





## Original research

# Endoscopic management of achalasia cardia: a regional approach for per oral endoscopic myotomy (POEM) in the Northern Region – lessons learnt in developing a service

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## ABSTRACT

**Introduction** Per oral endoscopic myotomy (POEM) for achalasia is available in many but not all areas of the UK; this article maps lessons learnt in bringing POEM to the Northern Region of the UK.

**Novice to independent practice** Over a 6-year period, the journey of the team delivering POEM in the Northern Region is described from inception to independent practice. Both expert trainers and expert nurses visited the team in person and remotely to support training in the POEM procedure.

**Learning structure framework** A learning framework is described with both knowledge and skills required to be able to perform the procedure independently.

**Teams contributing to a safe and high-quality POEM service** The Northern POEM team contributed to the safe and effective delivery of the service. Members of this team are described and their importance and contribution are detailed.

**Outcomes** 38 procedures have been performed, with no major intra-procedural complications. Five conservatively managed leaks occurred at contrast swallow on day 1 post-POEM and one was readmitted with pleural effusion requiring drainage. Four patients required further intervention post-POEM.

**Trainer recommendations** Both technical and non-technical training skills specific to the POEM procedure and generic peer-to-peer advanced endoscopy training are described.

## WHAT IS ALREADY KNOWN ON THIS TOPIC

- ⇒ Per Oral Endoscopic Myotomy (POEM) is a well-recognised and robustly evidenced treatment for Achalasia that is delivered as an option for patients in many but not all areas of the UK.
- ⇒ There is a learning curve for this technique that takes endoscopists from novice to independence that can be successfully achieved with the support of skilled trainers

**Conclusion** To bring the POEM procedure to a region, a team mentality is preferred. Team members (endoscopists, nurses, anaesthetists, multi-disciplinary team, referrers) need to upskill together to provide a safe and effective service. Learning structures and teaching structures and the importance of team members are discussed to support other regions in developing the procedure.

## INTRODUCTION

Per oral endoscopic myotomy (POEM) is a relatively new<sup>1</sup> minimally invasive advanced endoscopic treatment for achalasia cardia. It is a procedure that requires intensive training in third space (submucosal) dissection and myotomy, with a steep learning curve.<sup>2</sup> Conventionally, achalasia cardia in the UK has largely



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**WHAT THIS STUDY ADDS**

- ⇒ This study shows that expert trainers can successfully deliver POEM training first by hands-on supervision then by remote supervision over an approximate 6-year period to establish a high-quality POEM regional service in the UK
- ⇒ We show the endoscopist is one link in the chain of safety and quality of the service, and the support from nursing teams, anaesthetic teams, physiology teams and regional referring clinicians makes the service robust and safe.
- ⇒ This study deconstructs learning the technique into two clearly defined sets of information. POEM endoscopic knowledge and POEM endoscopic skills that are necessary to acquire to become proficient in the technique
- ⇒ This study discusses training techniques for advanced endoscopic procedures and uses the ENTS structure to describe how the learners and the trainers approached training in POEM

**HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY**

- ⇒ This study shows that all regions of the UK can develop a safe and effective POEM service if they are supported by expert trainers and are able to build up a team that supports this service
- ⇒ Performing POEM procedure can be deconstructed to enable endoscopists to work on individual aspects of essential knowledge and skill. This study describes these aspects potentially facilitating other teams to develop POEM in their region

