

Modified peroral endoscopic myotomy: a “Push and Pull” technique

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Received: 21 June 2017 / Accepted: 13 September 2017 / Published online: 19 October 2017
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Abstract

Background Peroral endoscopic myotomy (POEM) is a minimally invasive yet challenging procedure for achalasia. Additional technological innovations and improvements are important for simplifying the procedure.

Methods We report the successful use of a modified POEM procedure, which utilized a “Push and Pull” technique, on a patient with achalasia.

Results Our modifications resulted in a short operation time of only 35 min. No complications arose during or after the procedure, up to a follow-up period of 6 months, and symptoms were significantly and quickly improved.

Conclusions This modified procedure shortens operation time and lowers the difficulty of the operation, while leaving the safety and efficacy uncompromised.

Keywords POEM · Modified procedure · Push and Pull technique

Peroral endoscopic myotomy (POEM) is a minimally invasive treatment for achalasia and has been an increasingly popular option since the concept was first introduced in 2007. Due to its numerous advantages, including less trauma and quicker recovery than other achalasia treatments, in a short period of time the POEM technique has seen widespread use and garnered recognition throughout the world [1]. In August 2010, our center was the first to successfully perform POEM in China. Since then, we have performed over 2500 surgeries using POEM and have developed a modified version using a “Push and Pull” technique. Here, we describe in detail our version of the procedure, which offers several advantages, including simplification of the procedure, reduced complications, and accelerated wound recovery.

Materials and methods

The procedure was performed on a 38-year-old male patient who had been suffering from dysphagia and regurgitation for 3 years. After a diagnosis of achalasia was established by radiographic (Fig. 1) and manometry findings, POEM was performed using a HybridKnife (ERBE Elektromedizin GmbH, Tübingen, Germany) by an experienced endoscopist (Dr. Zhou, P.H.). The scope used was a single-channel gastroscop (GIFQ 260; Olympus Medical Systems Co. Tokyo, Japan). The modified steps used to conduct the procedure were as follows (Fig. 2; Video 1):

Step 1: mucosal incision. The incision point we chose was at the 5 o’clock position in the posterior wall of the esophagus. After the injection of saline mixed with indigo carmine and epinephrine, we made a 2-cm longitudinal incision approximately 10 cm above the esophagogastric junction (EGJ).

Dan-Feng Zhang and Wei-Feng Chen have contributed equally to this paper.

Electronic supplementary material The online version of this article (doi:10.1007/s00464-017-5889-y) contains supplementary material, which is available to authorized users.

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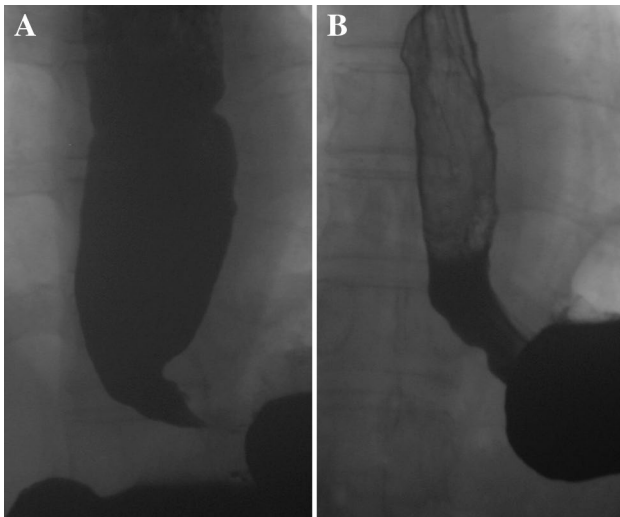


Fig. 1 Barium esophagograms of the patient before and after POEM. **A** Typical “bird’s beak” in the distal esophagus, with a dilated esophagus before POEM. **B** Barium can pass smoothly through the distal esophagus to the stomach

Step 2: submucosal tunnel creation. A submucosal tunnel was created beginning at the incision point, continuing along the longitudinal axis of the esophagus and down toward the cardia, and stopping 3 cm below the cardia, between the mucosal and submucosal layers.

Step 3: full-thickness myotomy under endoscopy. We started myotomy at a position 2 cm below the entry point, and both the circular and longitudinal muscular layers were dissected until 2 cm below the EGJ. For the myotomy, we adopted the following technique, which we named “Push and Pull”: turn the UD knob and cling the longitudinal muscle fibers to the knife, lifting them up toward the esophageal lumen. At the same time, push the scope and cut the muscles. In cases of a confined area, such as cardia, turn the UD knob to bend the angled portion down, pulling the knife and cutting the muscles.

Step 4: mucosal entry closure. After careful hemostasis with soft coagulation, we closed the mucosal incision with several hemostatic clips.

Results

The procedure was uneventful, and the operation time was only 35 min. The patient was observed in the ward and given a liquid diet on postoperative day 1. On postoperative day 2, he was discharged. At the 6-month follow-up, the patient’s symptoms and manometry were significantly improved (Table 1) [2].

