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Peroral endoscopic myotomy for the management of symptomatic cricopharyngeal bar (C-POEM): a case series and video demonstration

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Abstract

Background A cricopharyngeal bar refers to a radiological description of a prominent cricopharyngeal muscle. While these may be incidental, they can lead to significant oropharyngeal dysphagia due to incoordination of the upper esophageal sphincter and true luminal narrowing. Various treatments have been used for the management of cricopharyngeal bar, including botulinum toxin injection, dilation, and surgical myotomy. Cricopharyngeal peroral endoscopic myotomy (C-POEM) is a novel procedure that uses the principles of "third-space" endoscopy to treat symptomatic cricopharyngeal bar.

Methods We report a retrospective case series of 5 patients referred with oropharyngeal dysphagia to 2 UK tertiary referral centers between 2022 and 2023 who subsequently underwent C-POEM. Technical success was defined as completion of all steps of the C-POEM procedure and clinical success as a reduction in the pre-treatment Dakkak and Bennett score to ≤1, or 0 if the pre-treatment score was 1.

Results C-POEM was associated with a technical success of 100% and clinical success of 100% over a median follow up of 2 months (interquartile range 1-8). There was 1 adverse event due to a small mucosal defect and associated leak on barium swallow, which was the result of difficult access during mucosal closure. This was managed conservatively with antibiotics. A step-by-step video demonstration of the procedure is provided.

Conclusion C-POEM offers an alternative upfront therapy for symptomatic cricopharyngeal bar, but should be undertaken by endoscopists with significant experience in third-space endoscopy in view of the difficulty of working within the hypopharynx.

Keywords Cricopharyngeal bar, peroral endoscopic myotomy, cricopharyngeal dysfunction, therapeutic endoscopy

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Introduction

Peroral endoscopy myotomy (POEM) is a minimally invasive procedure of the so called "third space". The overarching principal is creation of a mucosal incision, careful dissection of the submucosal space with electrosurgical knives (i.e., tunneling), myotomy, and finally closure of the mucosal incision [1]. This procedure was originally applied to the treatment of achalasia (E-POEM), and later to Zenker diverticulum (Z-POEM), gastroparesis (G-POEM), and epiphrenic diverticulum (D-POEM) [2]. More recently, it has emerged as a potential treatment for refractory cricopharyngeal bar (C-POEM).

A cricopharyngeal bar refers to a radiological description of a prominent cricopharyngeal muscle [3]. While this may be incidental, it can lead to significant oropharyngeal dysphagia due to incoordination of the upper esophageal sphincter and true luminal narrowing (Fig. 1) [4]. Traditional treatments have included balloon dilatation, botulinum toxin injection,

and surgical myotomy [5]. C-POEM is a new technique that allows careful transection of the cricopharyngeal muscle. Early data from case series are encouraging, with high technical and clinical success rates based on the resolution of symptoms [6,7]. The largest cohort to date is a retrospective series on 27 patients that had a technical success of 100%, clinical success of 100% over a median follow up of 42 months, and an adverse event rate of 7.4% [8]. Here, we report our experience of 5 patients undergoing C-POEM for symptomatic cricopharyngeal bar with a step-by-step video demonstration.

Case series

This was a retrospective case series evaluating the clinical outcomes of 5 patients who underwent C-POEM for symptomatic cricopharyngeal bar, performed by a single operator between 2022 and 2023 at 2 tertiary referral centers within the UK (Cleveland Clinic London and University College London Hospital). A total of 41 patients who had troublesome oropharyngeal symptoms secondary to a suspected anatomical defect of the upper esophageal sphincter on barium imaging were referred for consideration of endoscopic management. Of these, 5 were confirmed to have a cricopharyngeal bar on upper gastrointestinal endoscopy and were included in the study. All 5 cases of symptomatic cricopharyngeal bar went on to have C-POEM. No patient underwent balloon dilatation or surgery.

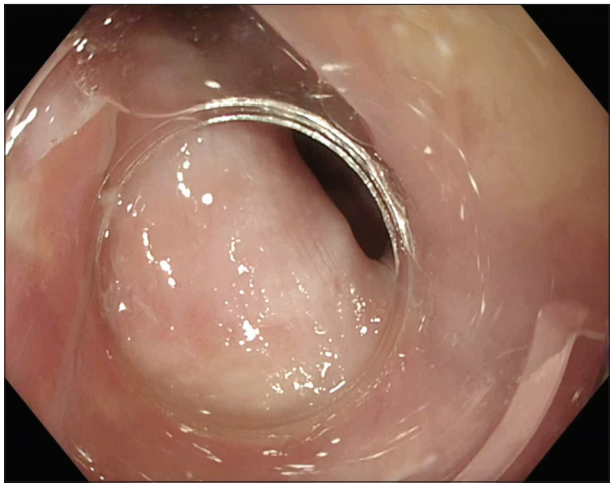

Figure 1 Endoscopic appearance of a prominent cricopharyngeal bar with high-definition white light endoscopy

Table 1 The Dakkak and Bennett dysphagia score

Grade	Characteristics
0	No dysphagia
1	Dysphagia to solids
2	Dysphagia to semi-solids
3	Dysphagia to liquids
4	Aphagia

Primary outcomes

The primary outcomes were technical success, clinical success, and rate of procedure-related adverse events. Technical success was defined as completion of all steps of the C-POEM procedure. Clinical success was defined as a reduction in the pre-treatment Dakkak and Bennett score (DBS) to ≤1, or 0 if the pre-treatment score was 1. DBS is a simple dysphagia score based on the patients' reported symptoms (Table 1). All adverse events were recorded for up to 30 days.

