Peroral endoscopic myotomy: a two-center retrospective study of practice and adverse events

C. Van Severen[1], S. Koch[2], J. Faure[2], M. Poncin[1], J-P. Loly[1]

(1) Centre Hospitalier universitaire de Liège, Gastroenterology and Hepatology, Liège, Belgium; (2) Centre Hospitalier régional universitaire de Besançon, Gastroenterology, Besançon, France.

Abstract

Background and study aims: **Peroral endoscopic myotomy (POEM) is the preferred technique for the treatment of esophageal motility disorders and is less invasive than surgery. This study was performed to compare two university centers in the practice of POEM, in terms of efficacy and adverse events, for the treatment of esophageal motility disorder.**

Patients and method: **Retrospective comparative study of patients undergoing a POEM between September 2020 and December 2022 from the University Hospital of Liège (Belgium) and Besançon (France). The clinical success was defined by an Eckardt score ≤ 3 after the procedure.**

Results: **Fifty-five patients were included. In both centers, 87,3% of the patients had achalasia (mostly type II), and 12,7% had another esophageal motility disorder. The use of antibiotic prophylaxis was systematic in Liège center but not in Besançon center (100% and 9.1% respectively). The mean value of the post-operative Eckardt score was 1.55± 2.48 in both center with 93.2% of patients with a score ≤ 3 (92% in Besançon and 94.74% in Liège). The rate of adverse event was generally low. There were two minor adverse events more frequent in Liège, clinical capnomediastinum and pain at day one, but they were managed with conservative treatment. Only 7.3% of the total patients had an infectious phenomenon that did not correlate with the use of antibiotic prophylaxis.**

Conclusion: **The post-operative Eckardt score and the adverse event rate were comparable between the university centers. This study confirmed that POEM is a safe and effective technique. It also showed that using an antibiotic prophylaxis does not influence the development of infectious adverse events.** (Acta gastroenterol. belg., **2024,** 87, **7-13**).

Keywords: Peroral endoscopic myotomy, adverse events, antibiotic prophylaxis.

Introduction

Peroral endoscopic myotomy (POEM) has become the preferred option for the treatment of achalasia and other esophageal motility disorders in many centers around the world (1). Previous treatment options for achalasia have included endoscopic pneumatic dilatation, laparoscopic surgery (Heller myotomy) and, to a lesser extent, botulinum toxin injection (1,2). POEM was performed for the first time on human patients in 2008 by the Japanese team of Inoue H. et al (3). For the past decade, POEM has been recognized as an effective and safe endoscopic technique for the treatment of achalasia (4). Many studies compared the different techniques and POEM was progressively recognized as an effective and less invasive technique compared to Heller surgery (5).

Although studies on the endoscopist learning curve have been reported (6), a comparative study between a new center and a center with several years of experience has never been studied.

Few data are available in the literature on the usefulness of antibiotic prophylaxis, even if it is currently recommended by the European Society of Gastrointestinal Endoscopy (ESGE) (7).

The main aims of this retrospective study were to compare the success rate and the adverse events of POEM between two university centers with different level of expertise and to compare the rate of infectious complications between these centers using different strategies in antibiotic prophylaxis.

The secondary objective aimed to identify intra-operative and perioperative predictors of adverse events.

Methods

We performed a retrospective study in the University Hospital of Liège (Belgium) performing the POEM since September 2020 and in the University Hospital of Besançon (France) performing the POEM since December 2015. Our study was approved by the Ethics Committee of Liege University and the Institutional Review Board (2023/70, Mar 7th 2023).

All patients treated with POEM over a two-year period between September 2020 and December 2022 were eligible for inclusion. Prior medical or surgical treatment for their motor disorder was allowed. Exclusion criterion was an age lower than 18 years old.

All the patients included approved the procedure during a preoperative consultation in gastroenterology. An organic cause of the symptoms was excluded by a pre-procedure gastroscopy. Esophageal motility disorder was confirmed by a high-resolution manometry with an Eckardt score higher than 3 (Table 1). The classification of motor disorders was based on the old "Chicago 3.0 classification".

