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Original Article

Clinical Success and Safety of Per-oral Endoscopic Myotomy (POEM) for Achalasia: A Real-World Retrospective Single-Center Case Series

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ABSTRACT

Background: Achalasia is a rare esophageal motility disorder that significantly impairs quality of life. Per oral endoscopic myotomy (POEM) has emerged as an effective minimally invasive treatment; however, data from Thai institutions remain limited.

Objective: This study aimed to evaluate the technical success, clinical outcomes, and perioperative safety of POEM at one year follow up in a single tertiary care hospital.

Materials and Methods: A retrospective observational study was conducted including all patients diagnosed with achalasia who underwent POEM between August 2018 and March 2025. Demographic data, procedural details, complications, Eckardt score, timed barium esophagography (TBE), and body mass index (BMI) were analyzed. Clinical success was defined as an Eckardt score ≤ 3.

Results: Fourteen patients were included. Technical success was achieved in 92.8% (13/14), with one conversion to endoscopic dilatation due to intraoperative bleeding. The median operative time was 162.5 minutes. Overall morbidity was 28.5%, including one esophageal perforation, one bleeding event, and two cases of aspiration pneumonia. Median length of hospital stay was four days. At one year follow up, clinical success was achieved in all patients, with significant improvement in Eckardt score, TBE parameters, and BMI.

Conclusion: POEM is a safe and effective treatment for achalasia and can be successfully implemented in a low volume or early experience center. Larger studies with long term follow up and objective reflux assessment are recommended.

Keywords: Per-oral endoscopic myotomy (POEM), Achalasia, Eckardt score

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Introduction

Achalasia is a rare primary esophageal motility disorder characterized by impaired relaxation of the lower esophageal sphincter and absence of normal esophageal peristalsis. Patients typically present with progressive dysphagia, regurgitation, and weight loss.[1-3] High resolution esophageal manometry (HREM) is the gold standard investigation for achalasia and enables classification into three subtypes according to the Chicago Classification.[4] HREM categorizes achalasia into type I (classic achalasia with absent peristalsis), type II (absent peristalsis with panesophageal pressurization), and type III (spastic achalasia with premature distal contractions). This subclassification has prognostic value and guides treatment selection and expected response. Even though HREM remains the diagnostic gold-standard, access to this investigation is limited in many regions of Thailand.[4-6]

Laparoscopic Heller myotomy has traditionally been the standard surgical treatment for achalasia.[7] Since its introduction by Inoue in 2008,[7-10] per oral endoscopic myotomy (POEM) has gained widespread acceptance as a minimally invasive alternative.

POEM utilizes a submucosal tunnel to perform a selective myotomy without external incisions of the abdomen.[8] Extensive data validate POEM's efficacy as comparable to LHM and superior to pneumatic dilation.[10-13] POEM is highly effective across all subtypes, particularly advantages in Achalasia Type III, and recent meta-analyses demonstrate its safety in specific populations, including the elderly and pediatric patients.[14,15] Long-term follow-up data now confirm that POEM provides durable symptom relief exceeding 90%.[16] However, POEM is associated with a higher incidence of iatrogenic gastroesophageal reflux disease (GERD) compared to LHM with fundoplication.[17] Recent literature highlights the importance of post-POEM reflux management, which is typically responsive to proton pump inhibitors (PPIs).[18-20] Despite this, the procedure's minimally invasive nature and rapid recovery profile have solidified its status as a preferred treatment.[20]

Given the rising global adoption of POEM, continuous evaluation of real-world outcomes is essential.[21-22] Due to limited availability of esophageal manometry in many hospitals in Thailand, especially in the Northern region, and the favorable outcome of POEM in all achalasia subtypes, the justification for applying POEM in these patients without prior classification is perhaps valid. Our center, Nakornping Hospital, initiated the POEM procedure in August 2018, becoming one of the early adopters of this innovative technique in the Northern region of Thailand. This retrospective observational study aims to present and critically analyze the outcomes of our seven-year experience with POEM in a single tertiary



care institution. We focus on technical success rates, clinical success rates, perioperative adverse events, and long-term complications. Through this study, we seek to contribute to the growing body of evidence supporting POEM as a first-line treatment for achalasia, while highlighting lessons learned and areas for ongoing improvement in technique and patient care.[23]

Materials and Methods

This retrospective single center observational study included all consecutive patients who underwent POEM for achalasia between August 2018 and March 2025. The study was approved by the Institutional Review Board (IRB code: 07768). The first two cases were performed under direct proctorship by an experienced POEM endoscopist from Siriraj Hospital to ensure procedural safety during the early phase of implementation. Subsequent procedures were performed by a single advanced endoscopist, certified in minimally invasive surgery.

