Introduction

Achalasia, a neurodegenerative motility disorder, is characterized by incomplete relaxation of the lower esophageal sphincter (LES), and to some extent, a lack of peristalsis of the tubular esophagus, resulting in a series of symptoms, including dysphagia, regurgitation, chest pain, and weight loss [1]. Peroral endoscopic myotomy (POEM) is an innovative endoscopic alternative to Heller myotomy for the treatment of achalasia. Since POEM was first performed in Japan in 2008 [2], it has been adopted with enthusiasm by endoscopists around the world. The indications for POEM have expanded from patients with simple achalasia to those with advanced sigmoid esophagus [3–5], failed surgical myotomy [6–9], and previous endoscopic treatments [10, 11].

Submucosal fibrosis in achalasia patients is a rare cause of aborted peroral endoscopic myotomy procedures

ABSTRACT

Background and aims Peroral endoscopic myotomy (POEM) is now an established treatment for esophageal achalasia. The standard protocol ensures a smooth operation in most patients, but technical challenges and failures exist and little is known about the incidence, causes, and impact of aborted procedures. Here, using a large patient cohort, we attempted to answer these questions.

Methods All patients admitted for planned POEM between August 2010 and July 2015 underwent chart review. Aborted POEM was defined as the inability to finish the procedure after submucosal injection. The cause of the failure, clinical course, management, and follow-up data were analyzed.

Results Thirteen of the 1693 POEMs (0.77%) were aborted. Out of the 13 failures, 12 (92.3%) were due to severe submucosal fibrosis, which precluded tunneling, and one (7.7%) was due to atrial fibrillation related to the electric current of the endoscopic knife. Submucosal fibrosis, prior Heller myotomy, and age (≥60 years) were related to technical failure, while a disease duration of ≥6 years, sigmoid esophagus, mucosal edema, and prior interventions were risk factors for the presence of fibrotic changes. In turn, fibrosis was correlated with a prolonged operation, longer hospital stay, more mucosal injuries, and more major perioperative adverse events. Finally, the yearly frequency of aborted POEMs decreased after the second year as operators became more experienced.

Conclusions Aborted POEM is a rare event and is largely due to the presence of submucosal fibrosis, which not only causes increased procedural difficulties, but also gives rise to major adverse events.
Over 5000 POEMs have been performed worldwide, with limited numbers of aborted procedures formally reported [12–20]. Although rare, aborted procedures represent the extreme of a continuous spectrum of technical challenges. Little is known about the incidence, causes, and sequelae of POEM technical failures, and an in-depth analysis of these cases may allow a better understanding of the procedure, as well as the disease. Accordingly, the aim of this study was to analyze the incidence, causes, impact, and management of technical failures of POEM.

Methods

Study design, POEM protocol, and aborted procedures

A retrospective review of the prospectively maintained database was carried out for all patients admitted for planned POEM between August 2010 and July 2015. A standard POEM procedure is reported in our previous publications [21] and involves: (i) submucosal injection and mucosal incision at the posterior wall (5–6 o’clock) about 10 cm above the esophageal–gastric junction (EGJ), unless this site is judged unfavorable (e.g. previous POEM or Heller myotomy); (ii) submucosal tunneling; (iii) myotomy, starting about 2 cm down from the mucosal incision and extending 2–4 cm into the cardia; (iv) closure of the mucosal incision and mucosal injury, if present.

Aborted POEM was defined as the inability to finish the procedure after submucosal injection. These patients did not receive standard follow-up at our center [4, 7, 13, 22], which would include clinical follow-up at 1, 3, 6, and 12 months, and yearly thereafter, as well as objective testing, including barium swallow, manometry, and endoscopy, at a lesser frequency. Instead, they underwent a single phone interview at the time of this study.

Major perioperative adverse events (mAEs)

We applied the same definition of mAEs as was used in our previous publication [23]: vital-sign instability, hospital readmission, intensive care unit stay, conversion to open surgery, blood transfusion, invasive postoperative procedure, or prolonged (>5 days) hospitalization due to functional impairment of the patient.

