Chinese Medical Journal®

Long-term outcomes of peroral endoscopic myotomy with simultaneous submucosal and muscle dissection (POEM-SSMD) for achalasia with severe interlayer adhesions

Jiancong Feng[1,2], Ningli Chai[2], Wengang Zhang[2], Longsong Li[2], Xiaowei Tang[2], Jiale Zou[2], Lu Ye[2], Enqiang Linghu[2]

[1]Medical School of Chinese People's Liberation Army, Beijing 100853, China;
[2]Department of Gastroenterology and Hepatology, The First Medical Center of Chinese People's Liberation Army General Hospital, Beijing 100853, China.

Many previous studies have confirmed the effectiveness and safety of peroral endoscopic myotomy (POEM) to treat achalasia. However, severe interlayer adhesions preclude the establishment of a submucosal tunnel and then result in aborted POEM procedures. To address this challenge, we introduced POEM with simultaneous submucosal and muscle dissection (POEM-SSMD) in 2014.[1] During the short-term follow-up, the symptoms of the patient were significantly improved. Thus, for patients with esophageal interlayer adhesions, the relative indications of POEM may be extended. Nevertheless, only a few case reports using this technique with a shorter follow-up have been published to date. Hence, the present study aimed to further report the long-term outcomes of POEM-SSMD for achalasia with severe interlayer adhesions in a relatively larger population.

A total of 22 achalasia patients with severe interlayer adhesions had undergone POEM-SSMD at Chinese People's Liberation Army (PLA) General Hospital from December 2014 to May 2019. The basic patient information is shown in Supplementary Table 1, http://links.lww.com/CM9/A926. All the patients were diagnosed with achalasia based on the clinical symptoms, esophagogastroduodenoscopy (EGD), barium swallow, and high-resolution manometry (HRM). In addition, the clinical symptoms were mainly evaluated using the Eckardt score. All the clinical data of the enrolled patients, such as the clinical characteristics, procedure-related parameters, perioperative complications, clinical efficacy, quality of life (QoL) scores, and clinical reflux adverse events, were analyzed. This retrospective study was approved by the Ethics Committee of the Chinese PLA General Hospital. Informed consent was obtained from all the participating patients.

The specific steps are as follows: (1) A submucosal injection was performed to form a liquid mat and then created an inverse T incision to establish the tunnel entry site. (2) A submucosal tunnel was extended as far as possible until it cannot be continued due to severe interlayer adhesions. (3) A 1–3 cm full-thickness myotomy was performed after establishing a short tunnel, and then submucosal and muscle was incised simultaneously to 2–3 cm below the esophagus-gastric junction (EGJ) with the corresponding mucosa remaining intact. (4) The mucosal incision was sutured with metal clips on the premise that complete hemostasis and endoscope can easily pass the cardia (Supplementary Figures 1, http://links.lww.com/CM9/A921 and 2, http://links.lww.com/CM9/A922, and Supplementary Video, http://links.lww.com/CM9/A928). All procedures were completed by endoscopists with abundant POEM experience (>5 years).

To evaluate gas-related adverse events such as subcutaneous emphysema or pneumothorax, the X-ray or chest and abdominal computed tomography (CT) was performed routinely. The patients were also monitored for delayed hemorrhage, delayed mucosal perforations, infection, and other adverse events. After the procedure, the patients were fasted for 3 days, followed by a clear liquid diet, and then a semi-liquid diet, and progressed gradually to a normal diet in 4 weeks. During the nil per os (NPO) period, intravenous proton pump inhibitor (PPI) and antibiotics were administered. Subsequently, oral PPI was required for at least 1 month.

Clinical sucess was defined by an Eckardt score $\leq$3 mesured at the last follow-up without Re-POEM or other treatment. Postoperative adverse events mainly included perioperative complications and gastroesophageal reflux disease (GERD). Major adverse events were defined as perioperative complications that required additional interventions or an intensive care unit stay.[2] QoL scores

Access this article online

Quick Response Code:

Website: www.cmj.org

DOI: 10.1097/CM9.0000000000001971

Jiancong Feng and Ningli Chai contributed equally to the work.