The primary objective is to evaluate the technical and clinical success of POEM at 1-year follow-up study. The secondary objective is to assess the perioperative morbidity and complications. Also, to evaluate postoperative nutritional recovery as reflected by change in the body mass index (BMI). The technical success is defined as successful POEM operation. The clinical success was defined as a postoperative Eckardt score less than 3. Sigmoid type achalasia was defined as marked esophageal dilatation with a tortuous S shaped configuration and maximal diameter greater than 8 cm.

Statistical analysis was performed using Stata software (StataCorp LLC, College Station, TX, USA). Continuous variables are presented as median and range. Preoperative and postoperative outcomes, including Eckardt score, timed barium esophagography parameters, and body mass index (BMI), were compared using the paired t test, as measurements were obtained from the same patients before and after the intervention. A p-value < 0.05 was considered statistically significant.

Techniques of POEM

All POEM procedures were performed under general anesthesia with endotracheal intubation, in a supine position, left arm tucked, and the patient's abdomen exposed to observe signs of pneumoperitoneum. The patient position and endoscopic suite set up according to Figure 1. Prophylactic intravenous antibiotics were administered 30 minutes prior to the procedure. Copious irrigation was performed to remove remaining esophageal content.

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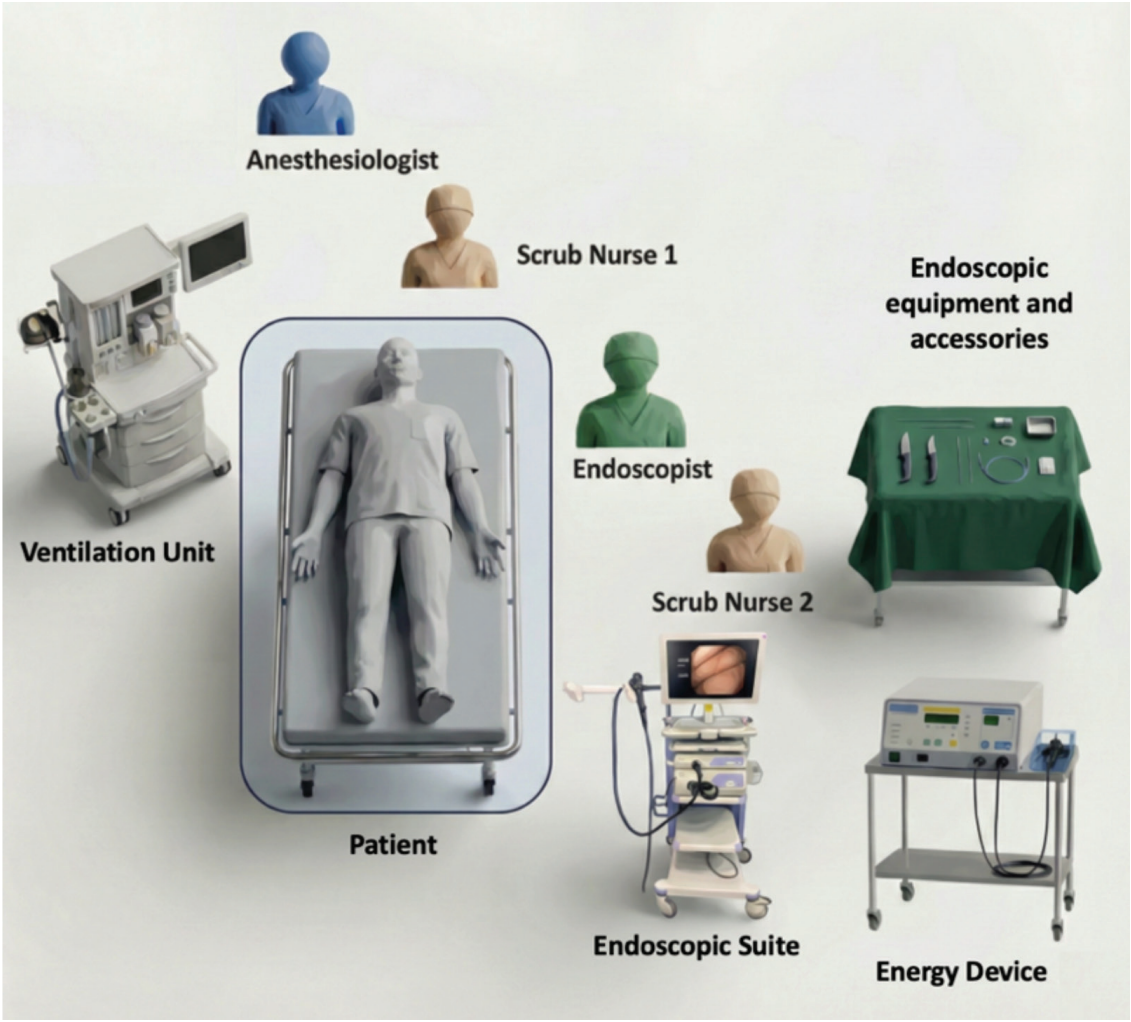