The subjects were recruited from databases in the two university centers over a defined period of 2 years.

Correspondence to: C. Van Severen, Centre Hospitalier universitaire de Liège, Gastroenterology & Hepatology, Avenue de l'Hopital 1, Liège, Belgium.
Email: chloe.vanseveren@chuliege.be

Submission date: 12/09/2023
Acceptance date: 26/12/2023

Table 1. — **Eckardt score: a clinical score for achalasia (minimum 0-maximum 12)**

Score	Regurgitation	Weight loss (kg)	Retrosternal pain	Dysphagia
0	None	None	None	None
1	Occasional	<5kg	Occasional	Occasional
2	Daily	5 to 10kg	Daily	Daily
3	Each meal	>10kg	Each meal	Each meal

Table 2. — **Population characteristics**

Qualitative Variable	Overall population n (%)	Besançon n (%)	Liège n (%)	P-value
Number of patients	55 (100%)	33 (60%)	22 (40%)	
Gender				
Male	34 (61.8%)	20 (60.6%)	14 (63.6%)	0.82
Female	21 (38.2%)	13 (39.4%)	8 (36.4%)	
Smokers				
Non smokers	32 (58.2%)	19 (57.6%)	13 (59.1%)	
Active smokers	12 (21.8%)	7 (21.2%)	5 (22.7%)	1.0
Ex-smokers	11 (20%)	7 (21.2%)	4 (18.2%)	
COPD				
Non-COPD	49 (89.1%)	30 (90.9%)	19 (86.4%)	0.67
COPD	6 (10.9%)	3 (9.1%)	3 (13.6%)	
Asthma				
Non-asthmatic	48 (87.3%)	30 (90.9%)	18 (81.8%)	0.42
Asthmatic	7 (12.7%)	3 (9.1%)	4 (18.2%)	
PPI treatment				
Yes	29 (52.7%)	16 (48.5%)	13 (59.1%)	0.58
No	26 (47.3%)	17 (51.5%)	9 (40.9%)	
Bronchodilators				
Yes	9 (16.4%)	4 (12.1%)	5 (22.7%)	0.46
No	46 (83.6%)	29 (87.9%)	17 (77.3%)	
Antiaggregant treatment				
Yes	7 (12.7%)	4 (12.1%)	3 (13.6%)	1.0
No	48 (87.3%)	29 (87.9%)	19 (86.4%)	
Anticoagulant treatment				
Yes	5 (9.1%)	3 (9.1%)	2 (9.1%)	1.0
no	50 (90.9%)	30 (90.9%)	20 (90.9%)	
Type of motor disorder				
Type I achalasia	17 (30.9%)	13 (39.4%)	4 (18.2%)	
Type II achalasia	26 (47.3%)	15 (45.5%)	11 (50%)	0.022
Type III achalasia	5 (9.1%)	0 (0%)	5 (22.7%)	
Other	7 (12.7%)	5 (15.1%)	2 (9.1%)	
Prior treatment				
Yes	13 (26.3%)	8 (24.2%)	5 (22.7%)	1.0
No	42 (76.4%)	25 (75.8%)	17 (77.3%)	
Quantitative Variable	**Mean +-SD**			
Age (y)	62.38 ± 17.18	61.6 ± 18.2	63.6 ± 15.8	0.67
BMI (kg/m²)	23.33 ± 4.54	22.7 ± 4.4	24.2 ± 4.7	0.23

From the electronic records of the patients, the following parameters were retrospectively collected:

– Pre-operative data (Table 2): demographic and clinical characteristics, type of motility disorder, the Eckardt score, current medications at the time of the procedure.

– Operative data (Table 3): length of myotomy, duration of procedure, capnography parameters (maximum end-tidal CO_2 ($ETCO_2$) value; the "delta" CO_2 corresponding to the maximum CO_2 intraoperative value minus the CO_2 level at the beginning of the endoscopy), prophylactic antibiotics.

