



The last innovation in achalasia treatment; per-oral endoscopic myotomy

ESOPHAGUS

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ABSTRACT

Background/Aims: Per-oral endoscopic myotomy (POEM) is a minimally invasive endoscopic treatment option for patients with achalasia and has been performed since 2010. It is less invasive than Heller myotomy and its use is spreading rapidly worldwide. We present our results of POEM that, to the best of our knowledge, are the first cases in Turkey.

Materials and Methods: We enrolled patients between May 2014 and September 2014; 8 patients with achalasia whose complaints recurred after pneumatic balloon dilatation underwent POEM. The procedure was performed under general anesthesia at the endoscopy unit of the gastroenterology clinic. Demographic data was recorded before the procedure, and the results of the procedure were recorded prospectively.

Results: The median age of the patients was 42.5 (30–72) years. Preoperative and postoperative median Eckardt scores were 10 (8–12) and 1 (0–2), respectively. The median total duration of the procedure was 101 (71–158) min, and the median myotomy length was 13.5 (10–16) cm. Postoperative oral intake started on median day 1 (1–2) and the length of hospital stay was 4 (3–6) days. In 2 patients, capnoperitoneum developed during the procedure and was treated with a Veress needle.

Conclusion: POEM is a safe endoscopic treatment modality for patients with achalasia in centers that are experienced in advanced endoscopic techniques.

Keywords: Achalasia, endoscopy, per-oral endoscopic myotomy, myotomy

INTRODUCTION

Achalasia is an esophageal motility disorder with an incidence of approximately 1/200,000 and a prevalence of approximately 1/10,000. Clinically, it is characterized by dysphagia; however, in advanced cases, chest pain, regurgitation, aspiration pneumonia, weight loss, and malnutrition can also accompany. Esophageal manometry findings are characteristic (1). Although there are different treatment options for achalasia, they all aim to improving the passage of solids and liquids through the gastroesophageal junction (GEJ) (2).

Until 2010, there were 4 different treatment modalities for patients with achalasia, including medical treatment

with drugs such as calcium channel blockers, botulinum toxin injections, pneumatic dilatation, and surgical myotomy (2). In 2007, submucosal endoscopy and trans-esophageal mediastinoscopy were performed with “mucosal flap safety valve (SEMF) technique” on the basis of natural orifice transluminal endoscopic surgery (NOTES) by Sumiyama et al. (3). In the same year, Pariscia et al. (4) reported the endoscopic myotomy results of their animal study; in 2010, Inoue et al. (5) presented per-oral endoscopic myotomy (POEM) in human beings that evolved into a new treatment option.

Although POEM was considered to be a complicated and invasive technique in the initial stages, after its

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wide-spread use worldwide and after it was performed in >1000 patients, it has been accepted as a treatment method with a high cure rate for patients with achalasia in experienced centers, with lower mortality and morbidity rates than those with surgery (6).

Here we present the first results of POEM in Turkey that was performed in 8 patients with achalasia.

MATERIALS AND METHODS

This study was approved by a local ethics committee. Written informed consents were obtained from all patients before the procedure. POEM was performed in 8 consecutive patients by a single expert endoscopist at the department of gastroenterology, Turkey, between May 2014 and September 2014. Data was prospectively obtained from patients before and after POEM was performed. Eligibility criteria for this procedure included age >18 years and a diagnosis of achalasia confirmed by esophageal manometry.

Demographic data including age, sex, duration of symptoms, dysphagia score (7), Eckardt symptom score (8), manometry, and barium esophagogram results before and after the procedure, prior achalasia treatment, total procedure time, tunnel and myotomy length, complications associated with the procedure, need for Veress needle placement, oral intake time, and length of hospitalization stay were prospectively recorded. Patients underwent preoperative manometry to establish the diagnosis of achalasia. Patients were additionally evaluated with upper endoscopy (Figure 1).