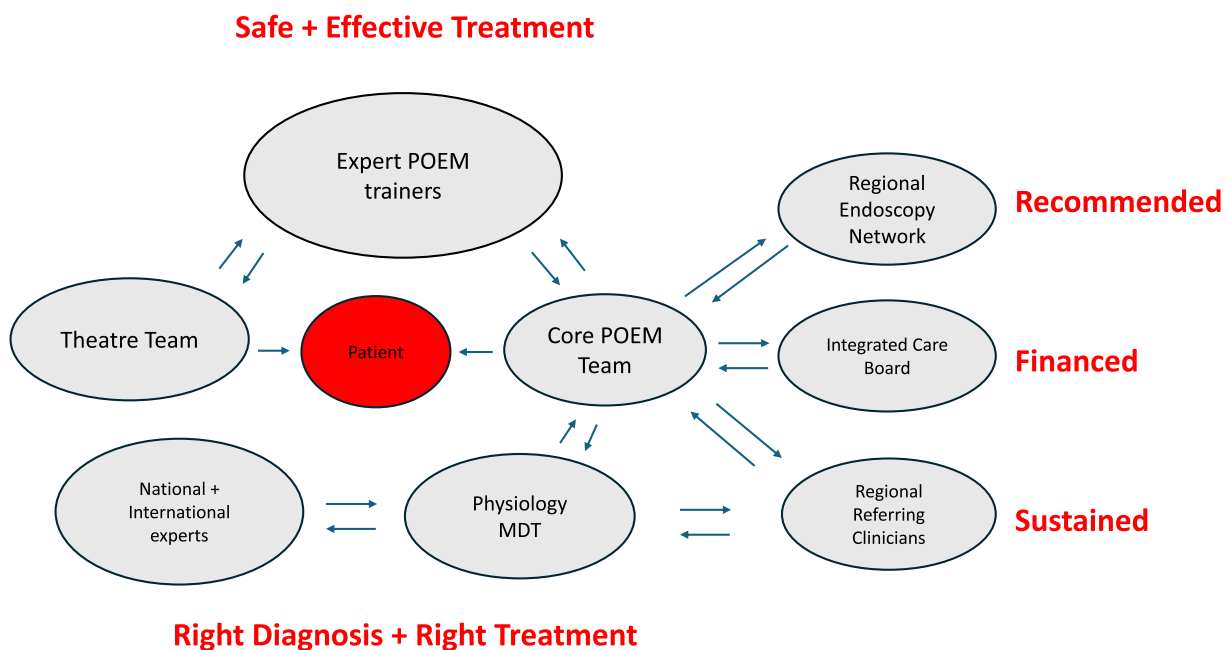
and training journey as a team from inception to delivery of a regional POEM service in the North-east of England. We show our outcomes and describe the important aspects of the multi-disciplinary team (MDT) and engagement with referral teams across the region that in our view makes it possible to create a reliable, resilient and safe regional service with good outcomes comparable to surgical options (figure 1). We propose a framework for a learning structure for the aspiring endoscopist that details the knowledge and skills acquisition required to become independent in POEM. We also discuss the endoscopic non-technical skills (ENTS) for advanced endoscopy for both the learner and trainer, and we discuss procedure-specific, and service-specific lessons learnt in our journey which we hope will provide support for the expansion of this and similar advanced endoscopic procedures to other regions in the UK who are planning on setting up third space endoscopic procedure services.

**JOURNEY FROM NOVICE TO INDEPENDENT PRACTICE OF THE NORTHERN REGIONAL POEM SERVICE**

**Creating the core team, planning training and team development (2018–2020)**

The Northern Regional POEMs endoscopic team was created in 2018 with an upper gastrointestinal (GI) surgeon in the south of the region and two gastroenterologists in the centre and north of the region, respectively. The endoscopy team was mentored by national POEM experts in Nottingham, London and Leeds. The three endoscopists initially attended hands-on courses using cadaveric pig and synthetic models and then visited their mentors to watch live procedures and gain some hands-on training. A monthly Northern Region

been managed by surgical services with laparoscopic Heller’s myotomy (LHM) and a Dor fundoplication. In this paper, we describe our learning experience



**Figure 1** Patient centred care for a regional POEM service.

achalasia MDT was set up with expert physiologists with access to international experts and all potential patients were discussed for agreement of diagnosis and treatment planning. In the first phase of the project, we continued to offer standard care (laparoscopic myotomy) to any patient deemed to be in urgent need of treatment. All other patients were referred to the centres of our trainers (Leeds, Nottingham and London) where we aimed to attend the POEM procedure on the day. Pneumatic dilatation (PD) is a viable option for some patient groups but the evidence of long-term efficacy for both POEM and LHM<sup>3</sup> is much stronger, so we rarely use PD in our practice. We also developed a patient information leaflet discussing all options and presented to regional meetings to engage with referrers in all hospitals in our region to develop patient referral pathways to the service.

#### Training and learning together, developing the wider team and referral pathways, patient engagement and using distance learning platforms (2019–2023)

The first two POEM procedures at our centre were performed by the three local endoscopists under direct supervision of an in-room proctor in April 2019. After these procedures and after all subsequent POEM procedures we had a constructive de-brief from our proctors followed by rigorous reflection on the learning points. During the COVID-19 pandemic, POEM lists were interrupted but soon restarted as the waiting list for patients with symptomatic achalasia built up. In addition to our regional lists, we continued to visit expert centres to gain further experience with hands-on training.

