



# REVISTA BRASILEIRA DE ANESTESIOLOGIA

Publicação Oficial da Sociedade Brasileira de Anestesiologia  
[www.sba.com.br](http://www.sba.com.br)



## CLINICAL INFORMATION

# Tension pneumothorax during peroral endoscopic myotomy for treatment of esophageal achalasia under general anesthesia



Tsung-Shih Li<sup>a</sup>, Tsung-Yang Lee<sup>b</sup>, Kate Hsiurong Liao<sup>b,\*</sup>

<sup>a</sup> Cheng-Ching General Hospital, Ping-Tien Branch, Department of Anesthesia, Taiwan

<sup>b</sup> China Medical University Hospital, Department of Anesthesiology, Taichung, Taiwan

Received 2 October 2014; accepted 28 November 2014

Available online 19 November 2015

### KEYWORDS

Peroral endoscopic myotomy;  
Tension pneumothorax;  
Esophageal achalasia;  
General anesthesia

**Abstract** More and more endoscopically gastrointestinal procedures require anesthesiologists to perform general anesthesia, such as “peroral endoscopic myotomy”. Peroral endoscopic myotomy is a novel invasive treatment for the primary motility disorder of esophagus, called esophageal achalasia. Despite of its minimally invasive feature, there are still complications during the procedure which develop to critical conditions and threat patients’ lives. Herein we describe a case about tension pneumothorax subsequent to esophageal rupture during peroral endoscopic myotomy. The emergent management of the complication is stated in detail. The pivotal points of general anesthesia for patients undergoing peroral endoscopic myotomy are emphasized and discussed. Also, intraoperative and post-operative complications mentioned by literature are integrated.

© 2015 Sociedade Brasileira de Anestesiologia. Published by Elsevier Editora Ltda. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

### PALAVRAS-CHAVE

Miotomia endoscópica por via oral;  
Pneumotórax hipertensivo;  
Acalasia esofágica;  
Anestesia geral

**Pneumotórax de tensão durante miotomia endoscópica por via oral para tratamento de megaesôfago sob anestesia geral**

**Resumo** Cada vez mais os procedimentos gastrointestinais feitos por endoscopia, tais como a miotomia endoscópica por via oral (MEVO), exigem anestesiolistas para administrar anestesia geral. A MEVO é um novo tratamento invasivo para o distúrbio de motilidade primária do esôfago, denominado acalasia esofágica (AE). Apesar de sua característica minimamente

\* Corresponding author.

E-mail: [hiphondance100@gmail.com](mailto:hiphondance100@gmail.com) (K.H. Liao).

invasiva, existem complicações durante o procedimento que evoluem para condições críticas e de risco à vida. Descrevemos aqui um caso de pneumotórax de tensão após a ruptura do esôfago durante uma MEVO. O tratamento de emergência da complicação é relatado em detalhes. Os pontos cruciais da anestesia geral para pacientes submetidos à MEVO são enfatizados e discutidos. Além disso, as complicações mencionadas pela literatura nos períodos intraoperatório e pós-operatório são integradas.

© 2015 Sociedade Brasileira de Anestesiologia. Publicado por Elsevier Editora Ltda. Este é um artigo Open Access sob uma licença CC BY-NC-ND (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## Introduction

In the era of minimally invasive gastrointestinal surgery, many procedures rely on anesthesiologists to provide varying degrees of sedation or anesthesia, such as esophagogastroduodenoscopy. Peroral endoscopic myotomy (POEM) is a novel treatment for esophageal achalasia (EA) in which clinical trials yield good results.<sup>1,2</sup> General anesthesia usually offers better cooperation and compliance when the surgeon manipulates the esophagus with an endoscope and also eliminates perioperative gut discomfort due to gas insufflation. In addition, positive pressure ventilation with endotracheal intubation provides better respiratory mechanics under increased intra-abdominal pressure generated by insufflated gas. However, complications resulting from surgical intervention may develop, e.g., pneumothorax, mediastinal emphysema, subcutaneous emphysema, and pneumoperitonium.<sup>3,4</sup> These complications have chance to develop to critical ones. In the following article we report a patient who encountered tension-pneumothorax while undergoing POEM under general anesthesia.