– Peri- and postoperative data:
  • clinical and/or radiological insufflation-related side effects (capnomediastinum, capnoperitoneum, capnothorax, capnopericardium, retroperitoneal air)
  • per-gesture hemorrhage and unintentional mucosal injury
  • pain according to the numerical pain scale (when the patient wakes-up: maximum 6h after the procedure; and on the day after the procedure or D+1 between 6h and 24h after the procedure)
  • introduction or maintenance of proton pomp inhibitors (PPI) treatment

Table 3. — **Procedure characteristics of the total population and of the population of each center. ($ETCO_2$: end-tidal CO_2; the "delta CO_2" corresponding to the maximum CO_2 intraoperative value minus the CO_2 level at the beginning of the endoscopy)**

	Overall population		Population of Besançon		Population of Liège		Comparison between Besançon and Liège
Quantitative variable	**n**	**Mean +-SD Median [Q1-Q3]**	**n**	**Mean +-SD Median [Q1-Q3]**	**n**	**Mean +-SD Median [Q1-Q3]**	**p-value**
Eckardt score							
Before POEM	54	7.59 ± 2.52	32	7.69 ± 2.75	22	7.46 ± 2.20	0.74
After POEM	44	1.55 ± 2.48	25	1.72 ± 3.12	19	1.33 ± 1.25	0.60
Length of the myotomy (cm)	45	8.18 ± 3.02	23	8.17 ± 2.96	22	8.18 ± 3.14	0.99
Duration of the procedure (min)	52	54.00[40.0-80.0]	33	54.0[41.0-69.0]	19	51.0[33.0-83.0]	0.99
Maximum $ETCO_2$ value (kPa)	52	6.14 ± 1.06	33	5.8 ± 0.67	19	6.7 ± 1.3	0.0015
"Delta CO_2" (kPa)	52	1.82 ± 1.1	33	1.60 ± 0.95	19	2.20 ± 1.26	0.059
Qualitative variable	**n**	**%**	**n**	**%**	**n**	**%**	
Antibiotic prophylaxis	54		33		21		<0.0001
Yes	24	44.4	3	9.1	21	100	
No	30	55.6	30	90.9	0	0	

- occurrence of infection
- delayed bleeding or perforation
- need of revision surgery
- length of hospital stay
- death

– Follow-up data:
- post-surgery Eckardt score
- onset of symptomatic gastroesophageal reflux disease (GERD)
- continuation of PPI treatment

The endpoint was the modification of the Eckardt score calculated during the medical consultation before and after the POEM. The success of the procedure was defined by a post-procedure Eckardt symptom score of 3 or less (≤3).

The characteristics of the procedure were the same in the two centers. The POEM was performed under general anesthesia, after endotracheal intubation and a "volume-control" ventilatory mode. A high-resolution endoscope was used with a cap attached to its distal end and CO_2 is used for insufflation. A hybrid knife allowing both dissection and injection was used. Myotomy of the inner circular layer was performed using a posterior approach, and submucosal injection was performed using saline liquid. The length of the myotomy was defined by the endoscopist and guided by the preoperative high-resolution manometry data. The submucosal tunnel was finally closed with hemostatic clips.

The results are expressed as means, standard deviations (± SD), quartiles (median, Q1, Q3), extremes values (minimum, maximum) for quantitative variables and as frequency tables for qualitative variables. For statistical tests, some parameters were log-transformed to normalize their distribution. The parameters were compared between the two groups by the paired Student t test (or Kruskal-Wallis test) for quantitative variables and by Fisher's exact test for qualitative variables. The change in Eckardt score between preoperative and postoperative medical consultation was analyzed by the paired Student t test. The correlation between two continuous variables was measured by the Pearson correlation coefficient. To consider a possible effect attributable to the medical center, the outcome was studied as a function of center and explanatory variable by linear regression. When the outcome was binary, logistic regression (univariate and bivariate) was used instead, and the odds ratio and its 95% confidence interval were reported. Results were considered significant at the 5% uncertainty level ($p<0.05$). Calculations were performed using SAS version 9.4.