Risk factors

Risk factors including demographic data, duration of disease, sigmoid esophagus, mucosal edema, and prior treatment history were extracted and categorized according to our previously used protocol [23]. Mucosal edema was defined as the presence of abnormal surface texture and/or increased cutting-edge thickness, and was classified into two grades based on severity. Mucosal injuries were separated into two types according to the difficulty of their repair [23].

Submucosal fibrosis was defined as the presence of poor mucosal lifting at injection, fibrotic and sclerotic tissues in the submucosal space, adhesion between mucosa and muscle, or thickened and disarrayed muscle fibers. In addition to what was recorded in the original endoscopic report, two endoscopists who were blinded to the patient’s history also reviewed images and videos taken during the procedure.

Statistical analysis

Categorical data were analyzed using Fisher’s exact test (α = 0.05, two-sided) and/or logistic regression, as appropriate. Continuous data were analyzed using a Student’s t test or Mann–Whitney U test, as appropriate. All analyses were made in IBM SPSS statistics 22.0 (IBM Corp., Armonk, New York, USA).

Results

Patient characteristics

A total of 1701 patients were admitted to our center for planned POEM between August 2010 and July 2015. Of these, eight were canceled because of unfavorable preoperative conditions (e.g. poor coagulation function, persistent pneumonia, or recent cerebral vascular accident) and were excluded from further analysis. Of the remaining 1693 patients, the procedure was successfully completed in 1680 and was not completed in 13 (▶Fig. 1). The median age of the 1693 patients was 38 years; their median disease duration was 4 years (range 1 month–60 years); 135 patients (8.0 %) showed sigmoid esophagus; and 441 (26.0 %) had received previous treatment.

For the 13 patients in whom POEM was aborted, median age was 48 years; median disease duration was 6 years (range 6 months–40 years); three patients (23.1 %) showed sigmoid esophagus; and eight (61.5 %) had received previous treatment. Eleven of the incomplete procedures were due to severe submucosal fibrosis and subsequent tunneling failure. One aborted procedure was due to fibrosis and altered esophageal anatomy following Heller myotomy, which led to both tunneling and myotomy failure. In addition, there was one failure due to atrial fibrillation that was related to the electric current of the endoscopic knife. Details of the 13 patients who experienced aborted POEMs are displayed in ▶Table 1.
Table 1. Clinical details of the 13 patients who experienced aborted peroral endoscopic myotomy (POEM) procedures.