Endoscopic technique

All POEM procedures were performed in the endoscopy unit under general anesthesia, with endotracheal intubation. During the procedure, overtube (MD-48718, Sumitomo Bakelite Co, Ltd, Tokyo, Japan) was used for all patients. We used a gastroscope with a CO₂ insufflation system (GIF-Q180J and UCR; Olympus, Tokyo, Japan) with an attached hood (D-20111804 Hood; Olympus, Tokyo, Japan). A mixture of saline and indigo carmine with a 23-gauge needle (M00518351, Boston Scientific, Massachusetts, USA) was injected into the submucosal layer of the anterior esophageal wall approximately 10-12 cm proximal to the GEJ in order to create a submucosal fluid bleb and the first mucosal incision (Figure 2). A 2-cm-long mucosal incision was made with a TT knife (Olympus, Tokyo, Japan) at the 2 o'clock position, and the scope was maneuvered into the submucosal layer. A submucosal tunnel was then dissected to at least 2-3 cm beyond the GEJ with the same knife and intermittent injection using the spray coagulation mode (Figure 3. a-b). Adequate tunnel length was confirmed by observing the length of blue dye extension into the stomach wall with the endoscope in a retroflexed intragastric position, visualization of palisading vessels on the mucosal flap, and endoscopic measurement (Figure 4,5). Then, the circular muscle bundle was dissected by a TT Knife 2-3 cm distal to the mucosal entry,

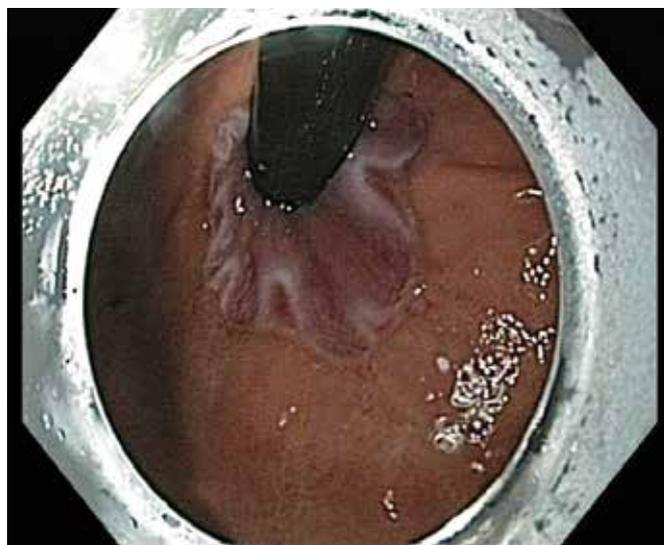


Figure 1. View of the cardia in retroflexion (before per-oral endoscopic myotomy).

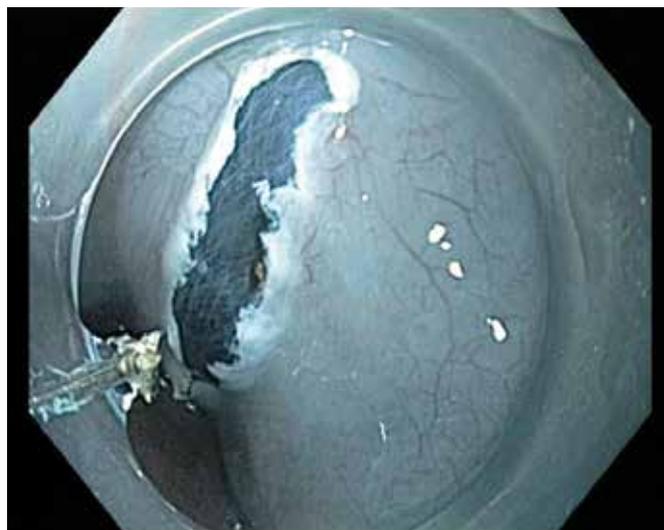


Figure 2. Longitudinal incision with a triangular knife.

