

## A Brief Insight about Peroral Endoscopic Myotomy (POEM)

Ahmed Atia Mohammed Kamel, Hoda Abd-elaziz Abd-elhady, Ayman Magd-Eldin  
Mohammad Sadek, Kareem Esaam Eldin Hadad

Department of Internal Medicine and Gastroenterology, Faculty of Medicine, Zagazig University,  
Egypt

**Corresponding author:** Ahmed Atia Mohammed Kamel

**E-mail:** ahmedatia1991.aak@gmail.com, akamel@medicine.zu.edu.eg

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### Abstract

POEM is an innovative technique that has gained popularity as it is an effective and safe treatment modality in achalasia. During upper endoscopy under sedation, a mucosal incision is created in the middle to distal oesophagus, and the endoscope is advanced within the oesophageal submucosal layer using blunt dissection. Symptomatic patients with manometrically proven primary idiopathic achalasia are candidates for POEM. This is the acceptable alternative treatment for type I and II achalasia and the preferred treatment for type III achalasia. Relative contraindications to POEM procedure are severe erosive esophagitis, liver cirrhosis with portal hypertension and varices, significant coagulation disorders, or prior therapy (radiation, endoscopic mucosal resection or radiofrequency ablation). Previous intervention such as pneumatic balloon dilation, pharmacologic injection or surgical myotomy are not considered contraindications to POEM. POEM has an outstanding safety profile. The adverse events occurred only on 3.2% of procedures performed, with no mortality. The most common adverse outcomes were mucosal injury, pneumothorax, and barotraumas.

**Keywords:** Achalasia, pneumothorax, barotraumas, oesophageal, procedures

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### Introduction:

Achalasia is not a common disorder in medicine. Most clinicians will not encounter a patient with this esophageal smooth muscle motility disorder, which occurs because the lower esophageal sphincter fails to relax. The esophagus also has a marked absence of peristalsis. In less than 50% of patients, the lower esophageal sphincter is hypertensive. This condition causes a functional obstruction at the gastroesophageal junction. (*Inoue H. et al., 2010*).

Achalasia is thought to occur from the degeneration of the myenteric plexus and vagus nerve fibers of the lower esophageal sphincter. There is a loss of inhibitory neurons containing vasoactive intestinal peptide (VIP) and nitric oxide synthase at the esophageal myenteric plexus, but in severe cases, it also involves cholinergic neurons. The exact etiology of this degeneration is unclear though many theories have been proposed. These theories include an autoimmune phenomenon, viral

Ahmed Atia Mohammed Kamel et. al.

## A Brief Insight about Peroral Endoscopic Myotomy (POEM)

infection, and genetic predisposition. Most cases seen in the United States are primary idiopathic achalasia; however, secondary achalasia may be seen in Chagas disease caused by *Trypanosoma cruzi*, esophageal infiltration by gastric carcinoma, eosinophilic gastroenteritis, lymphoma, certain viral infections, and neurodegenerative disorders (*Inoue H. et al., 2010*).

### Peroral Endoscopic Myotomy (POEM)

POEM is an innovative technique that has gained popularity as it is an effective and safe treatment modality in achalasia. During upper endoscopy under sedation, a mucosal incision is created in the middle to distal oesophagus, and the endoscope is advanced within the oesophageal submucosal layer using blunt dissection (*Inoue H. et al., 2010*).

A tailored myotomy of the oesophageal and LES circular muscle is performed using a cautery device, and the mucosal incision is subsequently closed using endoscopic clips (*Modayil R. et al., 2021*). The length of myotomy can be tailored to the individual's unique motor pattern and can be extended from the upper oesophagus to the proximal stomach, which is particularly relevant with pan-oesophageal spastic contractions in achalasia type 3 where a long myotomy is preferred, in contrast to achalasia types 1 and 2 where a short myotomy can suffice (*Nabi Z. et al., 2021*).

### Indications

Symptomatic patients with manometrically proven primary idiopathic achalasia are candidates for POEM. This is the acceptable alternative treatment for type I and II achalasia and the preferred treatment for type III achalasia (*Kane E. et al., 2019*).

Although POEM was developed for achalasia, it is increasingly being used to treat other spastic foregut disorders, such as diffuse esophageal spasm (DES) or Jackhammer esophagus (*Kandulski A. et al., 2016*).

### Contraindications

Relative contraindications to POEM procedure are severe erosive esophagitis, liver cirrhosis with portal hypertension and varices, significant coagulation disorders, or prior therapy (radiation, endoscopic mucosal resection or radiofrequency ablation). Previous intervention such as pneumatic balloon dilation, pharmacologic injection or surgical myotomy are not considered contraindications to POEM (*Tyberg A. et al., 2018*).