## Case report

A 56-year-old previously healthy woman (height 155 cm, weight 48 kg) was scheduled to undergo peroral endoscopic myotomy for new diagnosed esophageal achalasia. Her laboratory tests were normal. She was held nil per os for 8 h. The initial vital signs in the operating room represented blood pressure 151/68 mmHg, with heart rate 78 bpm and saturation 95%. During induction of general anesthesia, preoxygenation with 100% oxygen via face mask was done for 5 min following by intravenous fentanyl 100 mcg, Propofol 120 mg, and lidocaine 20 mg. Rapid sequence technique was applied with cricoid pressure after administration with rocuronium 35 mg. Successful nasal endotracheal intubation was achieved. The lung was ventilated at a tidal volume of 10 mL/kg and a rate of 10 breaths/min. The patient was maintained in stable hemodynamics with sevoflurane. The initial plateau pressure was 21 mmHg under PEEP 5 mmHg. The endoscope was then inserted into the esophagus and a submucosal tunnel created by mucosotomy with blunt air dissection was made. The patient's abdomen was increasingly distended and gradually elevated airway pressure (from 21 mmHg to 30 mmHg) occurred

during the first 2 h of the procedure. The surgeon deflated and evacuated the air in the gut so that airway pressure declined to 23 mmHg. The following third hour of the operation, plateau pressure rapidly rose again up to 35 mmHg within 30 min, and desaturation from 100% down to 85% accompanied by loss of breath sounds of right lung and loss of right chest wall movement was detected. Right chest percussion showed hyper-resonance. Her jugular vein was engorged. There was obvious subcutaneous emphysema over her face, neck, shoulders and chest wall. Tachycardia with HR 132 bpm and hypotension with BP 80/55 mmHg ensued. Right tension pneumothorax resulting from esophageal rupture was diagnosed immediately. The anesthesiologist used emergent needle decompression (by a 16 G needle) via right second intercostal space. The airway pressure decreased to 27 mmHg and blood pressure became normal within few minutes. Soon after a right chest tube was placed, the patient's saturation restored to 100%. The surgeon completed the treatment and the patient was transferred to intensive care unit in the end of the operation. Two hours after the surgery she was successfully extubated in the ICU. Post-operative Day 3, the patient developed mediastinitis with right empyema and underwent thoracotomy for esophageal repair and pleural decortication. In the following days her condition was stable under antibiotic administration. She was discharged 10 days later.

## Discussion

Esophageal achalasia is a primary motility disorder characterized by increased lower esophageal sphincter (LES) tone and lack of peristalsis of the esophagus.<sup>5</sup> In recent years POEM has been a novel promising therapeutic modality for EA. Of course, miscellaneous complications of POEM have also been mentioned.

Intraoperative pneumothorax during POEM (2.5%) described in the literature<sup>3</sup> was actually uncommon. No scenario of tension pneumothorax during POEM has been published. The mechanism of this complication in our patient was majorly due to gas leakage via surgical tear of mediastinal pleura when dissecting thoracic portion of the esophagus. Our surgeon chose air as insufflation gas for better distension to provide better manipulative space. Comparing to carbon dioxide, air is less absorbable for

pleural cavity. Furthermore, positive pressure ventilation under general anesthesia facilitated the development of pneumothorax. That's why tension pneumothorax occurred in this patient following 2 h of surgery. Evidence supported that the use of air had a higher rate in gas-insufflation related complications than the use of carbon dioxide.<sup>3,6</sup> Ren et al.<sup>3</sup> reported three cases as intraoperative pleural drainage for intraoperative pneumothorax resulting from carbon dioxide insufflation. The patient we described here is the first case who experienced shock due to air insufflation induced tension pneumothorax and was treated with emergent needle decompression and chest tube drainage. Because sometimes transmural openings of the esophagus into the mediastinum may occur for surgical reasons.<sup>7</sup> We emphasize the importance of awareness in excessively elevated airway pressure during POEM, especially the surgeon chooses air as insufflation gas with a long duration. We suggest minimal gas insufflation to gut with carbon dioxide and limited pressure to minimize gas leakage. Abnormal findings in physical examination such as decreased breath sounds, hyper-resonance in chest percussion and jugular venous distension may indicate the formation of pneumothorax. Once tension pneumothorax (pneumothorax with compromised vital signs) is considered, prompt decompression should be done without any image evidence for the reason of immediate rescue of unstable hemodynamics.