Correspondence to: Enqiang Linghu, Department of Gastroenterology and Hepatology, The First Medical Center of Chinese People's Liberation Army General Hospital, Beijing 100853, China
E-Mail: linghuenqiang@vip.sina.com

Chinese Medical Journal 2022;135(6)

Received: 28-09-2021; **Online:** 14-02-2022 **Edited by:** Yuanyuan Ji

were measured using the AE-18 health-related QoL scale comprising 18 items with a maximum score of 90 points; higher scores correspond to a better QoL. The patients were scheduled for follow-up at 3 months, 6 months, and 12 months after POEM-SSMD and then annually. EGD, HRM, and 24-h esophageal pH monitoring were performed if possible. Patients were also contacted to obtain the AE-18 score and latest postoperative Eckardt score via interview at the clinic or via telephone.

Statistical analyses were processed using the Statistical Package for the Social Sciences (SPSS) version 25.0 (IBM Inc., USA). Measurement data were expressed as the mean or median, enumeration data were presented as frequencies (%). Paired-sample Student's *t*-test or the Wilcoxon matched-pairs signed-rank test was used to estimate the treatment outcomes of POEM-SSMD. All the reported *P* values were two-tailed, and $P < 0.05$ were indicated statistical significance.

As shown in Supplementary Table 1, http://links.lww.com/CM9/A926, the study cohort consisted of 15 males and 7 females, aged from 19 years to 76 years (mean 49.8 years). According to the endoscopic morphology of esophageal lumen reported in the previous study,[3] 3 patients (14%), 2 patients (9%), 16 patients (73%), and 1 patient (5%) were Ling classification IIa, IIb, IIc, and IIIr types, respectively. Thirteen of the 22 patients (59%) had a treatment history (Botox injection, Balloon dilatation, POEM, or Laparoscopic Heller myotomy [LHM]). All 22 patients successfully received POEM-SSMD without major adverse events. The mean operation time was 62.3 min (23–130 min) in our study. The median length of the tunnel and the mean length of myotomy were 7.0 cm (2–12 cm) and 5.5 cm (3–8 cm), respectively. The median hospitalization was 7 days (5–12 days). Regarding minor adverse events, mild to moderate substernal pain was noticed in six patients (27%), no intervention was given, and the patients were relieved spontaneously. CT showed a small amount of pleural effusion in one patient; the patient had no obvious discomfort, and then the effusion was absorbed without special intervention. Moreover, two cases (9%) developed neck subcutaneous emphysema, which was absorbed spontaneously. In addition, cardia mucosal penetration occurred in three patients (14%) and was successfully closed by fibrin sealant and metal clips. Postoperative fever occurred in four cases, which returned to normal quickly after antibiotic treatment.

Four patients were lost to follow-up in the present study. During a mean follow-up period of 28.7 months (10–63 months), clinical success was achieved in 15 patients (83.3%). The median Eckardt score decreased from 6.5 (4–11) preoperatively to 1 (0–6) postoperatively ($P < 0.05$; Supplementary Table 2, http://links.lww.com/CM9/A927 and Figure 3, http://links.lww.com/CM9/A923). Postoperative manometry was performed in five patients, and the lower esophageal sphincter pressure (LESP) was significantly decreased after POEM-SSMD ($P < 0.05$; Supplementary Table 2, http://links.lww.com/CM9/A927 and Figure 4, http://links.lww.com/CM9/A924). Sixteen patients (89%) had an improved AE-18 score during the follow-up. The median AE-18 total score increased from 69 (54–79) preoperatively to 87 (67–89) postoperatively ($P < 0.05$; Supplementary Table 2, http://links.lww.com/CM9/A927 and Figure 5, http://links.lww.com/CM9/A925). Two patients had reflux esophagitis on EGD, which were Los Angeles classification B and C, respectively. And altered esophageal acid exposure in another patient was defined by 24-h pH monitoring. A GerdQ total score ≥ 8 in six patients (33%) was defined as symptomatic reflux (Supplementary Table 2, http://links.lww.com/CM9/A927).