Table 1 shows the number of POEM procedures over the 6-year period. In 2022 after discussion with our mentors, we started a remote proctoring model using a commercially available platform (CHiP from

Surgease, UK) to allow trainers to be in their base unit and watch the procedure being done through a live screen and provide live feedback to procedures performed in our centre. Remote proctoring mode on CHiP allowed live annotation on the screen from our proctors to provide guidance during procedures. During this period, regional television broadcast a TV interview on POEM procedure showing a northeast patient pre- and post-POEM. Patients seem keen to benefit from minimally invasive procedures and have shown no hesitation to travel to the regional surgical centre.

Box 1 shows feedback and personal perspectives from two patients treated with POEM in 2024.

We further engaged with the regional endoscopy network and developed an agreed pathway for patients with achalasia. This included open access to the monthly achalasia MDT and the opportunity for all suitable patients in the region to be offered POEM if they chose.

#### Independent practice, developing referral pathways across the region, developing MDT resilience (2024 onwards)

By 2024, our mentors felt that skill levels had increased sufficiently to perform independent lists. Numbers of patients started rising (see table 1) and lists became more regular. MDT core membership was agreed and two fellows joined the team to support the running of the meetings. The monthly MDT and the POEM service were highlighted to the regional network team and all the physiologists performing HRM in the region were invited monthly and were provided with POEM information leaflets to give to patients with probable achalasia to encourage patient choice and POEM referral.

**Table 1** Outcomes of POEM procedures in the Northern Region

Year	POEM (n)	Pre-POEM Eckardt score median (range)	Post-POEM Eckardt score median (range)	Leak on contrast swallow post-procedure	Post-POEM complications	Further intervention (for achalasia)
2019	3	5 (4–11)	0 (0–4)	0	0	No
2020	2	10 (10)	0.5 (0–1)	0	0	No
2021	8	7 (3–10)	2 (0–4)	0	0	No
2022	8	7 (5–12)	2.5 (0–9)	0	One probable subdiaphragmatic leak post-discharge requiring re-admission and chest drain	X1 pneumatic dilatation x1 POEM re-do
2023	8	10 (5–12)	4 (0–5)	X1 (managed conservatively)	0	X1 planned LHM X1 pneumatic dilatation
2024	9	9 (4–12)	3 (0–4)	X4 (all managed conservatively)	0	No
Total	38	9 (3–12)	3 (0–9)	5	1	4

LHM, laparoscopic Heller's myotomy; POEM, per oral endoscopic myotomy.

### Box 1 Feedback and perspectives from two patients treated with per oral endoscopic myotomy (POEM) in 2024

#### Patient 1

A normal day would consist of me vomiting several times and I would spend a large amount of time hiding this condition from friends, family, children and work colleagues. I also had to deal with weight loss and the physical impact on myself. Instantly following the operation, I have my life back. I feel access to the POEM procedure is so important to people who have this condition.

#### Patient 2

The journey has been a long one. I had my first endoscopy in response to symptoms in September 2020 where I was given a diagnosis of reflux. In early 2023 I asked for a second opinion and further tests confirmed achalasia. Eating, and drinking to some extent, becomes a torture and social interaction becomes difficult. I was very, very fed up. It is now six months after the procedure, and I can say that my achalasia has a minor effect on my life. For me POEM has been a complete success.

Organisational aspects: the theatre team, the MDT team and the regional endoscopy network

#### *Nursing team support*

An operating theatre assistant responsible for the accessories and the wider nursing team is crucial for the success of an operative procedure. This is especially true in the early phase of training when the operator is not fully experienced, is working at the limit of their knowledge and skill level and is under direct supervision of a mentor. POEM experienced nurses from other national centres visited our centre with the national trainers during our second phase of training to upskill our theatre nursing team, with a structured checklist of the instruments needed and advice on their use. This made a significant difference towards our own independence and built up the confidence of the local support team. It is desirable that the assistant can keep an overview of the procedure and identify and correct technical problems when they occur. Predictive nursing is required to be proactively involved in steps ensuring the smooth running of the procedure such as keeping the knife free from coagulum, ensuring CO<sub>2</sub> is supplied, preparation for haemostasis of bleeding vessels with diathermy and the detection and management of pneumoperitoneum.

#### *Anaesthetic team support*

All procedures in our centre have so far been carried out under general anaesthesia in a standard operating theatre environment, as part of a planned general surgery list following routine preoperative assessment.