Figure 1 Operating Room Set Up

A high-definition gastroscope (GIF-HQ170, Olympus) with low flow carbon dioxide insufflation was used. A transparent distal cap (11.6–13.9 mm) was fitted to facilitate dissection and visualization. Electrosurgical dissection was performed using a 4.5 mm TriangularTipKnife (TT) knife (Olympus, Japan) or a 2.0 mm Dualknife (Olympus, Japan) connected to a high-frequency generator ERBE VIO 3 electrosurgical unit (ERBE, Germany). The setting used during incision/myotomy, submucosal dissection, hemostasis is shown as Table 1.

Table 1 Electrosurgical setting for Per-Oral Endoscopic Myotomy.

POEM step	VIO 200 D	VIO 300	VIO 3
Incision/Myotomy	ENDOCUT Q, Effect 2 *(Cutting duration 3, Cutting interval 3)* DRYCUT, Effect 2-3, 30-80 W	ENDOCUT I, Effect 2-4 *(Cutting duration 1-3, Cutting interval 1-3)* DRYCUT Effect 2-3, 30W	DRYCUT, Effect 3-5, ENDOCUT Q, Effect 1-2 PreciseSECT, Effect 3,4-5
Submucosal Dissection	ENDOCUT Q, Effect 2 *(Cutting duration 3, Cutting interval 3)* DRYCUT Effect 2, 30-80W	FORCED COAG, Effect 2-3, 35-100 W SWIFT COAG, Effect 2-3, 35-100 W DRYCUT, Effect 2-3, 35-100 W	SWIFT COAG, Effect 3-4 DRYCUT, Effect 3-4 ENDOCUT Q, Effect 1-2 PreciseSECT, Effect 3,4-5
Hemostasis	FORCED COAG, Effect 2, 60 W	SOFT COAG, Effect 5, 60-100 W	SOFT COAG, Effect 5 SPRAY COAG, Effect 1-4, PreciseSECT, Effect 3,4-5

Esophagogastroduodenoscopy was done to examine the esophagus, stomach, and duodenum as shown in Figure 2. Irrigation and removal the remaining esophageal content was done. If there are thickened content, an overtube may be placed for copious irrigation and clearance of the esophageal content. Documentation of the esophagogastric junction (EGJ) distance and decision for mucosal entry site was selected at least 8-12 centimeters proximal to the EGJ. All patients were performed by posterior approach.