<table>
<thead>
<tr>
<th>Patient number</th>
<th>Age; sex</th>
<th>Disease duration, years</th>
<th>Prior treatment</th>
<th>Sigmoid esophagus</th>
<th>Mucosal edema</th>
<th>Reason for incomplete procedure</th>
<th>Salvage treatment</th>
<th>Follow-up time, months</th>
<th>Preoperative Eckardt score</th>
<th>Recent Eckardt score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>69; female</td>
<td>3</td>
<td>Dilation</td>
<td>No</td>
<td>No</td>
<td>Submucosal fibrosis → failed tunneling(^1)</td>
<td>Stent</td>
<td>1</td>
<td>7</td>
<td>Unknown</td>
</tr>
<tr>
<td>2</td>
<td>34; female</td>
<td>25</td>
<td>Heller myotomy</td>
<td>No</td>
<td>No</td>
<td>Submucosal fibrosis → failed tunneling(^2) and second tunnel attempt also failed</td>
<td>Re-POEM</td>
<td>48</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>38; female</td>
<td>0.5</td>
<td>Dilation</td>
<td>No</td>
<td>No</td>
<td>Submucosal fibrosis → failed tunneling(^3)</td>
<td>Unknown</td>
<td>Lost</td>
<td>7</td>
<td>Unknown</td>
</tr>
<tr>
<td>4</td>
<td>55; male</td>
<td>5</td>
<td>Heller myotomy</td>
<td>No</td>
<td>No</td>
<td>Submucosal fibrosis → failed tunneling(^2)</td>
<td>Dilation</td>
<td>23</td>
<td>6</td>
<td>Unknown</td>
</tr>
<tr>
<td>5</td>
<td>48; female</td>
<td>20</td>
<td>Stent</td>
<td>No</td>
<td>Yes</td>
<td>Submucosal fibrosis → failed tunneling(^3) and second tunnel attempt also failed</td>
<td>Heller myotomy</td>
<td>45</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>40; female</td>
<td>3</td>
<td>None</td>
<td>Yes</td>
<td>Yes</td>
<td>Submucosal fibrosis → failed tunneling(^3)</td>
<td>Unknown</td>
<td>Lost</td>
<td>6</td>
<td>Unknown</td>
</tr>
<tr>
<td>7</td>
<td>37; male</td>
<td>19</td>
<td>None</td>
<td>Yes</td>
<td>Yes</td>
<td>Abnormal anatomy and fibrosis → failed tunneling and myotomy(^4)</td>
<td>Dilation and diaphragmatic hernia repair</td>
<td>39</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>60; female</td>
<td>18</td>
<td>Heller myotomy</td>
<td>Yes</td>
<td>No</td>
<td>Submucosal fibrosis → failed tunneling(^1)</td>
<td>None</td>
<td>35</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>30; male</td>
<td>3</td>
<td>Stent</td>
<td>No</td>
<td>No</td>
<td>Submucosal fibrosis → failed tunneling(^1)</td>
<td>Unknown</td>
<td>2</td>
<td>6</td>
<td>Unknown</td>
</tr>
<tr>
<td>10</td>
<td>47; male</td>
<td>6</td>
<td>None</td>
<td>No</td>
<td>Yes</td>
<td>Submucosal fibrosis → failed tunneling(^1)</td>
<td>None</td>
<td>30</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>11</td>
<td>65; female</td>
<td>40</td>
<td>None</td>
<td>No</td>
<td>Yes</td>
<td>Submucosal fibrosis → failed tunneling(^1)</td>
<td>Unknown</td>
<td>2</td>
<td>6</td>
<td>Unknown</td>
</tr>
<tr>
<td>12</td>
<td>59; male</td>
<td>10</td>
<td>None</td>
<td>No</td>
<td>No</td>
<td>Submucosal fibrosis → failed tunneling(^1)</td>
<td>None</td>
<td>22</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>13</td>
<td>68; female</td>
<td>3</td>
<td>None</td>
<td>Yes</td>
<td>Yes</td>
<td>Atrial fibrillation</td>
<td>None</td>
<td>42</td>
<td>9</td>
<td>6</td>
</tr>
</tbody>
</table>

\(^1\) Failed tunneling at the lower esophagus because of fibrosis.
\(^2\) Failed tunneling at the lower esophagus because of fibrosis.
\(^3\) Failed tunneling at the incision because of severely edematous, erosive, or sclerotic mucosa, and poor lifting after injection.
\(^4\) Prominent fibrosis was noted during tunneling and the operator performed concurrent tunneling and myotomy until 3 cm above the esophageal–gastric junction, where hypertrophic and sclerotic muscle fibers, as well as altered anatomy and loss of normal landmarks, forced the operator to abort the procedure.
Submucosal fibrosis and other risk factors

Univariate logistic regression showed that submucosal fibrosis (odds ratio [OR] 191.52 [95% confidence interval (CI) 24.65–1487.8]), prior Heller myotomy (OR 14.80 [95% CI 4.40–49.69]), mucosal edema (OR 8.74 [95% CI 2.90–26.33]), and age (≥60 years; OR 4.34 [95% CI 1.32–14.26]) were associated with aborted POEM (▶Table 2).

Multivariate forward logistic regression further determined submucosal fibrosis (OR 165.51 [95% CI 20.89–1311.26]), prior Heller myotomy (OR 6.25 [95% CI 1.52–25.71]), and age (≥60 years; OR 5.09 [95% CI 1.27–20.41]) to be risk factors for aborted POEM (▶Table 2).

Severe submucosal fibrosis was the primary cause for aborted POEM. Therefore, the 111 patients with submucosal fibrosis were further analyzed as a subgroup. The median age of the group was 39 years; their median disease duration 6 years (range 3 months–40 years); 22 patients (19.8%) presented with sigmoid esophagus; and 58 (52.3%) had received previous treatment of any type (dilation, botulinum toxin injection, stent placement, Heller myotomy, or POEM) to be risk factors for aborted POEM (▶Table 3). Typical manifestations of fibrosis are shown in ▶Fig. 2.