**Figure 1** Tight GEJ in a patient with achalasia. GEJ, gastroesophageal junction.

### Preoperative preparation

All patients are placed on a liquid diet for one to two days prior to a POEM procedure to ensure a clear endoscopic view and avoid aspiration during induction of anesthesia (*Khashab M. et al., 2014*)<sup>1</sup>.

Anticoagulant or antiplatelet medications, with the exception of acetylsalicylic acid prescribed for cardiovascular diseases, should be stopped prior to the procedure. Broad-spectrum intravenous antibiotics, such as a second-generation cephalosporin, are administered prior to the procedure (*Stavropoulos S. et al., 2014*). An increased incidence of oesophageal candidiasis is associated with POEM and so some centres administer an empiric antifungal agent for 3–5 days prior to the procedure (*Bechara R. et al., 2015*).

### Operative technique

A high-definition therapeutic gastroscope with both a large suction channel and a dedicated water jet channel for removing food residue in the esophageal lumen is preferred to use. A transparent cap is secured onto the tip of the gastroscope with tape to prevent accidental dislodgement within the submucosal tunnel. Carbon dioxide (CO<sub>2</sub>), which is more readily absorbed than air, should be used for insufflation to reduce the risk of mediastinal emphysema, tension pneumoperitoneum, or pneumothorax (*Inoue H. et al., 2011*).

POEM can be performed in the operating room or the endoscopy suite. The patient is placed supine with the abdomen exposed. A thorough cleansing of the esophageal lumen is performed with water or an antibiotic solution prior to any mucosal incision. Any adherent residue present on the esophageal mucosa can be removed using the cap or suction (*Khashab M. et al., 2014*)<sup>1</sup>.

The procedure can be split into four consecutive steps: the mucosal incision, formation of the submucosal tunnel, myotomy and closure of the mucosal incision (*Khashab M. et al., 2014*)<sup>2</sup>.

**Step 1: Mucosal incision:** The level of the esophagogastric junction (EGJ) is identified and subsequently determines the level submucosal tunneling. In most centers, an anterior (2 o'clock position) is used for the submucosal tunnel and myotomy. However, in some centers a posterior orientation (5 o'clock position) is favored. An anterior myotomy may decrease the damage to the angle of His, a barrier to post-operative GERD. If there is doubt as to the identification of the anterior and posterior walls, water can be injected into the esophageal lumen and will pool on the posterior aspect when the patient is positioned supine (*Tan Y. et al., 2018*).

A submucosal cushion is then made 3 cm proximal to the proposed commencement of myotomy using 0.01% epinephrine, 0.25% indigo carmine and 0.9% saline solution. A 1.5 cm vertical mucosal incision is made using a hybrid Knife (HK) or triangular tip (TT) knife (using a dry cut mode). The gastroscope is then inserted into the submucosal space after dissection of the submucosal fibers at the level of the mucosal incision. The length of the submucosal tunnel (and hence myotomy) must be determined prior to commencement of the mucosal incision. In patients with achalasia subtype I and II, a 6-10 cm esophageal myotomy is performed (*Kumbhari V & Khashab M., 2015*).

**Step 2: Creation of submucosal tunnel:** After an adequate mucosal flap is created, submucosal entry is achieved and the submucosal tunnel is carefully extended 2–3 cm into the gastric cardia. During creation of the tunnel, the operator must be diligent in maintaining the perpendicular orientation of the circular muscle fibers to avoid spiralling of the tunnel, which can result in an unintended location of the GEJ myotomy. Generally, major bleeding on the oesophageal side of the tunnel is infrequent as large submucosal vessels in the oesophagus are uncommon. However, with chronic stasis or recurrent candida oesophagitis, neovascularization can occur, resulting in increased vessel density and frequency of bleeding. Haemostasis of minor bleeding or prophylactic coagulation of small vessels can be achieved with the needle knife (*Bechara R. et al., 2015*).

Using TT knife or HK, the submucosa is dissected with a no-touch technique using spray coagulation mode. The dissection plane is located nearly on the surface of the muscularis propria. Recurrent jet injection of indigo carmine mixed with saline is done to increase the delineation between the submucosal fibers and muscularis propria whenever the planes become ambiguous. Care must be taken to avoid injury to the mucosal layer during creation of the submucosal tunnel as the mucosal layer is the only barrier between the esophageal lumen and mediastinum after myotomy (*Minami H. et al., 2015*).

**Step 3: Myotomy:** Selective myotomy of the inner circular muscle bundles is performed starting 2 cm distal to the mucosal incision. Circular muscle bundles are individually lifted toward the submucosal tunnel by the sharp tip of the knife and divided with spray coagulation current at 50 watts on effect 2 (ERBE). Selective myotomy of the inner circular muscle proximal to the LES with preservation of the outer longitudinal esophageal muscular layer is often performed during POEM to avoid entering the pleural space. When performed by less experienced operators, such technique adds a "safety net" to the procedure (*Li, Q. et al, 2013*).