Discussion

POEM is a minimally invasive endoscopic treatment for achalasia, and here we report the successful use of a modified version of this technique. Since POEM was first used in human patients in 2008, the technique has developed quickly and the procedure has improved [3]. In our case, we used a modified version of the technique, which differed from traditional POEM with respect to the following aspects:

1. The choice of incision position. We chose a position at approximately 5 o’clock in the posterior wall of the esophagus, instead of the traditional 2 o’clock position, because the former is more convenient when creating the tunnel and performing the myotomy. Specifically, since the instrument channel is directly beneath the visual field in most contemporary endoscopies, when assuming a natural operating posture, the knife will be pointing to the posterior wall of the esophagus; therefore, performing the myotomy after using a 5 o’clock incision position ensures adequate space for a more convenient procedure. In contrast, if we had chosen the traditional incision position, we would have needed to bend the endoscope up and down frequently during the cutting procedure. Having to repeat this action would not only prolong the operating time, but also limit visualization of the operating field. To ensure that the operating field is visible when using the 2 o’clock position, the endoscope would likely have to be adjusted using an unnatural holding posture, which inhibits control of the knife and would be especially problematic for beginners.

Finally, performing an anterior myotomy has the advantage of avoiding damage to the angle of His. To our knowledge, the 5 o’clock incision position does not directly lead to the angle of His either, and a myotomy from the luminal side incurs minimal disturbances of the natural anti-reflux mechanisms around the EGJ, including the angle of His.

2. Full-thickness myotomy. A circular muscle myotomy that preserves the longitudinal muscle bundles is often recommended, but it is difficult to achieve technically. The longitudinal bundles are so thin and delicate that it is almost impossible to protect them from electrical or mechanical injury, and there are several disadvantages of trying to avoid those injuries, including (1) added difficulty to the procedure and a longer operation time, increasing the risk of complications; (2) increased potential for an incomplete myotomy of the inner circular muscle bundles and restricted efficacy of the operation. In contrast, a full-thickness myotomy can significantly shorten the operation time. Thus, we believe that