Upon POEM completion, we found that patients with submucosal fibrosis sustained more mucosal injuries (P<0.001), underwent longer POEM procedures (P<0.001), and had a longer hospital stay following the procedure (P<0.001) (▶Table 4; available online). In addition, there appeared to be more mAEs (6/99) in these patients, but the difference was not statistically significant (6.1% compared with 3.0%; P=0.13; ▶Table 4; available online).

A comparison of the three patient groups (all 1693 patients who underwent POEM, the 99 patients with submucosal fibrosis whom POEM was completed, and the 12 patients with submucosal fibrosis in whom POEM was aborted) is displayed in ▶Table 5 (available online).

We found that a long duration of disease (≥6 years), sigmoid esophagus, mucosal edema, and prior treatment of any type (dilation, botulinum toxin injection, stent placement, Heller myotomy, or POEM) were risk factors for submucosal fibrosis (▶Table 6). It is extremely unlikely for a patient without any of the above risk factors to have fibrosis (P<0.01).

Under multivariate forward regression analysis, sigmoid esophagus (OR 1.84 [95% CI 1.04–3.27]), mucosal edema (OR 5.26 [95% CI 3.23–8.56]), prior esophageal stent (OR 3.14 [95% CI 1.53–6.42]), prior botulinum toxin injection (OR 2.27 [95% CI 1.11–4.65]), prior Heller myotomy (OR 3.68 [95% CI 1.73–7.81]), and prior POEM (OR 12.18 [95% CI 4.87–30.45]) were confirmed to be risk factors for submucosal fibrosis (▶Table 6).

Perioperative management, hospital course, and follow-up

Salvage dilation before discharge was recommended for selected patients in whom POEM had been aborted, but none were performed according to the preference of the patient or their family. Patients with aborted POEM typically did not require special management and stayed in the hospital for a median of 2 days (range 1–5 days). Importantly, none of the 13 patients with aborted POEM developed perioperative mAEs.

Phone interviews for all 13 patients were carried out between June and August 2016. Seven patients were successfully
contacted, of whom four did not receive any further intervention. One patient underwent repeated POEM, one underwent Heller myotomy, and another underwent an unclear surgical procedure (diaphragmatic hernia repair according to the patient, no other details were available). All seven patients reported stable or improved Eckardt scores during their recent follow-up (Table 1).

One patient had undergone pneumatic dilation 23 months postoperatively and reported having had symptom relief soon afterward, but was later lost to follow-up.

### Discussion

Studies on technical failures of medical procedures are difficult for various reasons. In particular, routine patient follow-ups are not easy to carry out, largely because it is hard to convince patients of the benefit. However, these failures provide important lessons both about managing challenging situations and the natural history of the disease.

We performed a literature review to determine the frequency of aborted POEM. We found limited data regarding aborted POEM [12–20] (Table 8), but, in studies that did report a figure, the rate of incomplete POEMs was low (1.2%–6.0%). Wide availability of proctorship may have contributed to the overall high rate of technical success, but a publication bias is also likely.

We determined that submucosal fibrosis is the most common direct cause of technical failure of POEMs and this is often a result of past interventions. We found that any type of intervention could cause fibrosis, including the seemingly benign pneumatic dilation and botulinum toxin injection. Esophageal stenting is rarely used in Western countries, but is frequently used in China for temporary relief in patients who are resistant to treatment. Nonetheless, it can cause very severe esophageal wall inflammation and long-term fibrosis.

Surprisingly, prior POEM and Heller myotomy are important risk factors for fibrosis. In theory, these two treatments should cause only local fibrosis, which can be observed by the operator and avoided during POEM. However, at least for POEM, it is not uncommon to see the tunnel spiraling unexpectedly in patients with dilated or sigmoid esophagus, which can lead to a wide and hard-to-avoid area of fibrosis. Finally, surgery may also cause inflammation in the esophageal wall that is not limited to the myotomy line.

Other studies have shown that past interventions do not affect successful performance of POEM or decrease its benefits [10, 11]. However, there is also evidence that patients with a history of interventions may require a longer operation time [10], which is most likely caused by difficulty in tunneling. Apart from past interventions, patients with long-standing disease and severe food stasis often have severe esophageal wall inflammation (demonstrated by mucosal edema), and this can also cause submucosal fibrosis. This fact was supported by our multivariate analysis, which showed that sigmoid esophagus and mucosal edema are risk factors for fibrosis.