Results

56 patients underwent a POEM over the predefined period (34 patients from Besançon and 22 from Liège). Among the patient group from Besançon, one was

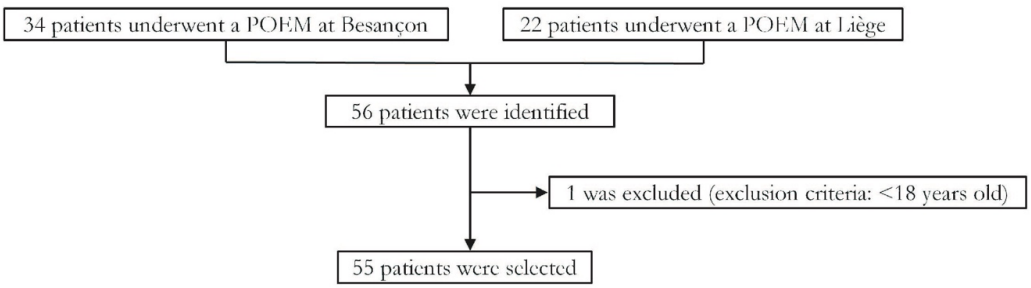

Figure 1. — Flow chart of enrollment from 01/09/20 to 31/12/22

younger than 18 years old and was excluded from the study (Fig. 1).

There were 34 male patients (61.8%) and 21 female patients (38.2%) with a mean age of 62.38 years ± 17.18, and the mean body mass index was 23.33kg/m² ± 4.54 (Table 2).

Concerning the type of motor disorder, 48 patients (87.3%) had achalasia and 7 patients (12.7%) had another esophageal motility disorder. Most of the patients had type II achalasia (n=26, 47.3%), followed by type I (n=17, 30.9%) and finally type III (n=5, 9.1%). The only significant difference concerned the type of achalasia: there were only type III achalasia and less type I achalasia in Liège than in Besançon (p=0.022).

The mean Eckardt score before the procedure was 7.59 ± 2.52.

Forty-two patients (76.4%) had no prior treatment for their motor disorder and 13 patients (23.6%) were treated with a prior medical and/or surgical treatment (1 with botulinum toxin injection; 5 with esophageal pneumatic dilatation; 1 with a Heller Myotomy (HM); 6 with both HM and esophageal pneumatic dilatation) (Table 2)).

In the overall population, 24 patients (44.4%) received an antibiotic prophylaxis, including Cefazolin or Amoxicillin with Clavulanic acid. There was a significant difference (p <0.0001) between the two centers in the use of antibiotic prophylaxis, which was systematic in Liège center (n=21; 100%) and not in Besançon (n=3; 9.1%) (Table 3).

The average length of the myotomy was 8.18±3.02 cm. The average duration of the procedure was 58.13±23.47 minutes.

The insufflation used was CO_2 for all patients, except for one patient in the Liège center: the procedure started with the use of CO_2 but accidentally ended with room air. This was caused by a staff member who inadvertently reached the control panel of the endoscope processor and thereby changed the insufflation gas from CO_2 to room air.

$ETCO_2$ curves were studied from intra-operative capnography (in Liège: collection of CO_2 value in % at a rate of one parameter/min; in Besançon: collection of CO_2 value in kPa at a rate of one parameter/min). The collected values of CO_2 in Liège were converted into kPa. The mean maximum $ETCO_2$ value was 6.14± 1.06 kPa and the mean "delta CO_2" was 1.82±1.1kPa. The Belgian center differs from the French center by a higher value of $ETCO_2$ max (p=0.001) (Table 3).

During the procedure, 6 patients (10.9%) presented a hemorrhage and 3 patients (5.5%) presented an involuntary mucosal injury. In all cases, these per-gesture adverse events were treated at the same time as the procedure (use of hot forceps, injection of adrenaline serum or use of hemostatic clips).