In terms of length of myotomy, it is essential to achieve a 2 to 3 cm myotomy into the gastric cardia. It is customary to perform a 6 cm myotomy on the esophageal side in patients with achalasia type I and II. In a trial of treatment-naïve patients with type II achalasia, a "short" myotomy performed equally as a standard (10 cm) myotomy while reducing procedural time and the risk of abnormal esophageal acid exposure at one-year follow-up (*Gu L. et al., 2021*).

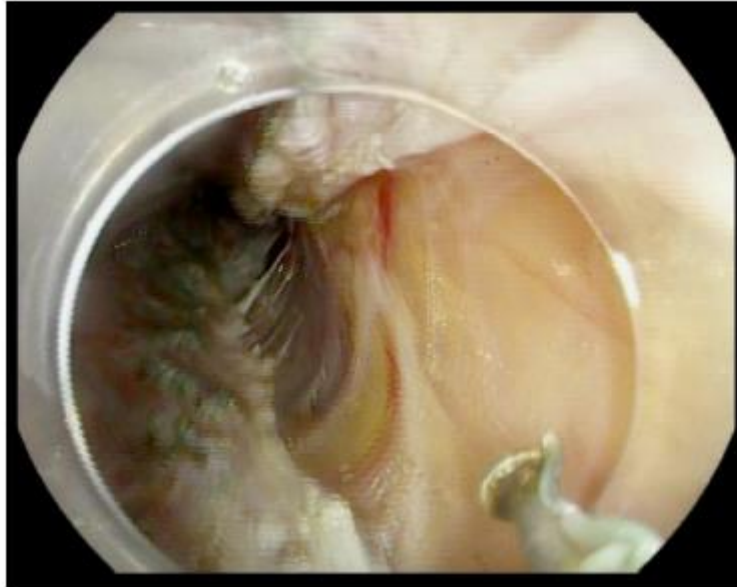


Figure 2: Full thickness myotomy

**Step 4: Closure of the mucosal incision:** Prior to closure of the mucosal incision, a careful inspection of the submucosal tunnel is performed and any oozing is controlled. Then the esophageal mucosa is interrogated and any laceration or mucosotomy is addressed. Lower esophageal sphincter relaxation is evaluated by retroflexed visualization of the gastric cardia. Repeat EndoFLIP measurements can now be performed to determine post myotomy distensibility (*Kumbhari, V. et al., 2014*).

The mucosal entry can be closed with endoscopic clips (*Baldaque-Silva, F. et al., 2014*) or the use of a flexible endoscopic suturing device (*Sharata A. et al., 2015*). When endoscopic clips are used, the initial clip is deployed at the most distal part of the mucosal incision to facilitate approximation of the incisional borders. Placement of subsequent clips is performed in a proximal direction until complete closure. Salvage closure techniques have been reported when standard methods fail. These include over-the scope clip and a covered esophageal stent (*Kumbhari V. et al, 2014*).



**Figure 3:** Clip closure of the entry site.

#### **Postoperative care**

Patients are admitted to the hospital for overnight observation and kept nil per os (NPO) and given antibiotics and antiemetics prophylactically. A water-soluble contrast esophagram on the day after the procedure should be done to exclude an esophageal leak, after which a soft diet is allowed. Patients are advised to remain on a soft diet for 10 to 14 days before starting a regular diet. Patients are routinely prescribed antibiotics for approximately three days and daily proton pump inhibitors (PPIs). The decision on continuing or stopping PPIs during follow-up should depend on reflux symptoms, findings during repeat endoscopy (if performed), and/or results of pH studies (*Barret, M. et al., 2020*).

#### **Complications**

POEM has an outstanding safety profile. The adverse events occurred only on 3.2% of procedures performed, with no mortality. The most common adverse outcomes were mucosal injury, pneumothorax, and barotraumas (*Inoue, H. et al., 2015*). *Jayan N. et al.* reported that pneumomediastinum, subcutaneous emphysema, pleural effusion, and pneumonia had occurred as complications of POEM (*Jayan N. et al., 2016*). Barotrauma complications may relate to an initial longitudinal mucosal incision, longer procedural time, full thickness myotomy, and subjects with sigmoid achalasia (*Wang, X. et al, 2015*).

Bleeding during submucosal tunneling is not uncommon. The risk of bleeding can be minimized with a careful stepwise dissection to allow for visualization of individual blood vessels. Small vessels can be prophylactically coagulated with the electrocautery; while hemostatic forceps should be used to coagulate larger vessels in the gastric cardia (*Haito-Chavez Y. et al., 2017*).

GERD is most common late adverse event associated with POEM. Based on objective data (endoscopic-proven erosive esophagitis and/or abnormal pH study), the prevalence of GERD after POEM varies between 20 and 57 percent, depending on studies (*Stavropoulos, S. et al., 2014*).

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Ahmed Atia Mohammed Kamel et. al.

A Brief Insight about Peroral Endoscopic Myotomy (POEM)

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