When tunneling is difficult because of fibrosis, a second incision and tunneling at another location can be attempted. This

### The technical learning curve

A Fisher’s exact test showed no significant yearly difference in the frequency of patients with submucosal fibrosis (P=0.18), but did indicate a significant difference in the frequency of aborted procedures (P=0.04). No incomplete procedures occurred during the first year in which POEM was performed; the occurrence of incomplete procedures reached a peak in the second year and slowly decreased in subsequent years (Table 7; available online).
was performed in two of the 12 patients with fibrosis-related incompletions in our cohort, but proved futile in the end. A second tunnel was not performed in other patients for three reasons. Firstly, the location of the tunnel was always chosen carefully to avoid the most severely fibrotic parts, especially for patients with past interventions or apparent anatomical alterations. As a result, it was unlikely that a second tunnel would see less fibrosis than the first. Secondly, the long duration of the procedure or other factors, such as severe mucosal injuries, made the operator believe another attempt was not appropriate. Finally, the fibrosis was judged to be diffuse rather than limited.

When creating proper submucosal working space seems impossible, concurrent tunneling and myotomy [24], or tunnel-free POEM [25] can be considered. This was performed in one of the patients in whom POEM was aborted in our cohort but was not successful because of the severely hypertrophic and disarrayed muscle fibers, as well as altered anatomy at the EGJ. Salvage pneumatic dilation immediately after aborted POEM can be attempted if only a short length of tunnel was created and if there is no mucosal or muscle injury. This was recommended to selected patients in our cohort, but was refused by the patients or their families.

Understandably, operator experience plays a role in carrying the procedure to a successful end and one might expect that more failed procedures might occur during the operator’s first years, rather than in later years. Although none of the aborted POEMs in our cohort occurred during the first year, this may be explained by a narrower selection of patients shortly after adoption of the procedure. From the second year on, yearly occurrence of incomplete procedures slowly decreased and none occurred during the fifth year.

Fig. 2 Endoscopic images showing: a poor mucosal lifting at injection; b edematous mucosa in a dilated and curved esophagus; c fibrotic and sclerotic tissues encountered during tunneling; d hypertrophied esophageal muscles.

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### Tab. 6 Logistic regression analysis of risk factors for esophageal submucosal fibrosis.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Univariate</th>
<th>Multivariate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Odds ratio (95% confidence interval)</td>
<td>P value</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>---------------------------------</td>
<td>-----</td>
</tr>
<tr>
<td>Sex</td>
<td>1.31 (0.89–1.94)</td>
<td>0.17</td>
</tr>
<tr>
<td>Age ≥ 60 years</td>
<td>1.30 (0.71–2.37)</td>
<td>0.40</td>
</tr>
<tr>
<td>Duration ≥ 6 years</td>
<td>2.07 (1.40–3.06)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Sigmoid esophagus</td>
<td>3.21 (1.94–5.32)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mucosal edema</td>
<td>5.84 (3.77–9.06)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Prior balloon/bougie dilation</td>
<td>1.73 (1.11–2.70)</td>
<td>0.02</td>
</tr>
<tr>
<td>Prior esophageal stent</td>
<td>2.89 (1.47–5.68)</td>
<td>0.002</td>
</tr>
<tr>
<td>Prior botulinum toxin injection</td>
<td>2.74 (1.40–5.37)</td>
<td>0.003</td>
</tr>
<tr>
<td>Prior Heller myotomy</td>
<td>4.55 (2.32–8.94)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Prior POEM</td>
<td>8.63 (3.72–20.00)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

POEM, peroral endoscopic myotomy; N/A, not applicable; NS, not significant.

