

Peroral endoscopic myotomy for esophageal achalasia: Indication and technique[☆]

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ABSTRACT

Since the inception of peroral endoscopic myotomy (POEM) in 2008, more than 2000 POEMs have been performed to date in the world. The technique has been standardized to include the following 5 steps: mucosectomy, submucosal tunnel creation, esophageal myotomy, cardiomyotomy, and mucosectomy closure. Minor technique variations do exist as far as the equipment utilized as well as with the orientation and completeness of the myotomy. This article describes the equipment used during POEM as well as the essential steps to have a safe and successful procedure.

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1. Introduction

The concept of natural orifice transluminal endoscopic surgery [1–3] has inspired gastroenterologists and endoscopic surgeons to create a less invasive method for treating various gastrointestinal diseases, including achalasia. The conventional treatments for achalasia include balloon dilation and laparoscopic myotomy, with Botox injection reserved for those not considered candidates for the aforementioned therapies [4–6]. Peroral endoscopic myotomy (POEM) is a less invasive endoscopic approach to Heller myotomy, and the short-term data demonstrate that it offers excellent outcomes that appear to rival those of the laparoscopic Heller myotomy [7]. The technique and equipment used during POEM are discussed in detail in this section.

2. Equipment used

A forward-viewing gastroscope with an outer diameter of 9.8 mm, with a transparent distal attachment cap (MH-588, Olympus) is used to perform POEM. The distal attachment cap allows for better endoscopic visualization of the submucosal space [8]. This obliquely tipped cap can allow easier insertion of the endoscope into the submucosal tunnel, whereas using a tapered cap (DH-28GR, Fuji) which can be used when entering the submucosal space is particularly difficult.

At our center, all equipment including the gastroscope is sterilized using ethylene oxide gas. Most centers, however, perform high-level disinfection as is standard for endoscopic procedures.

The tunnel is typically created by progressive dissection using esophageal submucosal dissection technique. A high-frequency electrosurgical generator such as the VIO 300D (ERBE, Tübingen, Germany) is used in the spray coagulation mode. Electrosurgical dissection is accomplished using the triangle-tip knife (KD-640L, Olympus) (Figure 1A) or the Hybrid knife T-type (ERBE, Tübingen, Germany) (Figure 1B). The hybrid knife can inject a stream of saline through the tip of the knife, whereas with the triangle-tip knife a separate needle injector is used for submucosal injection.

During dissection when large vessels are noted, coagulating forceps (Coagrasper, FD-411QR, Olympus) are used to coagulate and achieve hemostasis.

Carbon dioxide gas is used for insufflation during the procedure, with a CO₂ insufflator (UCR, Olympus) providing CO₂ at a constant rate of 1.2 liters per minute. Endoscopic CO₂ insufflation is beneficial for reducing mediastinal emphysema and air embolization. One should confirm that the air button on the endoscopy processor is off. Otherwise, air would also be supplied in addition to CO₂ insufflation.

Finally, for the closure of the mucosal entry site and any accidental injuries to the mucosal flap, hemostatic clips (EZ-CLIP, HX-110QR, Olympus) are applied. Some operators may use alternative clips and endoscopic suturing devices to achieve closure of the mucosal entry to the tunnel, particularly if a large mucosectomy defect and unfavorable mucosal edges are present or if full-thickness injury involving the muscularis is present.

3. Procedure

Patients undergoing POEM are intubated and under general anesthesia. Severe mediastinal emphysema and pneumothorax may occur if POEM is done with only conscious sedation. Positive pressure ventilation reduces the risk of mediastinal emphysema.

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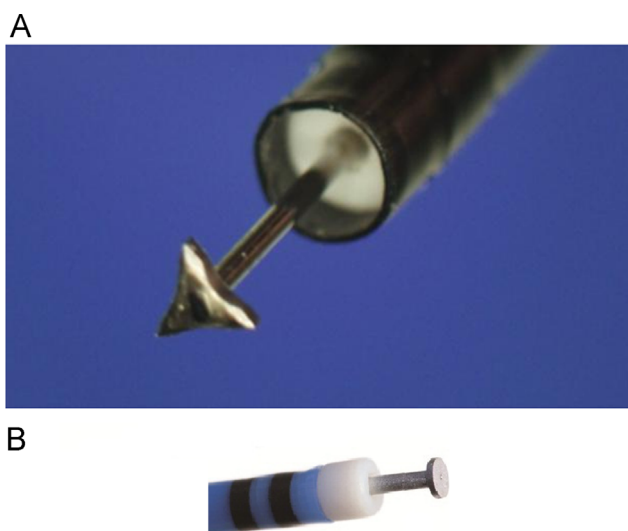


Fig. 1. (A) Triangular-tip (TT knife) knife and (B) Hybrid knife T-type.

During POEM, pneumoperitoneum may occur in some cases. To prevent abdominal compartment syndrome, the upper abdominal wall is exposed and checked periodically during the procedure. When the abdomen is excessively distended, a puncture is made using an angiocatheter or Veress needle, to vent the pneumoperitoneum and reduce abdominal pressure. All POEM operators have reported using similar methods to decompress capnoperitoneum [8–16].