Regarding the insufflation-related side effects, 7 patients (12.7%) presented a clinical capnomediastinum (subcutaneous emphysema), 4 patients (7.3%) a radiological capnomediastinum, 3 patients (5.5%) a clinical capnoperitoneum (abdominal distension, tympanism), 4 patients (7.3%) a radiological capnoperitoneum, 2 patients (3.6%) a clinical capnothorax, 1 patient (1.8%) a radiological capnothorax and 1 patient (1.8%) a radiological retroperitoneal air. There was no clinical or radiological capnopericardium. Among these insufflation-related side effects, only clinical capnomediastinum (subcutaneous emphysema) was significantly more frequent in Liège than in Besançon (p=0.013) (Figure 2).

4 patients (7.3%) presented an infectious phenomenon (mainly pneumological: bronchial inhalation during the induction of anesthesia or covid pneumopathy; or of undetermined origin). There was no delayed hemorrhage or perforation.

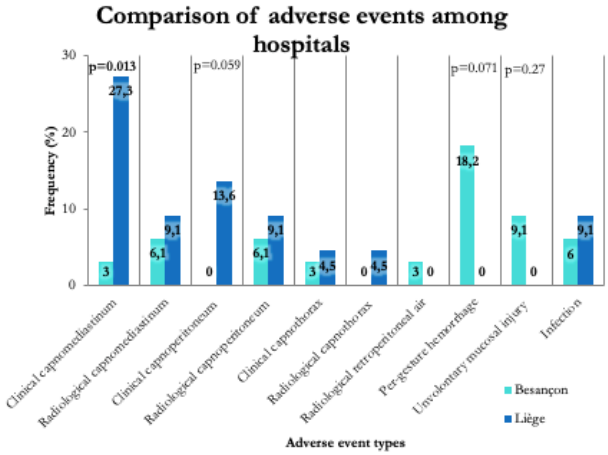

Figure 2. — Comparison of adverse events between the two university centers

The average score of pain was 3.87±3.01 when the patients woke up and 1.73±2.34 on the first day after procedure according to the numeral scale (0 = no pain, 10 = worse pain ever). In Liège center, there was a significant higher pain level on the day after the procedure: 2.59 ± 2.63 (p=0.020).

Serious adverse events were very rare. There were no deaths. Two patients required an intensive care unit stay: one patient from Liège had part of the procedure accidentally performed with room air insufflation, which explained the bilateral capnothorax, the capnomediastinum and the capnoperitoneum. The treatment consisted in a needle exsufflation of the capnoperitoneum and in the placement of two surgical chest drains. The patient was monitored for a few days in the intensive care unit and developed a pulmonary embolism, cured by anticoagulant treatment. One patient from Besançon developed a tension capnothorax during the procedure, resulting in cardiorespiratory arrest. Following immediate cardiopulmonary resuscitation and needle exsufflation of the capnothorax, the patient was stabilized and monitored for several days in the intensive care unit.

Regarding postoperative prescriptions, the use of post-procedure PPI prescription was systematic in Liège

center (n=22; 100%) but not in Besançon center (n=24; 72.7%) (p=0.008).

The average hospital stay was 2.61 ± 2.67 days.

The mean duration of follow-up was 7.53 ± 4.15 months. There was no meaningful difference in term of post-procedure Eckardt score (Table 3): the mean score value was 1.55 ± 2.48, with 41 patients (93.2%) with a score of 3 or less (23 patients (92%) in Besançon and 18 patients (94.74%) in Liège).

At the follow-up consultation, 11 French patients (44%) and 6 Belgian patients (31.6%) complained of symptomatic GERD with no significant difference between both centers (p=0.54). On the overall population, 29 patients (65.9%) continued their PPI treatment.

Discussion

Our study was aiming to compare the practice (in term of efficacy and adverse events) of POEM between two centers with different levels of experience of this technique. The results showed no difference in the adverse event rate and efficacy between the two centers and suggested that POEM is a safe endoscopic technique that can be rapidly acquired by endoscopic expert.