Oral endotracheal intubation is mandatory due to risks of aspiration at induction given the potential presence of fluid and food in the oesophagus. Standard cardiorespiratory monitoring was used without invasive arterial monitoring in our series though it would be considered in patients with significant comorbidity. Pneumoperitoneum has been the most common complication so far and leads to raised peak airway pressures as well as potential cardiovascular instability. These changes can be managed by alterations in ventilatory parameters and cardiovascular support, but percutaneous abdominal needle decompression is usually the best solution when significant. Following a postoperative stay in recovery all patients in our series were transferred to a ward environment with multimodal analgesia and antiemetics and discharged the following day if gastrografin swallow was satisfactory. Procedures could potentially be completed in an endoscopy suite; however, this would require additional resources to enable general anaesthesia to be given safely in an 'out of theatre environment' but could lead to an expansion of lists that limited theatre slots sometimes restrict.

#### *Expert physiologists and MDT development*

Monthly achalasia MDTs were set up in the first phase of training. These meetings have built teamwork and have helped to ensure the right patients get the right treatment. This includes discussion on the appropriateness of endoscopic rather than surgical options and length of myotomy (short/long) and approach (posterior/anterior). Access to national and international experts has been very important in planning the management of difficult cases. Identification and classification of achalasia with manometry is complex. Provocation tests are important to use appropriately and repeat manometry may be necessary at times.

#### *Regional endoscopy network*

Regional endoscopy networks are developing across the UK to spread best practice and support innovations. The Northern Endoscopy Network supported the development of our regional achalasia pathway so that clinicians and patients across the region were made aware of the POEM service and had access to the procedure for their patients by referring patients to the MDT as clinically appropriate.

#### *Northern Region POEM service outcomes*

There have been 38 POEM procedures in the Northern region to date (table 1). Outcomes show consistent improvement in post-POEM Eckardt scores with overall pre-POEM median score (range) of 9 (3–12) and post-POEM score of 3 (0–9). Contrast studies on day 1 postop showed five minor leaks or extravasation of contrast into the tunnel. All were managed conservatively and

**Table 2** Survey of the most recent 10 patients receiving POEM in the Northern Region

Delay in reaching achalasia diagnosis?	3/10 no; 7/10 yes; mean delay 2 years (1–4 years range)
Were both surgery (LHM) and POEM offered?	10/10 yes
Why choose POEM?	5/10 minimally invasive (no operation) 2/10 best option 1/10 best outcome 1/10 quickest option 1/10 not sure
Immediate symptom improvement post-POEM?	9/10 yes; 1/10 no
Sustained symptom improvement post-POEM?	7/10 yes; 3/10 no
Further treatment for achalasia so far?	10/10 no
Reflux post-POEM?	7/10 no; 3/10 yes
If reflux did it respond to PPI?	2/3 yes
Are you satisfied with your POEM treatment?	10/10 yes
LHM, laparoscopic Heller's myotomy; POEM, per oral endoscopic myotomy.	

were discharged after 5–7 days following a short period of peripheral parenteral nutrition. There was one significant complication of a pleural effusion requiring successful drainage who had a satisfactory contrast study and discharge post-POEM but had to be re-admitted for a probable post-POEM sub-diaphragmatic leak. Four patients did not have significant improvement in their symptoms and required a post-procedure balloon dilatation (two), re-do POEM (one) and LHM (one planned).

We conducted a patient survey of the last 10 patients receiving the POEM procedure this year, see [table 2](#). We found seven of ten had a delay in diagnosis, all were offered surgery or POEM and reasons for choosing POEM included minimally invasive procedure (five), best option (two), best outcome (one), quickest option (one) and one was not sure. Nine of ten had an immediate response and seven had a sustained response. None of the ten patients sampled have needed further intervention so far and three had reflux of which two responded to proton pump inhibitors. All 10 were satisfied with the POEM procedure.

#### Learning structure framework

##### *Technical knowledge and skills acquisition*

To perform the POEM procedure safely and effectively the operator needs to master the knowledge of the submucosal space or 'third space'. The operator must have physical or technical skills to perform the POEM procedure ([box 2](#)). The three operators in our team had different skill sets but worked together to move up the learning curve in a supportive manner. We needed to supplement training opportunities with trips to the trainers' base units. The clinical knowledge needed for POEM has been shown to be easier to acquire than the skills.<sup>4</sup> If endoscopic submucosal dissection is being performed on a regular basis this will often provide many skills required for POEM, such as

the ability to use the transparent hood to get into the submucosal space, perform safe dissection and coagulation of the vessels. Myotomy skills from regular surgical procedures (Heller's procedure) mean that the upper GI surgeon had more experience (and confidence) in how far to cut and was more at ease during this part of the procedure.