3.1. Creation of the submucosal tunnel

Before starting POEM, the position of the gastroesophageal junction (GEJ) and its tightness on retroflexion are confirmed (Figure 3A). A submucosal injection consisting of saline stained with 0.3% indigo carmine is used to create a mucosal bleb before performing a mucosal incision (Figure 2A). The mucosal incision is usually made along the right anterior wall. Incision along the 2-o'clock orientation leads to the lesser curve of the stomach, which enables smooth continuous dissection into the gastric

cardia muscle. Dissection along the 2-o'clock orientation also potentially avoids injury to the sling muscle fibers, which are a major component of the angle of His and may limit acid reflux.

Submucosal injection is generally done first at the level of the mid esophagus, approximately 13 cm proximal to the GEJ. This location is just below the carina and approximately 29 cm from patient's incisors creating a submucosal tunnel length of approximately 16 cm. A 2-cm longitudinal mucosal incision is made on the mucosal surface to create a mucosal entry to the submucosal space (energy source at Endocut Q, 30 W, cutting duration 1: interval: 6).

The submucosal tunnel is extended distally using a technique similar to esophageal submucosal dissection, passing over the esophagogastric junction and entering the proximal stomach for approximately 3 cm. The width of the tunnel is approximately one-third of the circumference of the tubular esophagus. The dissecting plane should closely follow the muscle layer (Figures 3B and 2B). Caution is taken never to dissect close to the mucosal layer, because the mucosal layer is the only barrier between the esophageal lumen and mediastinum after completion of the myotomy. Repeated submucosal injection makes the dissection easier whenever the demarcation between submucosal layer and muscle layer becomes obscure. The submucosal tunnel is extended beyond the GEJ.

An important concern during POEM is appropriate identification of the GEJ in the submucosal space. For clear identification of the GEJ, the following indicators should be checked:

1. The first indicator is the insertion length of the endoscope from the incisors. The position of the GEJ in the lumen of the esophagus is recorded accurately before the endoscope is inserted into the submucosal tunnel, as the insertion depth of the endoscope in the submucosal space is almost the same as in the true lumen. The submucosal tunnel which is created ends at least 3 cm distal to the estimated GEJ.
2. The second indicator is a marked increase in resistance when the endoscope approaches the GEJ, followed by a prompt easing when the endoscope passes through the narrow GEJ and enters the submucosal space of the gastric cardia. The working space in the submucosal tunnel also becomes gradually narrower when the endoscope approaches the lower esophageal sphincter (LES). At the LES, movement of the endoscope is limited owing to the high resistance. Once the endoscope has passed

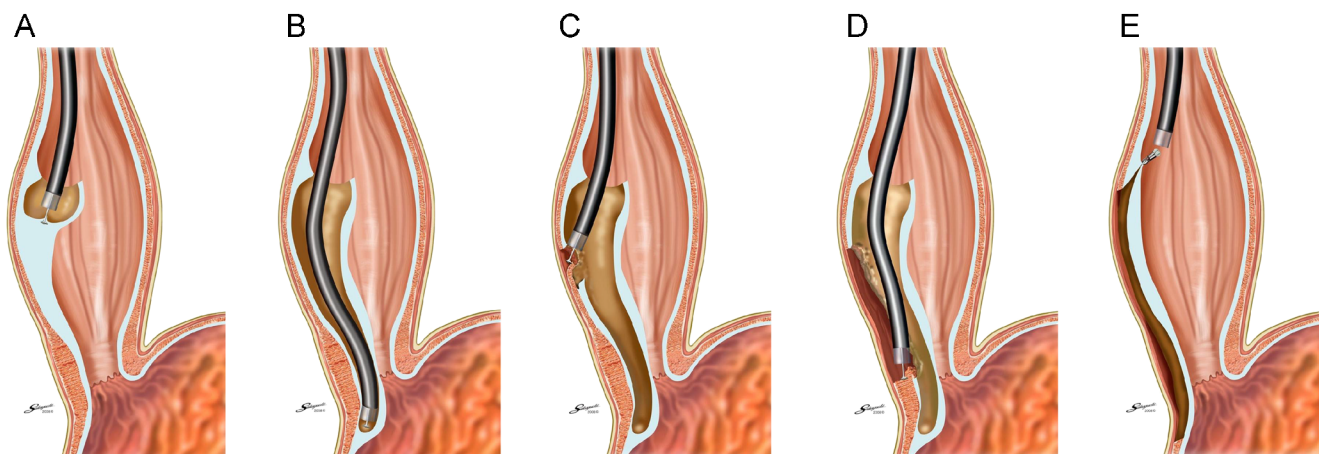


Fig. 2. (A) Mucosal entry. The mucosal entry to the submucosal space is usually made at approximately 13 cm proximal to esophagogastric junction (EGJ). (B) Submucosal tunnel. The Submucosal tunnel is created in the submucosal space and extended to the level of the gastric cardia. It is approximately 15-cm long (12 cm on the esophageal side and 3 cm on the stomach side). This long tunnel is the working space for the myotomy. (C) Endoscopic myotomy. The endoscopic myotomy is carried out with the endoscope in the submucosal tunnel. It is initiated 2 cm distal to mucosal incision. A circular muscle myotomy is shown here. (D) Completed myotomy. The endoscopic myotomy is extended beyond the EGJ to include a 2-cm cardiomyotomy. Complete dissection of the lower esophageal sphincter and cardiomyotomy are very important parts of this procedure. (E) Closure of the mucosal entry site. The mucosal entry site is closed with endoscopic clips.

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