Post-operative complications of POEM associated with gas insufflation and gas leakage via minor esophageal tear include pneumothorax, pneumoperitonium, mediastinal emphysema, and subcutaneous emphysema. One study detected different degrees of post-operative pleural effusion and focal atelectasis by thoracic CT on POEM treated patients.<sup>6</sup> Literature had reported these complications as common but non-life threatening ones and most patients could recover under conservative treatment or tube drainage.<sup>3,6-9</sup> It is to be noticed, however, even these complications are self-limiting, they may deteriorate post-operative respiratory function in patients with pulmonary diseases. An unexpected complication, atrial fibrillation, caused by left atrial compression from esophageal submucosal hematoma had been reported by Abdulaziz et al.<sup>10</sup>

The patient we described here had symptoms of epigastric fullness and regurgitation of undigested food before the surgery. During induction, the risk of pulmonary aspiration was concerned. We applied rapid sequence induction with cricoid pressure to the patient. This complication occurred during general anesthesia in a patient undergoing POEM reported in literature.<sup>11</sup> Nevertheless cricoid pressure might be unnecessary after pre-induction endoscopic clearance of esophageal contents.<sup>12</sup> Anesthesiologists should be alert in this risk during induction period and take well preparation and prevention strategy.

## Conclusion

POEM is a new technique to treat esophageal achalasia and general anesthesia is usually needed. Anesthesiologists should have a great understanding in intraoperative and post-operative complications of POEM such as tension pneumothorax, and apply immediate and correct managements. Also, anesthesiologists must have a clear concept about the risk of pulmonary aspiration when they perform general anesthesia to these patients and provide good prevention.

## Conflicts of interest

The authors declare no conflicts of interest.

## References

1. Verlaan T, Rohof WO, Bredenoord AJ, et al. Effect of peroral endoscopic myotomy on esophagogastric junction physiology in patients with achalasia. *Gastrointest Endosc.* 2013;78:39-44.
2. Von Renteln D, Fuchs KH, Fockens P, et al. Peroral endoscopic myotomy for the treatment of achalasia: an international prospective multicenter study. *Gastroenterology.* 2013;145:309-11.
3. Ren Z, Zhong Y, Zhou P, et al. Perioperative management and treatment for complications during and after peroral endoscopic myotomy (POEM) for esophageal achalasia. *Surg Endosc.* 2012;26:3267-72.
4. Li QL, Zhou PH, Yao LQ, et al. Early diagnosis and management of delayed bleeding in the submucosal tunnel after peroral endoscopic myotomy for achalasia (with video). *Gastrointest Endosc.* 2013;78:370-4.
5. Francis DL, Katzka DA. Achalasia: update on the disease and its treatment. *Gastroenterology.* 2010;139:369-74.
6. Cai MY, Zhou PH, Yao LQ, et al. Thoracic CT after peroral endoscopic myotomy for the treatment of achalasia. *Gastrointest Endosc.* 2014;80:1046-55.
7. von Renteln D, Inoue H, Minami H, et al. Peroral endoscopic myotomy for the treatment of achalasia: a prospective single center study. *Am J Gastroenterol.* 2012;107:411-7.
8. Sharata AM, Dunst CM, Pescarus R, et al. Peroral endoscopic myotomy (POEM) for esophageal primary motility disorders: analysis of 100 consecutive patients. *J Gastrointest Surg.* 2015;19:161-70.
9. Swanström LL, Rieder E, Dunst CM. A stepwise approach and early clinical experience in peroral endoscopic myotomy for the treatment of achalasia and esophageal motility disorders. *J Am Coll Surg.* 2011;213:751-6.
10. Saleem AM, Hennessey H, von Renteln D, et al. Atrial fibrillation as an unexpected complication after peroral endoscopic myotomy (POEM): a case report. *Surg Laparosc Endosc Percutan Tech.* 2014;24:e196-9.
11. Chiu PW, Wu JC, Teoh AY, et al. Peroral endoscopic myotomy for treatment of achalasia: from bench to bedside (with video). *Gastrointest Endosc.* 2013;77:29-38.
12. Tanaka E, Murata H, Minami H, et al. Anesthetic management of peroral endoscopic myotomy for esophageal achalasia: a retrospective case series. *J Anesth.* 2014;28:456-9.