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Anaesthetic management and associated complications of per-oral endoscopic myotomy (POEM) procedure in a patient with achalasia cardia type II: A case report

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Abstract
Achalasia, a benign motility disorder of the esophagus, results in incomplete relaxation of the lower esophageal sphincter (LES) and absent peristalsis. Patients experience dysphagia, regurgitation, chest pain, weight loss, and heartburn. Pharmacological therapy has been unsatisfactory and definitive treatment has focused on mechanical disruption of the tight LES. Peroral endoscopic myotomy (POEM) is a safe and minimally invasive modality regarded as the first-line management of all types of achalasia. POEM is performed under general anesthesia with endotracheal intubation using an orally inserted gastrointestinal endoscope. Briefly, POEM involves endoscopic creation of a mid-esophageal submucosal incision, creation of a submucosal tunnel with the endoscope, and then a myotomy of distal circular muscles with a Triangular Tip electrosurgical (TT) knife, resulting in relaxation of the achalasia. We, hereby report a case of a patient with Achalasia Cardia Type II posted for POEM procedure under General Anaesthesia.

Keywords: POEM, endoscopic, gas related complications, ventilatory impairment

Introduction
A purely endoscopic approach, peroral endoscopic myotomy (POEM), is a recently developed, less-invasive treatment for achalasia that has been shown to be effective. POEM is performed via endoscopic mucosal entry into, and a submucosal tunnel within, the distal esophageal wall. Creation of submucosal tunnel in the esophageal wall is a key component [1]. The continuous insufflation of CO2 is required for submucosal tunnelling which inadvertently tracks into surrounding tissues and leads to capnomediastinum, capnothorax, capnoperitoneum, and subcutaneous emphysema. Thus, the challenges, for an anaesthesiologist are not only providing remote location anaesthesia, increased risk of aspiration during induction, but also early detection of these complications and specific emergency management [2].

Case report
Sixty year old female (weight 35 kgs, height 150 cm) was scheduled for POEM procedure under General Anaesthesia. The patient came with complains of dysphagia since 1 and half year, which was insidious, gradually progressive, more to solids than liquids, associated with nasal regurgitation, food impaction and significant weight loss, not associated with upper or lower gastrointestinal bleeding, chest pain, abdominal pain or abdominal distension.
There was no past history of Tuberculosis/ neck radiation/ long standing heartburn.
The patient was diagnosed with Achalasia Type II on High Resolution Manometry and CECT abdomen. The patient initially underwent achalasia pneumatic balloon dilatation of esophagus which was uneventful.
Preoperative airway assessment predicted an ASA risk, mouth opening of more than 3 Finger breadths, MPC Class II, adequate neck movements, thyromental distance and neck circumference, poor oral hygiene with multiple missing tooths and no loose tooth. The echocardiography findings were normal and the other haematological investigations were within normal limits.