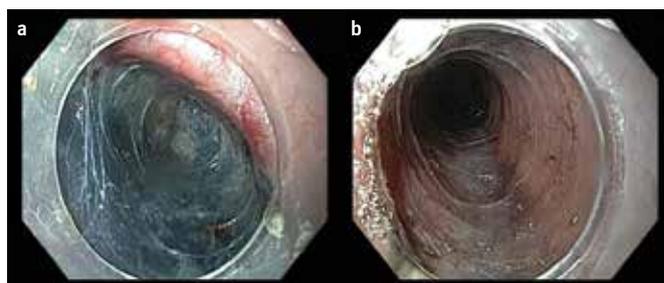


Figure 3. a,b. Endoscopic view of the tunnel.

more than 10 cm until 2-3 cm above the GEJ (Figure 6). When myotomy was completed, the endoscope was re-inserted into the lumen down to the stomach to visualize the smooth passage of the endoscope through the GEJ, for retroflexed evaluation of the valve and to confirm adequate myotomy (Figure 7). After myotomy was completed, gentamicin was flushed into the submucosal tunnel and the mucosal entry site was closed with endoscopic clips (Figure 8).

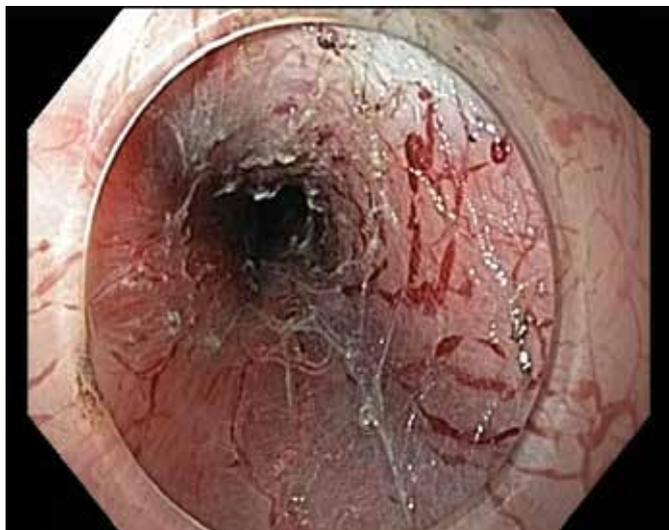


Figure 4. View of a rich vascular net at the gastroesophageal junction through the submucosal tunnel.



Figure 6. Myotomy with a triangular knife.



Figure 5. Endoscopic view of perforating vessels at the gastric area.

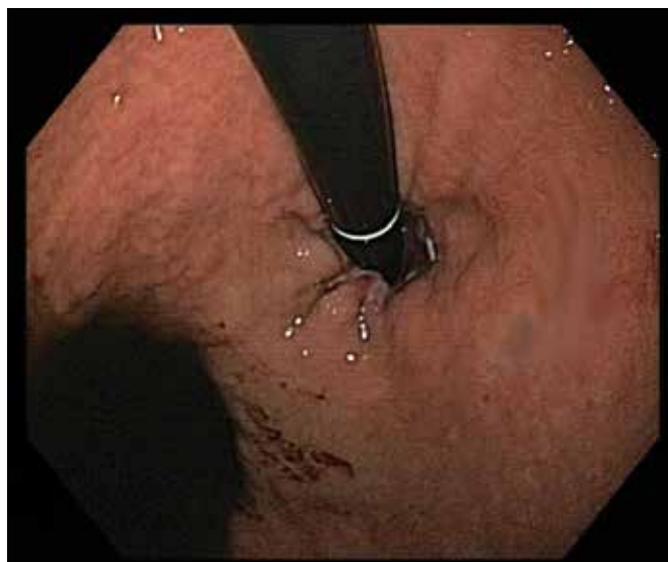


Figure 7. View of the cardia in retroflexion (after per-oral endoscopic myotomy).

Postoperatively, patients were kept nil by mouth through the night and were started on an intravenous proton pump inhibitor. A barium esophagogram was obtained on the next day to assess the effects of myotomy and to determine complications such as leaks. To assess mucosal injury on the next day, all patients were evaluated by endoscopy. Oral intake with liquid diet began when no complications were determined on endoscopy and esophagography; all patients were given a full liquid diet approximately on day 5. Patients were generally discharged within 3–5 days following POEM if no clinical complications were observed.

Statistical analysis

Data were analyzed using SPSS 17.0 program (SPSS Inc, Chicago, IL, USA).

