Capnoperitoneum During Peroral Endoscopic Myotomy—Recognition and Management: A Case Report

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Peroral endoscopic myotomy (POEM) is a minimally invasive procedure for treating esophageal achalasia. During POEM, carbon dioxide is insufflated under pressure into the esophagus and stomach, which can cause clinically significant capnoperitoneum, capnmediastinum, or capnоторax. We present a case in which gas accumulation in the abdomen during POEM had adverse effects on ventilation. Once the cause was recognized, needle decompression of the abdomen led to immediate improvement in ventilation. (A&A Case Reports. 2017;8:145–6.)

Achalasia is a rare medical condition of unknown etiology characterized by incomplete or absent relaxation of the lower esophageal sphincter and impaired peristalsis of the distal esophagus. It typically presents with dysphagia and regurgitation of liquids and undigested foods. Treatment of achalasia involves disruption of the LES to allow passage of food into the stomach. Medical management has been with botulinum injections and/or calcium channel blockers. Surgical interventions include pneumatic dilation of the LES and laparoscopic Heller myotomy.1 Recently, a minimally invasive procedure, peroral endoscopic myotomy (POEM), has been highly effective in treating achalasia.2 The purpose of this communication is to familiarize anesthesiologists with potentially adverse pulmonary changes that frequently occur during POEM3 and to describe the simple management approach for reversing these changes.

CASE DESCRIPTION

A 41-year-old woman (height 1.63 m, weight 44 kg) was scheduled for a POEM procedure for esophageal achalasia and progressive dysphagia. She was otherwise healthy. Preoperatively, she was normotensive with peripheral oxygen saturation (Spo2) of 100% when breathing room air. Following preoxygenation with 100% O2, a rapid sequence anesthetic induction was performed with IV fentanyl, propofol, and succinylcholine, and the airway was secured with an endotracheal tube. General anesthesia consisted of atropine, rocuronium for muscle relaxation. Intermittent positive pressure ventilation (IPPV) was initiated with Fio2 0.7, tidal volume (Vt) of 400 mL at 10 breaths per minute (bpm), and positive end-expiratory pressure (PEEP) of 2 cm H2O and peak inspiratory pressure (PIP) of 12 cm H2O. At the time of incision, the patient’s blood pressure (BP) was 115/62 mm Hg, her Spo2 was 100%, and her end-tidal carbon dioxide (etco2) level was 34 mm Hg.

The surgeon began low-flow CO2 insufflation through a flexible gastroscope. The system we employ does not allow measurement of gas delivery pressures. The mucosal incision, dissection, and myotomy were performed with a low-wage electrocautery (monopolar) instrument, so there is no need to reduce Fio2.

Following the start of esophageal CO2 insufflation, etco2 levels began to rise, reaching 52 mm Hg within the first 10 minutes. At that time, BP was 114/60 mm Hg, Vt 386 mL, PIP 16 cm H2O, and PEEP 5 cm H2O. Ten minutes later, PIP also began to rise. Starting with a baseline of 12 to 14 cm H2O, PIP rose to 40 cm H2O 30 minutes into the procedure and was associated with a progressive rise in etco2. Hypercarbia was initially treated by increasing the respiratory rate to 12 bpm and then 15 bpm at a Vt 500 mL to increase the minute ventilation. etco2 rose to a maximum of 75 mm Hg 40 minutes after the start of surgery; BP was 110/46 mm Hg. Throughout the entire procedure, BP remained stable.

The patient’s abdomen was palpated and found to be distended and tense. Subcutaneous emphysema was also present over the patient’s chest and neck. The surgeon was informed of these findings, and the operation was temporarily stopped. He inserted a Veress needle into the patient’s abdomen to decompress the capnoperitoneum. The patient’s Spo2 rose after the needle decompression from 96% to 100%, PIP decreased to 34 cm H2O, and etco2 improved from 75 mm Hg to 46 mm Hg within 10 minutes of this intervention.