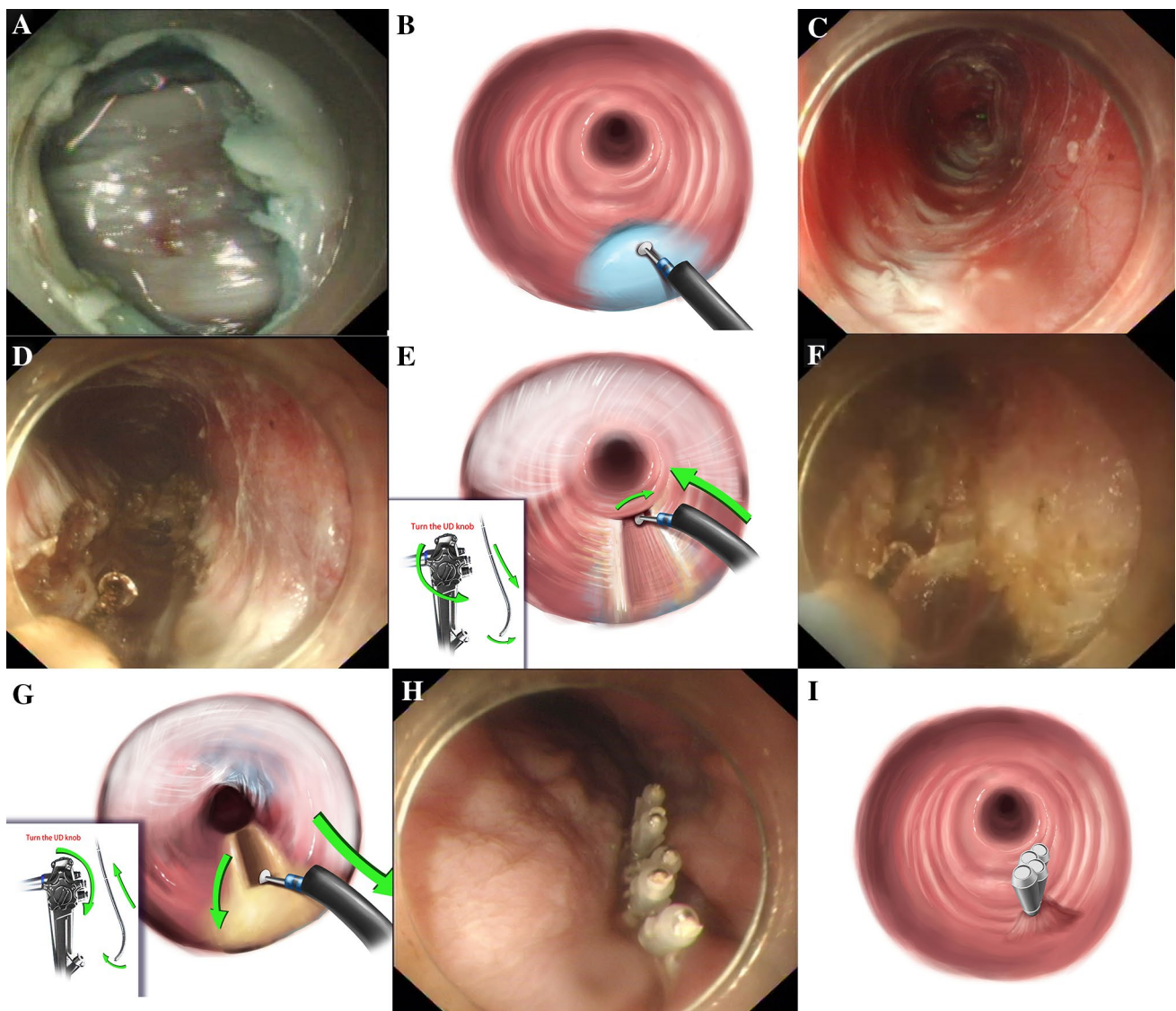


Fig. 2 Main steps of the modified POEM procedure. **A** and **B** Mucosal incision at the five o'clock position of the esophagus. **C** The submucosal tunnel. **D–G** Images representing the procedure for a full-thickness myotomy are shown. **D** and **E** Attach the knife tip to

the longitudinal muscle fibers and lift them up, toward the esophageal lumen, and push the scope to cut the muscles. **F** and **G** Images of a confined area, pulling the knife and cutting the muscles. **H** and **I** Mucosal entry closure

Table 1 Manometry findings and symptom scores before and after POEM

Assessments	Pre-POEM	6-month post-POEM
Lower esophageal sphincter pressure (mmHg)	19.8	9.5
Symptom score		
Dysphagia (0–3)	3	1
Regurgitations (0–3)	3	1
Chest pain (0–3)	3	1
Weight Gain Over 24 Months (kg)	–	20

operating without focusing on avoiding injury to the outer longitudinal bundles is a better choice.

One concern with performing a full-thickness myotomy is that it could potentially increase the risk of post-therapeutic reflux or other complications; however, in our experience, a full-thickness myotomy does not increase the incidence of procedure-related adverse events or clinical reflux complications [4]. In addition, there are natural anti-reflux mechanisms around the EGJ which are important in preventing reflux [5]. Since POEM achieves myotomy from the luminal side, both the full-thickness and circular muscle approaches are associated with only a minimal disturbance of these

mechanisms. Moreover, the elimination of dissection at the level of the diaphragmatic hiatus can help in preserving the phrenoesophageal ligaments, which may help patients undergoing full-thickness myotomy avoid postmyotomy reflux.

Finally, the occurrence of an incomplete myotomy, with potential fibrotic healing, could be a major contributor to postoperative recurrence, and full-thickness myotomy can theoretically reduce symptom remission in the long-term.

3. “Push and Pull” technique. One of the critical components of the “Push and Pull” technique is the maneuver of the endoscopy. Traditionally, performing a myotomy requires continuously adjusting the insertion length of the knife, because (1) the operation site is not in the same plane as the one in which the knife extends; (2) the knife occupies much of the view, and directly pushing the endoscopy could easily result in perforation or hemorrhage. In contrast, the “Push and Pull” technique adopts an incision point at the posterior wall, minimizing the problems above and eliminating the need to frequently adjust the insertion length of the knife. The relatively fixed positions of the knife and the endoscopy enable better control of the knife by maneuvering the scope. It is not necessary to frequently adjust one’s hand, and a continuous cut can be achieved by simply pushing or pulling the scope. While this technique does not increase the risk of the procedure, it can greatly reduce the difficulty and shorten operation time.

In tight areas, like the cardia, we recommend using the “Pull” rather than the “Push” approach. In the confined area of the tunnel, the space between the muscular and mucosal layers is very small. Since “Push” involves an outside-in movement (from the muscular layer to the mucosal layer), whereas “Pull” moves from far to near and inside to out, “Push” has a greater potential for injuring the mucosal layer.

Taken together, compared to the traditional surgery, utilizing the Push and Pull technique can make this step

more fluid and reduce the frequency of knife use, which can shorten surgery time and make the procedure safer for patients. Importantly, the maneuver can be quickly mastered and is convenient to promote.

In conclusion, the novel techniques we applied to the POEM procedure in this case were effective in shortening the operation time and reducing the difficulty of the operation. However, prospective multicenter studies are necessary to more fully evaluate the clinical efficacy.

Acknowledgements Drs. Dan-Feng Zhang, Wei-Feng Chen, Quan-Lin Li, Mei-Dong Xu, Yun-Shi Zhong, Yi-Qun Zhang, and Ping-Hong Zhou have received grants from the Major Project of Shanghai Municipal Science and Technology Committee (16411950400, 14441901500, and 15JC1490300), National Natural Science Foundation of China (81470811 and 81670483), and the Project of Shanghai Municipal Commission of Health and Family Planning (201440393).

Compliance with ethical standards

Disclosures Dan-Feng Zhang, Wei-Feng Chen, Mei-Dong Xu, Yun-Shi Zhong, Yi-Qun Zhang, Quan-Lin Li, Ping-Hong Zhou have no other conflicts of interest or financial ties to disclose.

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