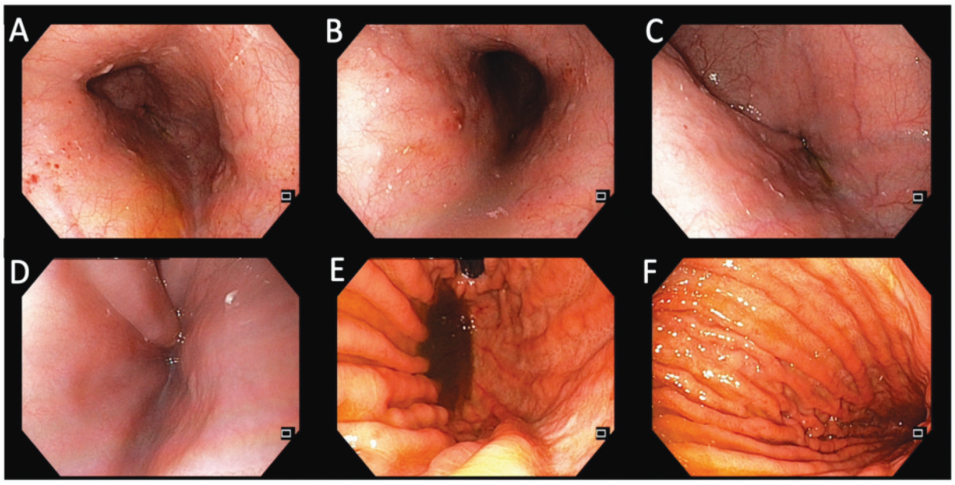


Figure 2 Esophagogastroduodenoscopy findings (EGD) in achalasia. Upper thoracic esophagus (A), Middle thoracic esophagus (B), Lower thoracic esophagus (C), Tight lower esophageal sphincter (D), Tight cardia in J-turn endoscopic view (E), Stomach (F)



Steps for POEM

1. Mucosal Entry

A submucosal injection is made at least 10–12 cm proximal to the esophagogastric junction (EGJ), using a lifting solution, usually with glycerol 200 ml tinted with 0.4% indigo carmine mixture to achieve a deep skyblue color and one ampule of epinephrine 1mg/ml was infused. Submucosal injection via a 23-gauge needle injection (Olympus, Japan) of at least 10 ml to separate the mucosal layer and submucosal layer to reduce the penetration of the muscularis propria. A longitudinal posterior mucosal incision approximately 1.5–2 cm is performed using a TT knife in Endocut I mode setting 2-3-3. Care is taken to avoid the 6 o'clock position (posterior) in sigmoid-type achalasia; consider the 2 or 5 o'clock position for better tunnel orientation and gravity-assisted exposure.

2. Submucosal Tunneling

A submucosal tunnel is created from the mucosal entry site down to 2–3 cm distal the EGJ into the proximal stomach. Switch setting to Endocut Q 2-3-3 and swift coagulation or spray coagulation mode 2-50 depending on the tissue resistance, a PreciseSECT mode is also an option. Maintain adequate submucosal lifting with repeated injections of the lifting solutions and normal saline irrigation to separate the submucosal plane. Any large vessels or bleeding are controlled via coagulation graspers and switch to hemostatic mode to minimize thermal damage.

3. Myotomy

A selective myotomy of the circular muscle layer is performed, starting 2–3 cm below the mucosal incision and usually 6-8 cm above the esophagogastric junction (EGJ), then extending 2–3 cm below the EGJ into the gastric cardia. Usually a posterior approach is performed due to feasibility of the patient position.

4. Closure of Mucosal Entry

After the passing the endoscopic through the esophageal lumen into the stomach, The mucosal entry is closed using standard endoscopic clips in a "zipper" fashion. The steps of per-oral endoscopic myotomy (POEM) is summarized in Figure 3 and the endoscopic view of the POEM is demonstrated in Figure 4.

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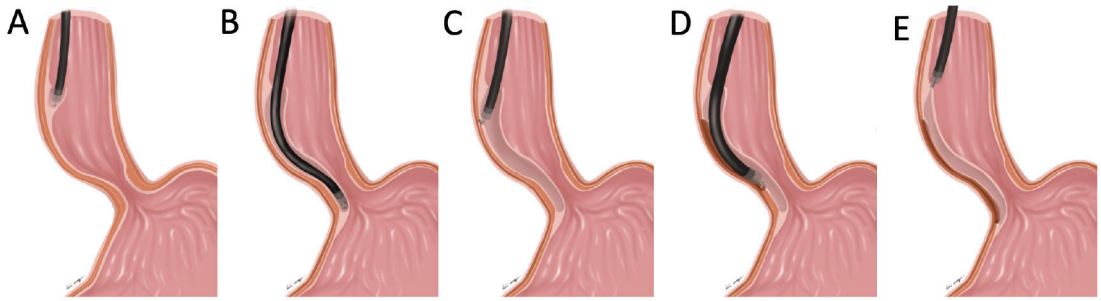