RESULTS

Per-oral endoscopic myotomy was performed in 8 patients (4 females and 4 males). The median age was 42.5 (30-72) years,

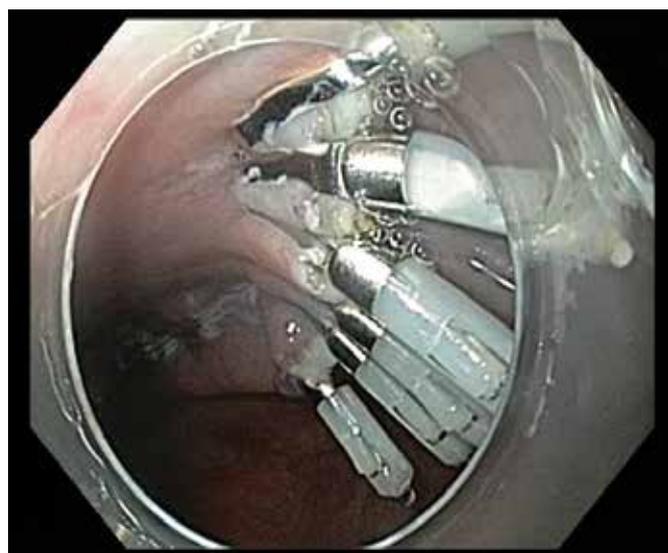


Figure 8. View of mucosal entrance closed with hemoclips.

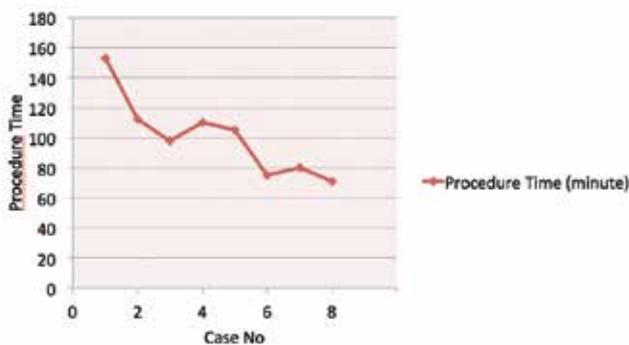


Figure 9. Procedure times of per-oral endoscopic myotomy.

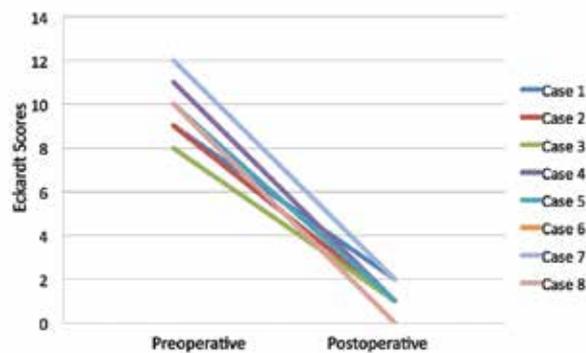


Figure 10. Preoperative and postoperative Eckardt scores in patients.

Table 1. Demographic features and results of POEM procedures

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
Age, Sex (male/female)	31, F	71, M	42, M	43, M	49, F	30, M	54, F	30/F
ASA class	1	2	1	2	1	1	2	1
Prior achalasia treatment (yes or no/number)	Yes/2 BD	Yes/3 BD	Yes/2 BD	Yes/2 BD	No/0 ∅	No/0 ∅	No/0 ∅	No/0 ∅
Achalasia sub-type*	-	-	1	-	1	2	2	1
Tunnel length, cm	15	19	16	19	19	18	19	16
Myotomy length, cm	10	14	10	16	14	15	13	13
Operation time, min	153	112	98	110	105	75	80	71
Adverse events	No	No	Cp	No	No	No	No	Cp
Veress needle decompression (yes/no)	∅	∅	Yes	∅	∅	∅	∅	Yes
Time of oral intake, days	2	1	2	1	1	1	1	1
Duration of hospitalization, days	5	6	4	4	3	4	5	4
Dysphagia score preoperative/ postoperative	3/1	3/1	3/0	3/0	3/0	3/0	3/0	3/0
Eckardt score, preoperative/ postoperative	9/2	9/1	8/1	11/1	10/1	10/0	12/2	10/0
Follow-up, days	173	157	137	95	86	81	75	66