For patients with severe adhesions, conventional POEM is difficult to achieve. Consequently, performing modified POEM to address this challenge is necessary. The tunnel entry site mainly depends on Ling's classification. For types Ling I, Ling II, and Ling IIb, the tunnel extends from a position approximately 8–10 cm on the oral side of EGJ. For types Ling IIc and Ling III, the tunnel is established from a location 5 cm on the oral side of the EGJ. The tunnel is extended as far as possible until it cannot be continued because of the severe adhesion.

We mentioned our ongoing and unpublished studies in the second version Therapeutics of Digestive Endoscopic Tunnel Technique, which included fewer patients (nine patients) and had shorter follow-up time. And the previous study only included patients with severe interlayer adhesions at cardia. To help the promotion of this procedure, we further report the long-term outcomes of POEM-SSMD for achalasia with severe interlayer adhesions in a relatively larger population. In the present study, POEM-SSMD also provides a treatment option for patients with severe interlayer adhesions at mucosal incision that could not establish a submucosal tunnel.

Our study showed that this technique produced an 83% (15/18) long-term symptom remission rate, indicating that POEM-SSMD is an effective treatment option for achalasia with severe interlayer adhesions. As a modified POEM, POEM-SSMD further enriched the concept of super minimally invasive surgery (SMIS), which is different from minimally invasive surgery and traditional surgery, has unique advantages in postoperative QoL.[4] According to retrospectively collected four subscales QoL information, it produced an 89% (16/18) improvement in the QoL rate. More randomized trials to compare with LHM are needed.

Regarding adverse events, a relatively low incidence of gas- related adverse events (9%, 2/22) was found in the present study. And the mucosal penetration rate was 14% (3/22); all three patients were successfully treated conservatively. Compared with the results reported of conventional POEM,[5] the clinical reflux adverse events rate in the present study was broadly consistent.

This study had several limitations. First, the study was retrospective and non-controlled analysis. Other limitations included a single-center design and a lack of paired HRM results in 17 patients. However, a significantly decreased median Eckardt score and increased AE-18 score were obtained postoperatively, confirming the good efficacy of POEM-SSMD. Notably, long-term outcomes need to be interpreted with caution, as our mean follow-up time was 28.7 months.

For patients with severe interlayer adhesions, the operation should be performed by experienced endoscopists and used modified POEM. POEM-SSMD is a safe and effective treatment option for achalasia with severe interlayer adhesions. In addition, it can improve QoL, as measured by the AE-18 health-related QoL. Further prospective, multicenter, randomized trials are warranted.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Funding

The present study was supported by grants from the National Key R&D Program of China (No. 2016YFC1303601) and Beijing Municipal Science & Technology Commission (No. Z181100001718177).

Conflicts of interest

None.

References

1. Li Y, Linghu E, Ding H, Zhang X, Li M, Xiong Y, *et al*. Peroral endoscopic myotomy with simultaneous submucosal and muscle dissection for achalasia with severe interlayer adhesions. Gastrointest Endosc 2016;83:651–652. doi: 10.1016/j.gie.2015.09.030.
2. Zhang XC, Li QL, Xu MD, Chen SY, Zhong YS, Zhang YQ, *et al*. Major perioperative adverse events of peroral endoscopic myotomy: A systematic 5-year analysis. Endoscopy 2016;48:967–978. doi: 10.1055/s-0042-110397.
3. Li HK, Linghu EQ. New endoscopic classification of achalasia for selection of candidates for peroral endoscopic myotomy. World J Gastroenterol 2013;19:556–560. doi: 10.3748/wjg.v19.i4.556.
4. Linghu EQ. A new stage of surgical treatment: Super minimally invasive surgery. Chin Med J 2022;135:1–3. doi: 10.1097/CM9.0000000000001534.
5. Nabi Z, Ramchandani M, Reddy DN. Per-oral endoscopic myotomy and gastroesophageal reflux: Where do we stand after a decade of "POETRY"? Indian J Gastroenterol 2019;38:287–294. doi: 10.1007/s12664-019-00980-5.

How to cite this article: Feng J, Chai N, Zhang W, Li L, Tang X, Zou J, Ye L, Linghu E. Long-term outcomes of peroral endoscopic myotomy with simultaneous submucosal and muscle dissection (POEM-SSMD) for achalasia with severe interlayer adhesions. Chin Med J 2022;135:724–726. doi: 10.1097/CM9.0000000000001971