Figure 3 Per-oral endoscopic myotomy (POEM) technique. Lifting submucosal injection at 8-10 cm above EGJ. Mucosostomy performed to enter submucosal space (A), Dissection of submucosal tunneling caudally to 2 cm below esophagogastric junction (EGJ) (B), Endoscopic myotomy of the 6-8 cms above EGJ (C), Endoscopic myotomy 2-3 cm below EGJ (D), Closure of mucosal defects at entry site (E).

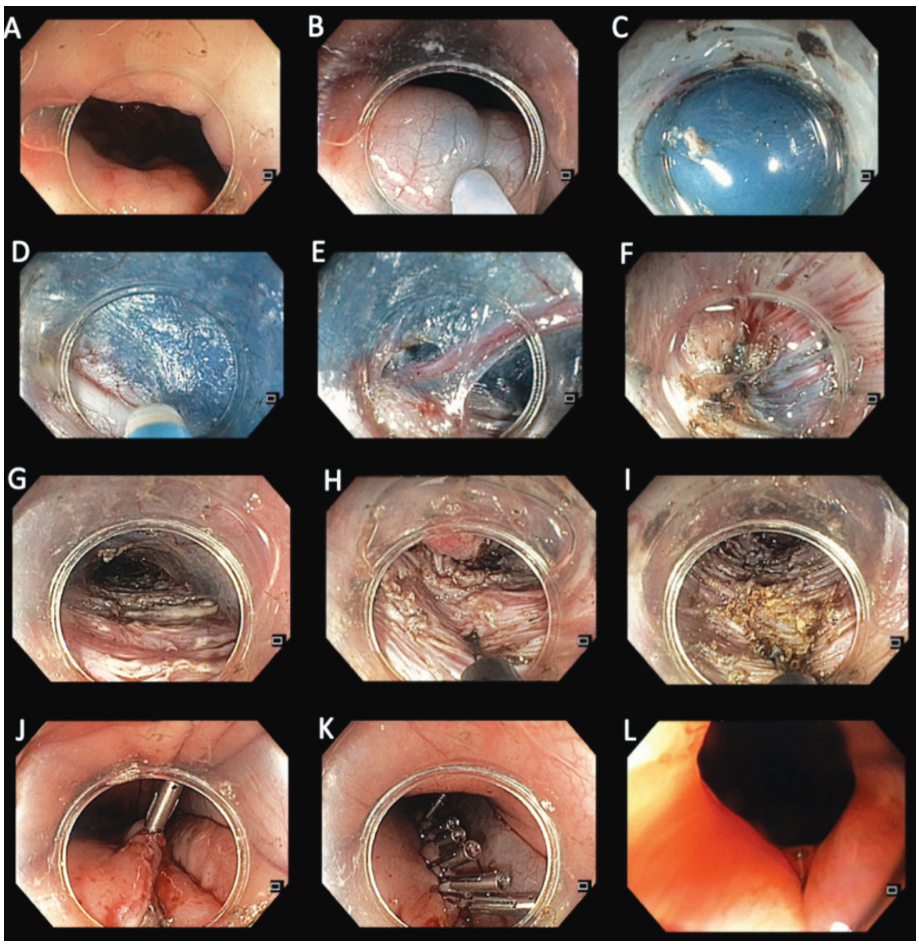


Figure 4 Per-oral endoscopic myotomy (POEM) endoscopic view. Esophagus location at 8-10 cm above the EGJ (A), Submucosal injection (B), Submucosal incision 1.5-2 cm allowing entry into the submucosal space (C), Submucosal tunneling (D), Submucosal esophageal vessels (E), Tight EGJ (F), Complete submucosal tunneling at esophageal and gastric site (G), Posterior myotomy of the esophageal circular and/or longitudinal muscle fibers via (H), Split circular muscles of the esophagus using a Triangular TipKnife (I), Closure of the submucosal entry site from caudal to cephalad (J), Complete closure of the mucosa of esophagus (K), Endoscopic view revealing relaxed lower esophageal sphincter at EGJ (L).