C-POEM procedure

Video 1 demonstrates the C-POEM procedure in 10 steps. The procedure is completed in an endoscopy suite under a general anesthetic. The cricopharyngeal bar is identified and isolated in the hypopharynx with the aid of a transparent distal attachment. The submucosal space is expanded with a submucosal injection using methylene blue or indigo carmine. A small mucosal incision is made using a Dual J knife (Olympus). Submucosal tunnelling is completed for 4-5 cm on the esophageal side, exposing the cricopharyngeus and upper esophageal muscle. The length of the tunnel is important for 2 reasons: first, to improve access for the myotomy, and second, to extend the myotomy distally, preventing the risk of pouch formation or recurrence. A complete myotomy of the cricopharyngeus muscle is completed with the IT NanoKnife (Olympus), which has an insulated tip to provide protection to deeper layers during dissection, and then extended a short distance distally. Residual muscle at the proximal end can be identified and further dissected with electrocautery after submucosal injection to ensure a safe and complete myotomy. The mucosotomy is finally closed with through-the-scope clips (Fig. 2). The patient is admitted overnight for observation and advised to take nil by mouth for 24 h. Patients are discharged the next day and given dietary instructions to follow a liquid diet for 3 days and then pureed diet for 7 days.

Results

A total of 5 patients underwent the C-POEM procedure. The full characteristics of the patients are shown in Table 2. Their median age was 74 years (interquartile range [IQR] 70.5-78.5), 2 (40%) were female, and all patients had a Charlson comorbidity index of 3. The median pre-treatment DBS was 2 (IQR 1.5-3) and 1 patient (20%) had undergone prior intervention. The average procedural time was 40.2 min (95% confidence interval ±20.8), technical success was achieved in 100%, and the median length of stay was 1 day (IQR 1-2.5). Clinical success was achieved in 100% over a median follow up of 2 months (IQR 1.0-8.0). There was 1 adverse event due to a small mucosal defect and associated leak on barium swallow. This was the result of difficult access during mucosal closure that limited further endoscopic intervention. It was

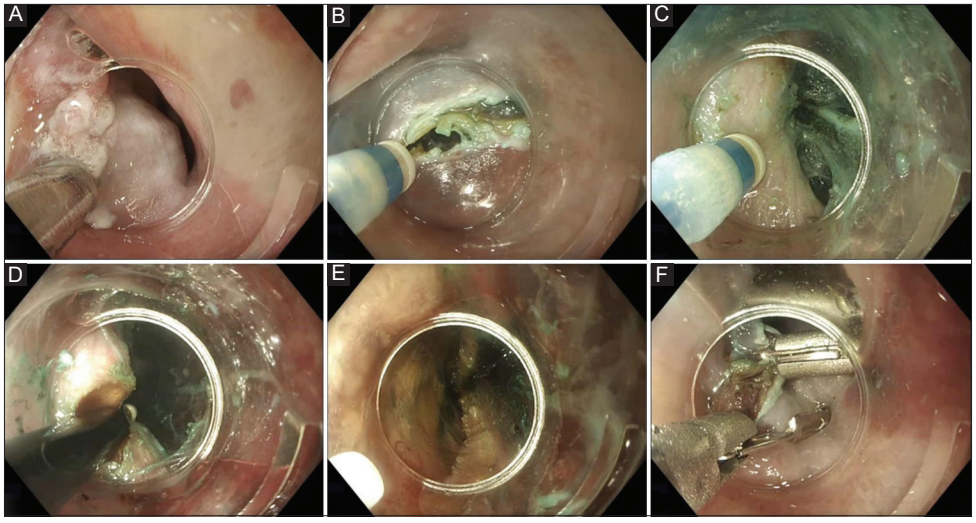

Figure 2 Abbreviated step-by-step guide to performing a cricopharyngeal bar peroral endoscopic myotomy. (A) The cricopharyngeal bar is isolated using a transparent distal attachment and a submucosal lifting agent is injected. (B) A mucosal incision is made directly over the bar with the Dual J Knife. (C) Submucosal dissection is completed on the esophageal side with the Dual J Knife to create a 4-5-cm tunnel. (D) Endoscopic myotomy is performed with the IT NanoKnife, which has a protective insulated tip. (E) The myotomy is extended a short distance distally. (F) The mucosotomy is closed with through-the-scope endoscopic clips

Video 1 Step-by-step demonstration of all steps for performing a cricopharyngeal bar per-oral endoscopic myotomy
URL: https://vimeo.com/906290166/f613567bd4

successfully managed conservatively with 48 h of intravenous antibiotics and observation in hospital before discharge on an oral course.