According to the actual guidelines, the use of an antibiotic prophylaxis is recommended (7). However, we showed that despite the use of a systematic antibiotic prophylaxis in Liege, there was no difference in the infectious adverse event rate between the two centers.

Despite the study of many operative parameters such as capnography variations, we didn't clearly highlight any potential predictive factors of postoperative pain and/or adverse event.

Four techniques have been reported for the management of achalasia: pneumatic dilation, botulinum toxin injection, Heller myotomy, and POEM. The POEM is actually the preferred therapeutic option and has functional results comparable to the Heller myotomy (2,7). A recent multicenter randomized trial comparing POEM to Heller myotomy, published by Werner YB. et al, confirmed the non-inferiority of POEM on the control of achalasia-related symptoms (5). POEM is less invasive than surgery, but it exposes the patient to a higher risk of GERD compared to surgery (1,5). This non superiority of surgery over endoscopy was confirmed in a "network" meta-analysis of randomized controlled trials published by Mundre P. et al (8). In summary, POEM and Heller myotomy were superior to pneumatic dilatation for the treatment of achalasia. But, but they weren't superior to each other (8).

Therefore, POEM and surgery are currently the mainstays of achalasia treatment. The choice of treatment should be discussed according to local expertise, the type of achalasia, the patient's choice and his comorbidities (2,8).

Concerning the intervention, there was no significant difference in the length of the myotomy, the procedural time and the hospital stay between the two centers.

In our study, it is confirmed that POEM is effective because most of the patients had an Eckardt score at the follow-up visit of 3 or less.

It should be noted that, in the population studied, 13 patients already had another prior treatment for their esophageal motility disorders. 10 of them came at the post-operative consultation and 8 of them had an Eckardt score value of 3 or less. These positive results may suggest that POEM is an effective second-line treatment.

The most common intra- and perioperative adverse events of POEM were pain, bleeding, perforation, infection, and insufflation-related side effects (capnoperitoneum, capnomediastinum, capnothorax, capnopericardium, retroperitoneal air) (4). Most of these adverse events were effectively managed during the operative procedure or treated conservatively (1,4). Serious adverse events were rare (1,7,4). The insufflation-related side effects are the most frequent, but their exact incidence is very difficult to determine because of the lack of harmony in terms of terminology and diagnostic means between the different studies (4). Despite the use of CO_2, the prevalence of insufflation-related side effects remained high, as shown by various studies performing systematic chest CT after POEM (7,4). The diagnosis of these adverse events can be made on the basis of clinical examination (subcutaneous emphysema, abdominal distension...), ventilatory parameters (especially $ETCO_2$) or radiological examinations (4). Nevertheless, most of them did not have significant clinical repercussions and therefore did not require specific treatment (7). Thus, it is not recommended to carry out additional examinations in asymptomatic or paucisymptomatic patients (7,4). However, in case of significant clinical repercussion with hemodynamic instability and depending on the compartment involved, different techniques allowed the management of these side effects during the operative procedure: gastric decompression, temporary stop of the procedure and insufflation to allow CO_2 resorption, modification of the ventilatory parameters to promote the elimination of CO_2, and needle decompression (4).

In order to standardize the evaluation of adverse events, we used the new classification for adverse events gastrointestinal endoscopy (AGREE classification) (9): minor adverse events (complications of the procedure that can be treated during the operative procedure or managed conservatively) correspond from grade 1 to 2 and major adverse events (complications of the procedure that led to the need of revision surgery, admission to the intensive care unit or death) correspond from grade 3 to 5. In the future, per-gesture complications treated during the procedure with no influence on the postprocedural course should probably no longer be considered as adverse events.

Of all the adverse events studied, the adverse event rate was generally very low in our study. There were no grade 5 adverse events according to the AGREE classification. Nevertheless, there were grade 3 and 4 adverse events, with these two patients requiring a short stay in intensive

care. Only clinical capnomediastinum (subcutaneous emphysema) was significantly more frequent in Liège than in Besançon (Figure 2). Nevertheless, those were treated conservatively with painkillers (except for this patient who accidentally had a procedure with room air insufflation and therefore required specific treatment because of hemodynamic instability mainly related to the presence of a bilateral capnothorax). This proves that most adverse events related to insufflation are grade 1 or 2 of the AGREE classification and do not require specific management.

