endoscopy is crucial for such procedure and highly beneficial.

## Conclusion

Heller cardiomyotomy with endoscopic guidance is very important not only as a guide to ensure adequate myotomy but also to limit the extent of the myotomy, thereby minimizing the postoperative reflux symptoms.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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