The remainder of the procedure was uneventful. The patient’s trachea was extubated at the completion of surgery. In the postanesthetic care unit, she experienced no respiratory or hemodynamic problems. The following day, routine Gastrografin (meglumine diatrizoate) esophagram, performed following all POEM procedures, demonstrated the complete mucosal closure and patency of the repair without residual subcutaneous emphysema.

DISCUSSION

POEM involves the insufflation of CO2 into the esophagus and stomach through a flexible endoscope. A submucosal tunnel is then created from the esophagus into the stomach spanning the LES. Once circular fibers of the muscles around the LES are identified, a myotomy is performed by
electrocautery to cut these fibers. The length of the myotomy varies, but typically is between 7 cm and 19 cm with the distal end terminating 2 to 3 cm into the stomach.

Since its initial description in 2010,2 there have been numerous publications describing POEM, but few have discussed the anesthetic problems associated with this procedure.4 Because POEM patients are being treated for achalasia, prevention of pulmonary aspiration is the anesthetic complication most often considered.5

Esophageal and gastric insufflation of CO2 under pressure can result in capnoperitoneum, capnomediastium, capnophorax, and subcutaneous emphysema.6 During surgery, visible transmural openings into the mediastinum and into the peritoneal cavity have been associated with these changes.7 Adverse effects because of CO2 insufflation were reported in <2% of almost 1700 patients undergoing POEM in the largest retrospective series.8 The complications of capnomediastium, capnoperitoneum, subcutaneous emphysema, or a combination of the above were first noted by routine chest imaging and esophagram on the first postoperative day, and all resolved without any therapeutic intervention.

A previous review of the anesthetic management of POEM observed minor elevations of etCO2 in all patients (28/28), which were treated by increasing minute ventilation.9 This study reported a small amount of subcutaneous emphysema in the neck in 1 patient, but no other adverse complications were seen. In another series, subcutaneous emphysema occurred in 6 of 16 patients, and needle decompression of a capnoperitoneum was performed in 50% (8/16) of patients.7 Neither of these articles mentioned ventilatory changes associated with gas accumulation in the chest or abdomen. A more recent series of 52 patients described the anesthetic management and complications of POEM.10 Minute ventilation was initially increased when etCO2 began to rise, with a goal to maintain etCO2 below 45 mm Hg. Any associated rise in peak airway pressure was used as a marker for increased intra-abdominal pressure, which was first managed by suctioning the stomach. The highest etCO2 noted in this series was 64 mm Hg and the highest PIP was 55 cm H2O. Six of the 52 patients underwent needle decompression of the abdomen. Of note, all these patients maintained normal blood pressure throughout the entire procedure.

Perhaps because of the different surgical technique, we have observed a much greater incidence of significant ventilatory changes during POEM procedures performed at our institution. PIP can rise to levels that can compromise ventilation or potentially cause barotrauma. Hypercarbia and related acidosis were always present. If the anesthesiologist is not aware of the cause, or is not monitoring the patient closely, considerable time may be lost before the correct diagnosis is made and appropriate treatment instituted. The abdominal compartment syndrome from a very large, unrecognized capnoperitoneum can cause clinically significant hypotension, which can be misdiagnosed as a cardiac event.

The most effective intervention for ventilator changes during POEM is the decompression of the peritoneum, so open communication with the surgeon is essential once significant changes begin to occur. Usually, simple needle decompression has been successful, but, in one of our patients, this was not sufficient and a 5-mm trocar needed to be inserted. Our surgeons actually prepare a region of the abdominal wall preoperatively, anticipating the need for intraoperative decompression.

The more serious but less frequent complication of POEM is tension capnothorax, which will not be corrected by abdominal needle decompression. Tension capnothorax must be considered if PIP does not decrease immediately after the abdominal needle decompression.11 It is important that everyone becomes familiar with the potential complications of CO2 insufflation during POEM. Ventilatory changes are common, and valuable time may be lost if the anesthesiologist considers other causes and/or attempts unsuccessful interventions rather than proceeding to needle decompression of the capnoperitoneum.

DISCLOSURES

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REFERENCES