Postoperative Protocol

1. Initiate sipping water immediately within the first 24 hours after POEM. Then a stepwise dietary advancement to liquids and soft diet over the next 24-48 hours after POEM.

2. All patients received high-dose proton-pump inhibitor medication to reduce gastro-esophageal reflux symptoms.

3. Discharge within 72 hours once a soft, low residual, puree diet is tolerable.

4. Postoperative patients who develop subcutaneous emphysema are closely monitored, as this condition typically resolves spontaneously without the need for additional therapeutic intervention

5. Routine follow up with clinical symptoms, monitoring Eckardt score and reflux symptoms. A timed-barium esophagography at 1 and 12 months is done due to a high-resolution esophageal manometry is unavailable at our institution.

Results

A total of 14 patients (N=14) were included in this study. The patient demographic data is shown in Table 2. The median age was 52 years, with a wide range (18–81 years), including 8 males (57%) and 6 females (43%). The median preoperative Body Mass Index (BMI) was 19.6 (14-24) kg/m^2. The median duration of symptoms prior to per-oral endoscopic myotomy (POEM) was 8 months (range: 2–120 months). All patients (100%) had no history of previous treatment for achalasia. Achalasia subtype distribution showed that 5 patients (35.7%) had the sigmoid type, while 9 patients (64.3%) had the non-sigmoid type. Preoperatively, the median Eckardt score was 7 (range: 4–11), and the median timed-barium esophagography (TBE) measurements at 5 minutes were 184 mm (range: 37–314 mm) for barium height and 53 mm (range: 31–138 mm) for barium width.

The POEM procedure outcomes and follow-up is demonstrated in Table 2. The technical success rate was 92.8% (n = 13), with one patient (7.2%) requiring conversion to endoscopic dilatation due to equipment technical issues, improper setting of energy device causing frequent bleeding upon mucosal tunneling. The median operative time was 162.5 (range: 95–225 minutes), and the median myotomy length was 8 cm (range: 8–11 cm). Estimated blood loss was minimal, with a median of 5 ml. Overall 30-day morbidity was 28.5% (n = 4). Intraoperative complications included one perforation (7.1%) and one bleeding event (7.1%). The perforation was at the esophagus and was controlled by endoscopic clips. The bleeding was encountered and controlled via endocoagulation graspers and endoscopic clips successfully. This patient was converted to endoscopic dilatation due to friable mucosa and contact bleeding during submucosal tunneling. Two patients (14.3%) developed postoperative aspiration pneumonia. The first patient needed mechanical



ventilation support and had difficulty in weaning ventilation, requiring the length of hospital stay for 22 days before being discharged home. The cause of pneumonia was due to elderly fragile patient not associated with severity of achalasia. The second patient that had pneumonia was clinically minor, not requiring advanced airway management or intubation. This patient was observed post operative for 2 days and switched to oral antibiotics and discharged home. The median length of hospital stay was 4 (2-22) days. Table 4 demonstrates comparison of outcomes after POEM. The most clinically significant finding is the profound reduction in the Eckardt score. The cohort shifted from a preoperative mean of 7 (moderate-to-severe symptoms) to a median of 1 (range: 0–3) at 1-year follow-up ($p < 0.001$). There also was statistically significant reduction in the TBE column height from 184 mm to 117 mm ($p = 0.018$). This 36.4% decrease suggests a marked reduction in stasis and improved bolus transit across the lower esophageal sphincter. The nutritional status, measured by BMI, showed a positive trajectory from 19.6 to 21.4 kg/m^2 ($p = 0.062$). The median postoperative follow-up time was 12 months.

Table 2 Patient demographic data.