Compared to other therapeutic techniques, POEM exposes the patient to an increased risk of GERD (2,4). This is due to the fact that Heller myotomy is often associated with an anti-reflux fundoplication, which is not the case with POEM (5). This increase in postoperative GERD would theoretically expose the patient to an increased risk of Barrett's esophagus. A regular follow-up endoscopy would be necessary and long-term studies have to confirm this (1,5). Therefore, a double dose PPI treatment postoperatively for a one month period is often prescribed. This anti-acid treatment allows the healing of the esophageal mucosa and also limits the symptoms linked to gastro-esophageal reflux (7). In the Belgian center, the use of post-procedure PPI prescription was systematic but not in the French center. However, at the follow-up consultation, there was no significant difference between the two groups in terms of symptomatic GERD. Further studies are needed to confirm the real risk and the follow-up of GERD after a POEM.

Various studies have been carried out to evaluate the learning curve and to estimate the number of technical acts necessary to fully master the POEM. This number is estimated to be between 20 and 25 procedures for a specialist in endoscopy, based on the study of total procedural time, dissection time (number of minutes per centimeter of myotomy) and the incidence of involuntary mucosal injury (6,10). In our study, we choose to compare the French center with the Belgian center, whose experiences were 8 years and 3 years respectively, to appreciate the learning curve. The results showed that there is no significant difference in terms of procedural time and adverse events. Nevertheless, it should be noted that the endoscopists in Liège have a great deal of experience in submucosal dissection and were trained in a high-volume reference center before starting the practice in their center.

The use antibiotic prophylaxis is recommended before this procedure (single intravenous injection one hour before the procedure) but the type and duration of antibiotics is adapted to local recommendations (7). Between the two studied centers, Liège center used systematic antibiotic prophylaxis, which differs from Besançon center (Table 3). However, there are few studies on this subject and, therefore, a very low level of evidence regarding this recommendation (7). In a study published in 2019, antibiotic prophylaxis had no impact on the occurrence of post-procedure adverse event (11). In our study, we were able to show that, despite the use of antibiotic prophylaxis, the low rate of infection adverse events was not further reduced. This observation invites us to reconsider the preoperative antibiotic prophylaxis treatment indication, which would require additional randomized studies.

The goal was also to investigate whether adverse events could be explained by intraoperative capnography variations, and also whether the postoperative pain could be explained by the presence of clinical capno-mediastinum. Because the procedure requires intra-luminal CO_2 insufflation and because CO_2 is quickly resorbed and then eliminated by the lungs, it seemed interesting to investigate whether intraoperative capnography variations ($ETCO_2$ and delta CO_2) could be a predictor of postoperative complication or pain. The pain often regresses during the day following the procedure, as shown by the values according to the numerical scale calculated when the patients wake-up and on the day after the procedure. At the perioperative level, we observed that Liège was distinguished by a higher pain level on the day after the procedure, but there was no significant association between pain at the day after the procedure and delta CO_2. There was also no significant association between delta CO_2 and the risk of infection. At the operative level, the Belgian center differs from the French center by a higher value of $ETCO_2$ max and more clinical capnomediastinum. However, it is impossible to determine whether this is a result of greater tolerance of the anesthesiologists ventilatory settings, or whether this is related to the presence of a greater rate of clinically detectable capnomediastinum. The possible existence of a link between clinical capnomediastinum and post-operative pain, was also studied. There was no significant association between the presence of clinical capnomediastinum and pain at the day after the procedure, however, there is a trend. Indeed, post-op pain tends to be higher in case of clinical capnomediastinum.

Based on the current study, it is not possible to conclude that there is a statistically significant association between intraoperative capnography and adverse events or between clinical capnomediastinum and pain. It is nevertheless a subject of study which would deserve to be approached in the future.