*Subtype of achalasia was identified in patients whose manometric test was performed using high-resolution manometry.
BD: balloon dilatation
Cp: capnoperitoneum

the median tunnel length was 18.5 (15-19) cm, and the median myotomy length was 13.5 (10-16) cm. The median procedure time was 101 (71-158) min (Figure 9), the median duration of hospitalization was 4 (3-6) days. Preoperative and postoperative median Eckardt scores were 10 (8-12) and 1 (0-2), (Figure 10), and dysphagia scores were 3 and 0 (0-1), respectively. Demographic features of the patients and characteristics of POEM procedures are summarized in the Table 1. Capnoperitoneum developed during the procedure in 2 patients and was treated with a Veress needle.

DISCUSSION

In this article, we present the results of the first POEM procedures that were performed successfully in 8 achalasia patients in Turkey, with a short review of the recent literature.

Achalasia is a rare esophageal motility disorder with aperistalsis in the distal third of the esophageal body and failure of

relaxation of the lower esophageal sphincter, and the aim of treatment is to relieve esophageal emptying and the patient's symptoms (1).

Per-oral endoscopic myotomy is a technique developed on the basis of NOTES (2), and since 2010, it has been successfully performed in humans (5). Except for patients with secondary achalasia, all symptomatic achalasia patients can be treated with POEM. It is a useful technique not only for patients with achalasia but also for those other motility disorders, such as diffuse esophageal spasm, hypertensive LES, and nutcracker esophagus, and for those with failed conventional and surgical treatments, such as pneumatic dilation, botox injection, and Heller myotomy (6,9). In our case series, endoscopic and manometric studies were performed before POEM in all patients with achalasia; secondary achalasia and other causes of dysphagia, such as tumor, were excluded.

The POEM procedure is generally performed with the patient in the supine position, under general anesthesia, and with endotracheal intubation by the supervision of an anesthesiologist in the operation room or endoscopy suits, under the appropriate conditions (5,10). For POEM, a high-definition forward-viewing gastroscope with a plastic cap is used with CO₂ insufflation. Before starting POEM, all measurements, including the position of the GEJ and start of the tunnel (usually about 13 cm proximal to the GEJ) are determined. In most centers, right anterior orientation (2 o'clock position) is used for the submucosal tunnel and myotomy (11). However, in some POEM centers, posterolateral orientation (5 o'clock position) is favored (12).

After the longitudinal incision, dissection of the tunnel can be done using different techniques such as pure electrosurgical dissection or balloon dilation (13). During tunnel opening, identification of the GEJ in the submucosal layer is important. To determine this, some techniques such as endoscopic measurement, narrowing of the submucosal space increased resistance and vascularity at the level of the GEJ, visualization of palisading vessels in the submucosal layer and perforating vessels in the gastric submucosal layer, and visualization of a blue color on intraluminal inspection of the cardia mucosa can be used (11).

In POEM, an important concern is that accidental injury of the mucosal flap, which is the only barrier between the esophageal lumen and mediastinum after myotomy, should be avoided (11). After opening the tunnel, the next step is to perform selective circular myotomy of the esophageal wall. Myotomy length should be 6–8 cm and is continued distally until extended 1-2 cm into the cardia (10). When myotomy is completed, the endoscope is re-inserted into the lumen down to the stomach to make sure that the endoscope passes smoothly through the GEJ, and a retroflexed evaluation of the cardia opening is performed. If the opening is not sufficient, the tunnel and myotomy can be elongated until the required relaxation is achieved. At the end of the process, gentamycin is flushed into the submucosa, and the mucosal entry is sealed with hemoclips (14).