##### *ENTS for advanced procedures for learners and trainers*

The importance of ENTS has been recognised since 2004 when it was reported that deficiencies in ENTS significantly contributed to 30-day mortality following therapeutic procedures.<sup>5</sup> ENTS is equally useful in learning basic endoscopy as it is in learning more advanced skills. We used the ENTS system developed by Ravindran *et al*<sup>6</sup> to map the way we learnt POEM and to describe how the trainers approached each teaching session ([box 3](#)).

All three learners tried to attend each session and the incision and tunnel were performed by the first and myotomy by the second. This meant fatigue was avoided and there was a natural break once the tunnel had been made. After each session, the learners reflected together on performance, progress and learning outcomes. Successes and areas of improvement were shared and used in a positive manner. Later, each learner performed the whole procedure as skill and confidence levels rose. Finally, the core team of endoscopists took steps to develop the whole team with expert nurses visiting to upskill the theatre team and the physiology team engaged national and international experts.

Four expert POEM trainers came to our unit for individual sessions on multiple occasions throughout the first and second training periods. An informal meal allowed for discussion of progress and previous difficulties and helped to break down barriers. On the day of the procedure the trainer ensured equipment and team members were

**Box 2 Knowledge and skills to master per oral endoscopic myotomy (POEM)****Knowledge to master for POEM****Incision**

Anterior (1 o'clock) or posterior (5 o'clock).

Horizontal, diagonal or vertical incision and how long.

Where to dissect the submucosa after initial incision to allow hood entry.

**Dissection**

How close to the muscle does the dissection need to be (lower third, sm3 of the submucosa)?

How to keep a reverse 'C' orientation of muscle (3 o'clock) and mucosa (9 o'clock).

Know how wide to make the tunnel (parallel rather than conical).

Recognise perforating vessels at gastro-oesophageal junction (GOJ) and know how to dissect and when to treat.

**Myotomy**

Keep orientated to allow myotomy to be straight.

Know how deep to cut and recognise circular/longitudinal fibres, serosa and mediastinum.

**Closure**

Know where to place the clip before the incision so tissue is 'heaped up' equally.

**Physical skills to master for POEM**

Use the endoscopic submucosal dissection knife and diathermy foot pedal in tandem to cut through tissue.

Placing the knife where it is intended (nondynamic).

Moving the knife while cutting tissue (dynamic).

Use the conical cap to wedge the tip of the scope into the incision to enter the submucosa.

Use the cap and scope tip to apply tension on the submucosa for dissection.

Use cap and then coag grasper to temporise and then control bleeding.

Place the first clip (at closure) so that tissue is heaped up before the start of incision.

Place subsequent clips ensuring mucosa does not over or under-run tissue suture line.

fully prepared. Once the procedure was started timely advice was given and an assessment of progress was made 'over the shoulder' by the trainers. Taking over the scope was communicated clearly with verbal cues and physical demonstration of a skill that needed development.

Dual task interference is characterised by the learner becoming saturated with usually quite simple tasks but unable to attend to them all. At this point, learning is diminished and control of the procedure reduces, and the learner will struggle to follow the trainer. Keeping the mental tasks for the learner to a minimum and maintaining slow careful progress is essential. All the trainers showed highly developed ENTS in supporting the learners and

**Box 3 Endoscopic non-technical skills (ENTS) for learners and trainers of advanced endoscopic procedures****ENTS for learners of advanced endoscopic procedures***Teamwork and communication*

Shared learning (openness to feedback, ability to reflect and change practice).

Support all members of the team to upskill.

*Judgement and decision-making*

Pre-brief of each learning experience with review of previous lessons learnt.

Critical reflection of decisions made.

*Situation awareness*

Aware of fatigue and training pathway.

Aware of barriers to skills improvement and specific interventions taken (model work to emphasise learning points).

*Leadership*

Cooperation and leadership of core team and wider team.

**ENTS for trainers of advanced endoscopic procedures***Teamwork and communication*

Preparation of training environment.

Breakdown of barriers to communication.

*Judgement and decision-making*

Taking over the scope.

To deconstruct or to persevere.

*Situation awareness*

Hope for the best, plan for the worst

Dual task interference.

*Leadership*

Supporting others.

Lifelong learning.

were also able to develop their own teaching skills as well in the process.