The main limitations of our study are its retrospective nature (preventing us from retrieving missing data) and the relatively small sample of patients. However, its strength is that it is a study comparing two different centers with different expertise.

Conclusion

Our study demonstrated an excellent efficiency and safety in the execution of the esophageal POEM in both centers of Liège and Besançon. Despite a more recent experience in Liège, the adverse events rate was not significantly different in both centers, suggesting that a new center with experienced endoscopists can rapidly be effective with this procedure.

Our study also showed no differences in infectious adverse events despite the use of an antibiotic prophylaxis, suggesting that the recommendation for an antibiotic prophylaxis treatment should be reconsidered in the guidelines.

Conflict of interest

The authors declare no conflict of interest.

References

1. ZERBIB F., CHABRUN E. La myotomie endoscopique (POEM) : le nouveau traitement de référence de l'achalasie et des troubles moteurs de l'œsophage? *Hépato-Gastro et Oncologie digestive*, 2018, **25**:411-415.
2. VAEZI MF., PANDOLFINO JE., YADLAPATI RH., GREER KB., KAVITT RT. ACG Clinical Guidelines: Diagnosis and Management of Achalasia. *American Journal of Gastroenterology*, 2020, **115**:1393-1411.
3. INOUE H., MINAMI H., KOBAYASHI Y., SATO Y., KAGA M., SUZUKI M. *et al.* Peroral endoscopic myotomy (POEM) for esophageal achalasia. *Endoscopy*, 2010, **42**:265-271.
4. ZAHEER N., NAGESHWAR R., MOHAN R. Adverse events during and after per-oral endoscopic myotomy : prevention, diagnosis, and management. *Gastrointestinal Endoscopy*, 2018, **87**:4-17.
5. WERNER YB., HAKANSON B., MARTINEK J., REPICI A., VON RAHDEN B., BREDENOORD AJ. *et al.* Endoscopic or Surgical Myotomy in Patients with Idiopathic Achalasia. *The New England Journal of Medecine*, 2019, **381**:2219-2229.
6. PULI S-R., WAGH MS., FORCIONE D., GOPAKUMAR H. Learning curve for esophageal peroral endoscopic myotomy: a systematic review and meta-analysis. *Endoscopy*, 2023, **55**:355-360.
7. WEUSTEN B. L.A.M., BARRET M., BREDENOORD AJ., FAMILIARI P., GONZALEZ J-M., VAN HOOFT JE. *et al.* Endoscopic management of GI motility disorders - part 1. European Society of Gastrointestinal Endoscopy (ESGE) Guideline. *Endoscopy*, 2020, **52**:498-515.
8. MUNDRE P., BLACK JP., MOHAMMED N., FOORD AC. Efficacy of surgical or endoscopic treatment of idiopathic achalasia: a systematic review and network meta-analysis. *Lancet gastroenterology and Hepatology*, 2021, **6**:30-38.
9. NASS KJ., ZWAGER LW., VAN DER VLUGT M., DEKKER E., BOSSUYT PM., RAVINDRAN S. *et al.* Novel classification for adverse events in GI endoscopy: the AGREE classification. *Gastrointestinal Endoscopy*, 2022, **95**: 1078-1085.
10. KURIAN AA., DUNST CM., SHARATA A., BHAYANI NH., REAVIS KM., SWANSTROM L. Peroral endoscopic esophageal myotomy: defining the learning curve. *Gastrointestinal endoscopy*, 2013, **77**:719-725.
11. HASTIER A., OLIVIER R., BENTILLIS I., PIOCHE M., PICHE T., PONCHON T. *et al.* Impact de l'antibioprophylaxie et des modalités de conditionnement lors de la réalisation d'une myotomie per-orale endoscopique pour troubles moteurs œsophagiens. *Endoscopy*.
12. LABONDE A., JACQUES J. La POEM (Per Oral Endoscopic Myotomy) à l'heure de l'Evidence Based Medicine. *Hépato-Gastro et Oncologie digestive*, 2020, **27**:97-100.