Discussion

We have demonstrated that C-POEM is a safe and effective treatment option for the management of symptomatic cricopharyngeal bar, with a high rate of technical success. In addition, early follow-up data show that the procedure is associated with good clinical success. C-POEM offers the benefit of a controlled and more complete myotomy of the cricopharyngeal muscle fibers. The endoscopist can directly visualize the dissection, as opposed to balloon dilatation where it is unclear how much the muscular fibers are being disrupted. Balloon dilatation is often used as the first-line intervention, because it is safe (adverse events in ≤5%, often from mucosal tears) [9], can be completed as a day-case, provides acceptable initial relief of symptoms (>80% clinical success), and can be repeated [10]. However, recurrence is common, with 57% requiring repeat dilatation, and 17% proceeding to surgical myotomy in 1 retrospective series [10]. The benefit of an endoscopic approach (e.g., rigid, flexible) is that it mitigates against some of the major risks of surgery, which can include recurrent laryngeal nerve injury, fistula formation, and mediastinitis [11]. Risks from any type of myotomy have been reported to range from 0-39% [9], with the risk of open myotomy 13.6% in 1 study, compared to 7.4% in the largest C-POEM series to date [8,12]. Regarding outcomes, endoscopic myotomy has shown equivalent efficacy, and in 1 report better efficacy, compared to traditional open myotomy [9,12].

Despite this evidence of high technical and clinical success rates, C-POEM can be a challenging procedure, given the tight working space of the hypopharynx. One of our patients, who had previously undergone intervention, had a mucosal leak post-procedure. Leak following C-POEM is one of the major concerns; the risk may be higher in those have undergone previous attempted intervention, because of significant submucosal fibrosis. Therefore, although balloon dilatation is a reasonable alternative, successive dilatations could lead to submucosal fibrosis, making the subsequent myotomy, if required, more difficult. We recognize concerns about C-POEM recently raised by Pittala *et al* [13], who reported 3 cases that all developed an esophageal leak post-endoscopy. They determined that this was due to difficulty working within the hypopharynx and conducting the initial mucosotomy, alongside other technical aspects. We would agree that the most challenging aspect of the procedure is the mucosotomy, which sets the precedent for a successful procedure. It is interesting

Table 2 Characteristics of all patients undergoing cricopharyngeal bar peroral endoscopic myotomy

Patient	Age (years)	Sex	Charlson comorbidity index	ASA grade	Pre-treatment Dakkak & Bennett score	Previous treatment	Operation time (min)	Technical success	Clinical success	Complications 30-days	Follow up (days)
1	79	Male	3	2	3	No	41	1	1	No	365
2	70	Male	3	2	1	No	35	1	1	No	152
3	78	Male	3	1	2	No	21	1	1	No	60
4	71	Female	3	2	3	No	37	1	1	No	62
5	74	Female	3	2	2	Yes*	67	1	1	Yes**	36

**Two attempted radiological dilations*
***Difficult apposition of mucosotomy leading to small mucosal leak on barium. Treated empirically with antibiotics*
ASA, American Society of Anesthesiologists physical status classification

to see that Pittala *et al* [13] started their mucosotomy 2 cm above the bar, whereas we would argue that the mucosotomy should take place directly over the bar to ensure orientation and enable tunnelling down into the esophagus, rather than inadvertently into the pharynx. Use of a conical transparent distal attachment can help within the tight space of the hypopharynx. Placement of endoscopic clips at the end of the procedure can be very challenging, but they are essential to ensure mucosal apposition to prevent leak development. These anatomical considerations of working within the patients' hypopharynx should be considered before embarking on the procedure. Swei *et al* [14], recently reported on their difficulty undertaking C-POEM because of this very issue. They underwent a modified approach with initial cricopharyngeal muscle dissection followed by tunnelling to ensure a complete myotomy, which may help to mitigate against the risk of leak.

When conducting C-POEM, or any intervention of the upper esophageal sphincter, one should consider the potential issues from its disruption. Abnormal upper esophageal sphincter function can lead to troublesome regurgitation, and has been linked to the development of laryngeal symptoms (e.g., hoarse voice, globus) [15]. Nonetheless, there is currently a paucity of data, and these symptoms were not reported by our patients on follow up.

Ultimately, C-POEM offers an alternative upfront therapy for symptomatic cricopharyngeal bar, but should be undertaken by endoscopists with significant experience in third-space endoscopy, in view of the potential difficulty and risk of adverse events. Studies comparing available treatment modalities for cricopharyngeal bar are required to clarify whether C-POEM should be considered the first-line treatment.

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