### Tab. 8 Studies identified in a literature review that reported on aborted peroral endoscopic myotomy (POEM).^1^.

<table>
<thead>
<tr>
<th>Study</th>
<th>Country</th>
<th>Aborted POEM, n (%)</th>
<th>Possible cause of incomplete procedure</th>
<th>Perioperative adverse event</th>
<th>Salvage treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yang (n=52) [14]</td>
<td>America</td>
<td>2 (3.8 %)</td>
<td>Submucosal fibrosis and failed tunneling</td>
<td>None</td>
<td>Dilation</td>
</tr>
<tr>
<td>Yuan (n=61) [16]</td>
<td>China</td>
<td>1 (1.6 %)</td>
<td>Submucosal fibrosis and failed tunneling</td>
<td>None</td>
<td>Heller myotomy</td>
</tr>
<tr>
<td>Worrell (n=35) [17]</td>
<td>America</td>
<td>1 (2.9 %)</td>
<td>Large submucosal vessels and a tortuous distal esophagus in a Jehovah’s witness</td>
<td>None</td>
<td>Heller myotomy</td>
</tr>
<tr>
<td>Ramchandani (n=220)</td>
<td>India</td>
<td>8 (3.6 %)</td>
<td>Submucosal fibrosis and failed tunneling (n=6) Inadvertent mucosal incision enlargement (n=2)</td>
<td>Mucosal laceration</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Familiari (n=100)</td>
<td>Italy</td>
<td>6 (6.0 %)</td>
<td>Submucosal fibrosis and failed tunneling (n=5) Long tear of the mucosa (n=1)</td>
<td>Mucosal laceration</td>
<td>Dilation</td>
</tr>
<tr>
<td>Werner (n=241) [20]</td>
<td>Germany and Italy</td>
<td>3 (1.2 %)</td>
<td>Submucosal fibrosis and failed tunneling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wu (n=1693)</td>
<td>China</td>
<td>13 (0.8 %)</td>
<td>Submucosal fibrosis and failed tunneling (n=12) Atrial fibrillation related to the electric current (n=1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Re-POEM (n=1) Stent (n=1) Heller myotomy (n=2) Dilation (n=1) 'Diaphragmatic hernia repair' and dilation (n=1) Conservative management (n=4) Lost to follow-up (n=3)</td>
</tr>
</tbody>
</table>

^1 Where multiple papers had been published from the same center, only the latest publication is displayed in the table.
Subsequent management of patients with aborted POEM depends on the cause of the incompletion. If fibrosis is diffuse, Heller myotomy might be the best option for further treatment as it provides a better and broader view, quick muscle dissection, more potent bleeding control, and is a definitive treatment for the disease. In contrast, if fibrosis is isolated, a re-POEM can be attempted at another location [22]. Other traditional interventions are options too, but are less likely to provide long-term symptom relief.

Interestingly, the seven patients contacted by phone in our cohort, including the four who received no further intervention, reported stable or improved Eckardt scores. Several patients mentioned lifestyle modification as the “ultimate way” to control their symptoms. These coping methods, including special diets, slow meals, “flush” after every bite of solid food, and elevated bed head, are crucial for achalasia management. These lifestyle changes can be difficult, but are frequently enough to keep symptoms under control if patients are reluctant to undergo further intervention.

Our study is the first to formally report on aborted POEM and to explore its risk factors, perioperative management, and long-term outcomes. Being a retrospective study, it is limited by subjectivity in judgment on factors such as fibrosis and by a high rate of loss to follow-up. We tried to keep the subjectivity to a minimum by assigning two endoscopists to review the full database independently. Although the rate of loss to follow-up is high, this represents the largest dataset of its kind in a patient group with poor compliance. Another limitation of our study is that the newly proposed grading of mucosal edema and typing of mucosal injuries still require validation in future studies.

In conclusion, aborted POEM is a rare event. It most often occurs because of submucosal fibrosis, which can result in failed tunneling. Both esophageal wall inflammation and previous intervention can lead to submucosal fibrosis, which is correlated with prolonged procedures, longer hospital stay, increased mucosal injury, and more mAEs. Aborted POEM itself rarely causes mAEs and typically does not require upgraded in-hospital care.

A second tunnel can be attempted in selected patients if the primary tunneling is stalled by fibrosis, but this approach is limited in both its applicability and utility if the choice of location for the first tunnel was carefully and properly made. Salvage dilation before discharge is appropriate in only a small proportion of patients. Increased experience of the operators can decrease the occurrence of technical failures. Finally, traditional intervention and a re-POEM can be attempted in patients with aborted POEM, but lifestyle modification is also an option.

Acknowledgments

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Competing interests

None

References


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