In all our cases, the procedures were performed in the section of the endoscopy unit particularly designed for advanced procedures, such as ESD and EMR, under general anesthesia, with endotracheal intubation performed by an anesthesiologist. Tunnel entry was performed at a median of 14 cm proximal to the GEJ at the 2 o'clock position, and the median tunnel length was 18.5 cm. The GEJ was defined by endoscopic measurements and spindle vessels in the submucosal layer, and perforating vessels in the cardia were observed. Selective circular myotomy was performed in all patients (Figure 6). The median myotomy length was 13.5 cm. The total duration of our first few POEM cases was shorter than that in the literature (12). Regarding the knowledge on POEM, previous experience with submucosal procedures such as EMR and ESD and attending hands-on POEM courses can positively affect the learning curve (12,15-17). Since 2012, 275 ESD and 432 EMR procedures

were successfully performed by the same endoscopist, and before the POEM procedures, he attended endoscopy workshops in Europe and Japan, besides completing hands-on POEM courses on both ex vivo and in vivo pig esophagus.

With retroflexion in 1 of our patients, it was observed that effective relaxation was not obtained at the cardia. Therefore, the tunnel was elongated 2 cm distally and the myotomy length was increased; this provided the aimed relaxation. The procedures were successfully completed in all 8 patients, and the tunnel entrances were sealed with hemoclips.

Pneumoperitoneum, cervical emphysema, and pneumomediastinum can often be seen during POEM. Side effects related to CO₂ insufflation are generally very well tolerated and occur as a result of CO₂ penetration through the muscular layer to the esophagus, mediastinum, neck, and peritoneum during the procedures, (6,12,15). Capnoperitoneum occurs frequently (>50%) and is usually clinically insignificant; however, when respiratory problems occur or when the abdomen is excessively distended, treatment of this complication can easily be achieved by inserting a desufflation needle (Veress needle) into the peritoneum (6,18,19). In our case series, desufflation of excess air in the abdomen by needle was required in 2 patients. No complication was seen after the procedure; the patients were started on a per-oral diet on the second day and were discharged on the fourth day. Complications such as mediastinal leak, mediastinitis, and hemorrhage can be seen after the procedure; however, their incidence is very low and they can be successfully managed by endoscopic or medical treatment (19). No complications after the procedure occurred in our case series.

After POEM, treatment failure due to incomplete myotomy or GERD are the most important later side effects. The risk of developing GERD symptoms after POEM is reported to be 5.7%-33% (14,20). This may be related to the direction of myotomy because the sliding fibers forming the His angle are located at the 8 o'clock position in the supine position and the His angle is the natural barrier preventing gastric content reflux into the esophagus (11). Although the 5 o'clock position is preferred in some centers, most specialists prefer the 1-2 o'clock position because of this reason (12). We preferred the 2 o'clock position for myotomy in all our cases. No reflux symptoms were detected at the follow-up after the procedures.

If there is no complication after the procedure, a control endoscopy after 24 h and esophagography for leak control should be performed. Oral intake should be initiated gradually. Parenteral antibiotics should be continued for 3 days, and the patient should be discharged with oral antibiotics (11,15). In our case series, on an average, per-oral intake was initiated on day 2 and the patients were discharged on 5. No complications were observed until discharge; white blood cell count and CRP levels were normal and no fever was recorded.

All reports on POEM show that this technique is highly efficacious in the short-term treatment of achalasia (6,12,19). In previous studies, treatment success was defined as postoperative Eckardt score of ≤ 3 ; this was achieved in 98% of cases (12). In our case series, preoperative and postoperative median Eckardt scores were 10 and 1, respectively; the postoperative success rate was 100%.

In conclusion, this treatment option for patients with achalasia, which is becoming more widely used worldwide, has been successfully performed for the first time in our country in 8 patients, in a center experienced in ESD and EMR. Complications that can occur after this minimally invasive technique, which has been performed in >1000 patients in the last 5 years," can be tolerated very well and no mortality has been reported yet. Until now, the success rate of this treatment option is 95%; however, long term results will be documented with prospective studies.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of İzmir Katip Çelebi University Atatürk Training and Research Hospital.

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author contributions: Concept - F.A.; Design - F.A.; Supervision - B.U.; Resource - F.A., E.A., Z.A.; Materials - F.A.; Data Collection &/ or Processing - F.A., Z.A., A.A., D.A.Y.; Analysis &/or Interpretation - F.A.; Literature Search - F.A., C.C.; Writing - F.A., Z.A.; Critical Reviews - E.A., S.B., B.U.

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