*Comparison of other learning frameworks*

Learning frameworks for POEM have been described. Shiwaku and Inoue<sup>7</sup> from Japan describe at least a 12-month training period and a well-structured learning framework. He described the first 2 months of observing and assisting with the procedure focusing on basic principles. After this, the learner starts performing POEM on cases such as straight type and type II achalasia and once proficient in these cases moving on to more complex cases with direct supervision at all times. Single operator experience without the benefit of constant expert supervision in the west has been described with thresholds for efficiency (between 20 and 40) and mastery (>60).<sup>8</sup> Liu *et al*<sup>2</sup> in China retrospectively reviewed 1346 POEM procedures and found technical failures and adverse events declined after 100 procedures. The UK has neither

the benefit of such high numbers nor the access to levels of direct supervision compared with other countries. As more UK regional centres develop POEMs technique, supervision for new learners should be more readily available.

*POEM procedure lessons and POEM service lessons learnt in developing a regional service*

#### POEM procedure lessons

**Box 4** Preparation as the foundation of success is as true for POEM as for any complex endoscopic procedure. Equipment that makes POEM easier: a conical hood (eg, Fujifilm ST 28GR), Erbe waterjet or hybrid knife, coagulation forceps; high-definition slim endoscope; Precise-Set setting on the ERBE Vio3. Reliable delivery of CO<sub>2</sub> insufflation is mandatory. Decompression of pneumoperitoneum with a Verres needle is an essential technique with which to become familiar. The oesophageal injection of fluid at the start should be at least 5–10 mL and early entry into the submucosal space is important as delay adds difficulty as the submucosal fluid cushion dissipates. It is important to stay close to muscle when dissecting in the submucosal space despite natural reservations. Moving towards the mucosa risks losing orientation (as the white muscle drifts out of view, spiralling can occur), thermal injury to the mucosa (risking perforation) and build-up of submucosal tissue above the muscle also makes myotomy harder as coagulum can build up. Orientation is paramount in POEM and expert supervision is vital during the early phase of training. Determining where to dissect at the GOJ is challenging. Using the hood to stretch the narrow submucosal space is important at this point. Avoid ‘reaching’ the knife ahead of the hood as this increases the risk of perforation. Ensure the dissection goes at least 2 cm into the stomach to allow a myotomy to extend beyond the GOJ. Keeping the myotomy at the centre of the dissected plane is recommended.

#### POEM service lessons

Interpreting high-resolution manometry, with the support of an experienced oesophageal physiologist and access to international experts when needed is essential. Funding for this service is challenging but regional integrated care board engagement can support this. Spreading the word around the region and gaining the confidence of the referrers to offer the POEM procedure to patients and to refer is a gradual process. The more procedures are done the more efficient the service is likely to become. Getting to the point where POEM lists are done monthly or even weekly makes a fledgling service into a much more robust one.

## CONCLUSION

This article describes our experience in developing and delivering an advanced third space endoscopic

### Box 4 Lessons learnt in developing a per oral endoscopic myotomy (POEM) service

#### POEM procedure lessons

##### Preparation

Ensure all kit is available: CO<sub>2</sub>/pump for knife/flushing knife/high-definition scope.

Initial submucosal injection

Ensure optimal submucosal injection pre-incision (5–10 mL of injection).

Submucosal level of dissection

Keep dissection close to the muscle (lower third).

Maintain orientation within and shape of the tunnel

Keeping close to the muscle maintains orientation and keeps the tunnel parallel.

Be ready and able to decompress pneumoperitoneum

Awareness of pneumoperitoneum and decompression with a Verres needle is essential.

#### POEM service lessons

Develop regular multi-disciplinary team meetings as a forum to discuss cases and to facilitate referrals.

Engage integrated care board and regional referrers in the service.

Aim to increase volume to improve outcomes to monthly lists.

regional service in the UK. We show that the outcomes are safe and effective with appropriate supervision and mentorship. We believe that it embodies the concepts of adult learning for both the developing team and the expert trainers. It also emphasises the need to build a POEM team and the importance of ENTS as adjuncts to the safe conduct of such procedures. We hope that our model will support other learners and trainers following a similar pathway in other regions of the UK for the next generation of advanced therapeutic endoscopists.

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GF and A Davidson wrote the physiology section. JB wrote the preliminary draft around these contributions and performed the survey. IB and WR acquired the data for the POEM outcome section. WR created the figure. NM, BH, MB and JC acted as expert trainers and attended POEM procedures in the Northern region in person and remotely. ADhar and YV edited the initial draft and all authors contributed to editing the subsequent drafts and the final manuscript.

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