Patient demographic data	Total (N = 14) N (%)
Age, median (range); years	52 (18-81)
Gender	
Male	8 (57%)
Female	6 (43%)
Comorbid disease	
No	11 (78%)
Yes	3 (22%)
BMI, median (range); kg/m^2	19.6 (14-24.2)
Duration of symptoms, median (range); months	8 (2-120)
Preoperative Eckardt score, median (range)	7 (4-11)
Achalasia	
Sigmoid type	5 (35.7%)
Non-sigmoid type	9 (64.3%)
Previous treatment	
No	14 (100%)
Yes	0
Pre-operative TBE at 5 minutes, median (range); mm	
Barium height	184 (37-314)
Barium width	53 (31-138)



Table 3 Per-oral endoscopic myotomy results.

Results	Total (N = 14) N (%)
Technical success	
Yes	13 (92.8%)
No (conversion to endoscopic dilatation)	1 (7.2%)
Operative time, median (range); min	162.5 (95-225)
Per-oral endoscopic myotomy length, median (range); cm	8 (8-11)
Estimated blood loss, median (range); ml	5 (4-20)
Complications	
Overall 30 day morbidity	4 (28.5%)
Intraoperative	
Perforation	1 (7.1%)
Bleeding	1 (7.1%)
Post operative	
Pneumonia	2 (14.3%)
Length of post-operative hospital stay, median (range); days	4 (2-22)
Clinical success	14 (100%)
1-year post operative Eckardt score	1 (0-3)
Post operative BMI, median (range); kg/m^2	21.4 (18-34)
Post operative TBE at 5 minutes, median (range); mm	
Barium height	117 (28-235)
Barium width	42 (31.6-86)
Post operative follow-up time (month)	12 (6-48)

Table 4 Comparison of postoperative results after POEM.

Parameters	Preoperative	Post operative	Difference	*p*-value
TBE Height (mm)	184 (37-314)	117 (28-235)	67 (9-79)	0.018
TBE Width (mm)	53 (31-138)	42 (31.6-86)	11 (-0.6-52)	0.121
Eckardt score	7 (4-11)	1 (0-3)	6 (4-8)	< 0.001
BMI (kg/m^2)	19.6 (14-24.2)	21.4 (18-34)	1.8 (1.4-9.8)	0.062

BMI, body mass index; TBE, timed-barium esophagography.



Discussion

Achalasia is a rare primary esophageal motility disorder due to impaired relaxation of the lower esophageal sphincter (LES) and absent peristalsis, leading to progressive dysphagia, regurgitation, and weight loss. Although treatment modalities have been developed to alleviate symptoms, including pneumatic dilation, botulinum toxin injections, and Heller myotomy. However, each of these treatments has limitations in terms of long-term efficacy and invasiveness.

Due to limited resources of high-resolution esophageal manometry in many hospitals in Thailand, the omission of this investigation, leading to unidentified types of Achalasia, may be a challenge in the counselling and decision of treatment of the patient. The advanced endoscopic era, peroral endoscopic myotomy (POEM) has gained widespread acceptance due to its effectiveness, shorter recovery time, and has the advantage for the ability to address different subtypes of achalasia. Therefore, the author, due to limitations of no esophageal manometry available, has justified that POEM is also suitable for all Achalasia subtypes. The limitations of this study for the clinical success, is monitored by Eckardt score < 3, rather than the integrated resting pressure (IRP). This study fails to objectively assess post operative gastroesophageal reflux disease (GERD), due to no available 24-hr pH monitoring data. The post operative GERD is only obtained clinically along with Eckardt score at follow-up. This procedure is technically challenging for a low volume center, and may need high experience in advanced endoscopy. This case series aims to contribute to the growing body of literature by analyzing the outcomes, complications, and long-term efficacy of POEM in a series of patients diagnosed with achalasia at our institution.

Larger cohorts are needed to improve statistical power and allow for more robust subgroup analyses, especially given the rarity of achalasia and the POEM procedure. Also a long-term follow-up is essential to assess the durability of symptom relief, late complications (such as gastroesophageal reflux disease), and quality of life outcomes.

Conclusion

The increasing utilization of POEM worldwide, the need for real-world data on its outcomes, particularly in diverse patient populations are necessary. Our institutional single-center case series has confirmed the feasibility of POEM with acceptable results. The initial experience can achieve good technical success, symptomatic improvement, and acceptable potential complications associated with POEM, contributing to the growing role as a primary treatment option. Long-term follow-up, larger sample size, manometry, and 24-hr pH monitoring is warranted for future studies.



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