Patient was advised a low residue diet and sips of carbonated drinks for 2 days before the procedure. Nil by mouth was advised from 8 pm on the day before POEM and premedicated with antiemetics and broad spectrum antibiotics. Patient was taken in the operation theatre and standard ASA monitors were applied and two wide bore intravenous access was secured one on right upper extremity and other on right lower extremity due to easy accessibility. A Nasogastric Tube was inserted and esophageal secretions were cleared and then it was removed. Intravenous glycopyrrolate 0.004 mg/kg, fentanyl 1mcg/kg was administered intravenously, routine anaesthesia induction with intravenous propofol 2mg/kg was conducted and after confirming bag mask ventilation, intravenous succinylcholine 1.5mg/kg was administered. Using a Macintosh blade no 3, a 6.5 mm ID portex cuffed endotracheal tube was inserted successfully, capnograph trace was present and bilateral breath sounds were confirmed. A mouth gag was inserted and the head was tilted towards the left side. The Olympus 190 GIF endoscope was then inserted and a vertical incision of 10 cm from the gastroesophageal junction through which tunnelling was done and carbon dioxide insufflation using the Alpha Endo Flator insufflator at medium flow rate was used throughout the procedure. The length of submucosal tunnel was 1–2 cm above the proximal LES in the esophagus. The respirator was set to deliver volume-controlled ventilation (VCV) with a tidal volume of 350 ml and respiratory rate of 14 breaths/min. Peak airway pressure (PAP) at the start of the operation was 20 cmH2O and end-tidal CO2 (EtCO2) was 35 mmHg. Anaesthesia was maintained on oxygen-air combination, dexmedetomidine infusion, intermittent boluses of propofol, intermittent doses of atracurium and nitrous oxide was avoided. At the beginning of the operation, her vital signs remained stable. However, EtCO2 gradually increased from about 45 minutes after the start of surgery. At 1 hour after the start of the operation, EtCO2 increased to 70 mmHg and PAP reached 45 cm H2O. Then, the ventilator's tidal volume and respiratory rate were increased to 450ml/min and 16 breaths/min respectively. We identified sudden abdominal distension and subcutaneous emphysema by the presence of the characteristic crackling feel over her chest and abdomen and backflow of blood was noted in the intravenous line on the right lower extremity which was connected to the intravenous fluid indicating compression of the inferior vena cava due to increase in intra- abdominal pressure. Immediately, the surgeons treated her with abdominal paracentesis; however, her PAP continued to increase despite the same volume-controlled ventilation settings. Although we changed from mechanical to manual ventilation, it became more difficult to ventilate her lungs and her tidal volume decreased to 250 ml under manual ventilation. The surgeon's stopped the procedure and the patient was manually ventilated till the parameters came down to baseline values and the patient was haemodynamically stable. Later, the surgeon's decided to go ahead with the procedure. At 1 hour and 15 minutes after commencement of the operation, not only there was elevation of EtCO2, but her SpO2 decreased to 88% and we were only able to achieve a tidal volume of approximately 50 -100 ml with manual ventilation. Hence, we decided to stop the procedure. By this time, the patient's EtCO2 had reached 104 mmHg. On auscultation, air entry was reduced on the right side with no breath sounds heard on left side with no chest rise. The surgeon's continued abdominal paracentesis and we continued manual ventilation. Arterial Blood gas analysis indicated a pH of 7.017, PaO2 of 152 mmHg, PaCO2 of 93.1 mmHg, and B.E. of − 10.1 mmol/l under manual ventilation with 100% oxygen. We continued manual ventilation, and the surgeon's performed abdominal paracentesis again at another site for deaeration. Subsequently, once EtCO2 gradually decreased over the next hour to 45 mmHg with PAP 30 cm H_2O and manual ventilation became easier, with return of breath sounds on left side of chest with adequate chest rise, the procedure was restarted and after 15 minutes, an elevation in EtCO2 to 75 mmHg and PAP of 45 cmH2O was again noted. This time, bluish discoloration of lips and finger tips was also noted with Spo2 of 83%. The surgeons were immediately asked to stop the procedure and the patient was mechanically ventilated with 100% O2, following which the patient's cardioscope showed Supraventricular Tachycardia with HR of 180-200/min, carotid massage was given and Intravenous Diltiazem 12.5 mg after which the rhythm was restored to normal. Intravenous magnesium sulphate 1gm slowly over 1 hour was administered for cardiac membrane stability and manual ventilation was continued till the EtCO2 came down to 40 mmHg and PAP 25 cmH2O. Hemoclipping for closure of mucosal entry was yet to be done and if not done, it would have led to aspiration of gastric secretions into the mediastinum leading to mediastinitis hence considering the urgency of the intervention, the procedure was restarted and hemoclipping was done within 10 minutes. During this period, there was no CO2 insufflation in the tunnel and the vital parameters were maintained. Post procedure, the patient was hemodynamically stable with manual ventilation with tidal volume of 350-400 ml, respiratory rate of 14-16 breaths/min, PAP of 22 cm H2O and EtCO2 35-40 mmHg. The patient was not reversed and not extubated and was shifted to Post Anaesthesia Care Unit (PACU) in view of intraoperative events, need for mechanical ventilation and for observation. The patient was gradually weaned of ventilator and extubation was done on the next day as the blood gases and other hemodynamic parameters were stable and the patient was later shifted toward post two days of observation in PACU.

Discussion

POEM has engendered a lot of excitement since it offers the efficacy of surgery with the lower cost and morbidity of an endoscopic procedure. With current safety and efficacy data, this should be considered as a first-line treatment for all achalasia. POEM is performed under general anaesthesia with endotracheal intubation to achieve a positive intrathoracic pressure and minimize the occurrence of mediastinal emphysema [3-4]. Unexpected movement of the patient during the procedure may be hazardous [9]. There are two important considerations for anaesthesia during POEM. One is to avoid aspiration during induction of anaesthesia, and the other is to be careful about the development of gas-related complications. In our case, we aimed to prevent aspiration by instructing the patient to stop eating and drinking on the night before the operation, inserting a Nasogastric Tube before the procedure to aspirate the esophageal contents and by performing rapid sequence induction. Gas-related complications during POEM, such as subcutaneous emphysema, capnoperitoneum, mediastinal

emphysema and capnothorax, have been previously reported [6, 7, 8] Since the esophagus does not have a serosal layer, these complications can occur relatively frequently when the muscle layer is breached. Endoscopists should always be careful to avoid damaging the esophageal muscle layer during the procedure. The risk of peak airway pressure elevation and ventilatory impairment caused by CO_2 insufflation is higher in cases which require a longer than normal muscular incision on the esophageal aspect. Given the risk of pneumoperitoneum, this should be checked for during the procedure and treated by immediate needle decompression of the upper abdomen [9].

Conclusion

Anaesthesiologists providing anaesthesia for POEM in achalasia patients should be prepared to tackle the complications of CO2 insufflation during the procedure and prevent pulmonary aspiration [10]. Anaesthesiologists should be aware that hypercarbia, capnoperitoneum, capnothorax and subcutaneous emphysema causing severe ventilatory impairment can occur during POEM [6]. Vigilant monitoring will facilitate safe performance of POEM.

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