

Unusual presentation of tension pneumoperitoneum during endoscopic submucosal dissection of early gastric tumor

Phui Sze Au Yong, Gek Kim Sharon Ong

Introduction

Tension pneumoperitoneum is a well-known but rare complication of upper gastrointestinal endoscopy. It is defined as the massive accumulation of air in the peritoneal cavity, which results in a sudden increase in intraabdominal pressure resulting in hemodynamic or ventilatory compromise. (1) The presentation varies from intense abdominal pain and tenderness to imminent collapse. (2)

Case description

The patient was a 72-year-old Burmese lady, 57.2 kg, 159 cm, American Society of Anaesthesiologists (ASA) 2 with a past medical history of Sjogren's syndrome. She was diagnosed with early antral gastric adenocarcinoma in October 2017. The lesion was 3 cm at the antrum lesser curve. She was electively admitted for endoscopic submucosal dissection in the endoscopy suite. The procedurist was amenable for the procedure to be done under sedation or general anaesthesia. However, as the duration was scheduled for 3 hours, a general anaesthesia technique with intubation, paralysis, and positive pressure ventilation was chosen. Induction of anaesthesia was uneventful. The patient's airway was secured with a size 7 standard endotracheal tube (ETT). She was positioned in a left lateral position and an-

aesthesia was maintained with an air-oxygen mixture and desflurane with boluses of fentanyl for analgesia. She was put on continuous mandatory volume-control ventilation. A bite guard was also inserted to facilitate endoscope movement.

Sixty minutes into the procedure, blood pressure decreased to 80/60 mmHg requiring intermittent boluses of ephedrine, followed by a marked increase in peak airway pressure from 17 cmH₂O to 23 cmH₂O despite adequate paralysis. Obstruction, kinking, and bronchospasm were ruled out. The patient's position was found to have flopped forward onto her abdomen. While repositioning, her abdomen was found moderately distended and the procedure was halted for nasogastric tube decompression. The airway pressure decreased to 17 cmH₂O and the procedure continued.

Seventy five minutes later, the airway pressure again gradually increased to 30 cmH₂O with accompanying hypotension requiring more boluses of ephedrine and phenylephrine, and gross abdominal distension. This was suspected that to be due to the gas insufflation from the endoscope. The procedurist verbalized that he had changed to air for insufflation instead of carbon dioxide to improve his visualization but did not inform the anaesthetist. Due to persistent ventilatory compromise, needle aspiration using a 50 ml saline-filled syringe with was performed to decompress the abdomen. (2) At least 500 ml of air was aspirated before the abdominal distension resolved. Bladder catheterization was also performed to reduce risk of perforation during needle aspiration. The procedure resumed and was completed in the next 15 minutes, and the stomach walls were examined carefully for gross macro perforation before withdrawing the scope. The total duration of the procedure was 4 hours 46 minutes.

Postoperative chest and abdominal X-ray were done after uneventful extubation (**Figure 1**), revealing moderate pneumoperitoneum and subcutaneous emphysema. The patient remained stable in recovery for 1 hour and was sent to high dependency unit overnight. She had no complaints

From Division of Anaesthesiology and Perioperative Medicine, Department of Surgical Intensive Care, Singapore General Hospital (Phui Sze Au Yong, Gek Kim Sharon Ong).

Address for correspondence:

Dr. Phui Sze Au Yong
Division of Anaesthesiology and Perioperative Medicine,
Department of Surgical Intensive Care, Singapore General
Hospital
Tel: +65 94366422
Email: phuisze.auyong@mohh.com.sg

of abdominal pain or breathlessness and vitals remained stable. Broad spectrum antibiotic coverage with ceftriaxone and metronidazole was commenced in view of the possibility of inadvertent pin-point gut perforation during dissection. Serial X-rays showed resolution of the pneumoperitoneum and emphysema. She was able to tolerate liquids on postoperative day 1, progressed to full diet 2 days later, and discharged on postoperative day 4.

Discussion

Endoscopic submucosal dissection (ESD) of gastric tumors is a minimally invasive, curative technique employed for early gastric tumors. It was developed in Japan in the mid-1990s. It has also been described for lesions of the esophagus, duodenum, and colon. The technique involves enucleation of the tumor with submucosal injection of diluted epinephrine and a diathermic electrosurgical knife, starting along the lower border of the lesion and extending circumferentially until it can be dissected away from the muscular layer and removed with an endoscopic bag. (3)

Procedural complications include bleeding and perforation. A meta-analysis found that the perforation rate for ESD was 4.5 percent. (3) Risk factors for perforation include operator factors e.g. precise technique, experience, and volume; lesion-related factors e.g. size, luminal distribution, and accessibility. The specimens retrieved in our case included a main specimen of 45x32 mm and smaller specimens of 21x8 mm and 9x4 mm, and procedure took a total of 4 hours 46 minutes. Chaves et al (4) reported a mean specimen diameter of 1.6 mm (0.6-3.5 mm) and a mean procedure duration of 85 minutes (20-160 minutes). For this patient, the procedure took a longer time and the lesion was large. Hence, the risk of perforation was higher. Pneumoperitoneum can occur due to micro or macroperforations. (5) Micro perforations are usually detected as free air on postoperative imaging due to the escape of air through invisible perforations in a wall thinned by cautery under insufflation pressure, whereas macro perforations are usually obvious to the procedurist and results from inadvertent deep cautery during incision or dissection phase. Pneumoperitoneum may progress to abdominal compartment syndrome if there is a rapid escape of gas through a perforation and has caused sudden cardiovascular collapse, tissue hypoperfusion, multiorgan dysfunction, and death. This has become infrequent since routine use of carbon dioxide.

Both sedation and general anaesthesia have been described for gastric ESD. Prolonged procedure

time and intense pain caused by distension and dissection of the gastric wall necessitate a deeper level of sedation, however this is associated with increased rates of aspiration. In a retrospective study, Yurtlu found that the incidence of nausea, cough, number of oropharyngeal suctioning, and desaturation episodes were significantly higher in the propofol sedation group versus those in the general anaesthesia group. (6)

Remote locations are often cramped with limited access to patients under drapes and often patients are positioned facing away from the anaesthetist. For the anaesthetist, it is important to consider patient access, duration of procedure and risk factors for bleeding and perforation in deciding on the anaesthetic technique. In this patient, general anaesthesia with endotracheal intubation, paralysis and controlled mechanical ventilation helped to detect and manage respiratory compromise from a tension pneumoperitoneum. This may have been missed if a sedation technique had been used as the patient's abdomen was not visible under the drapes. Moreover, any increase in respiration or movement may be interpreted as patient discomfort and sedation would have been increased to obviate this. The possible sequelae could be desaturation with respiratory or cardiac arrest, (5) and potential aspiration. Hence, it is important to check the abdomen regularly, and entertain a differential diagnosis of tension pneumoperitoneum if increased airway pressure and hypotension were encountered. The immediate management of tension pneumoperitoneum is a needle decompression, while supporting ventilation and hemodynamics simultaneously. In addition, the airway should be secured, due to the risk of respiratory collapse. For severe macro perforations, an exploratory laparotomy for more definite management is warranted.

Conclusion

Advances in technology have necessitated the involvement of the anaesthetist beyond the familiar confines of the operating theatre. Awareness of the procedure and its potential complications, choice of anaesthetic technique, increased vigilance in monitoring and good inter-professional communication can help to increase patient safety and minimize a poor outcome.

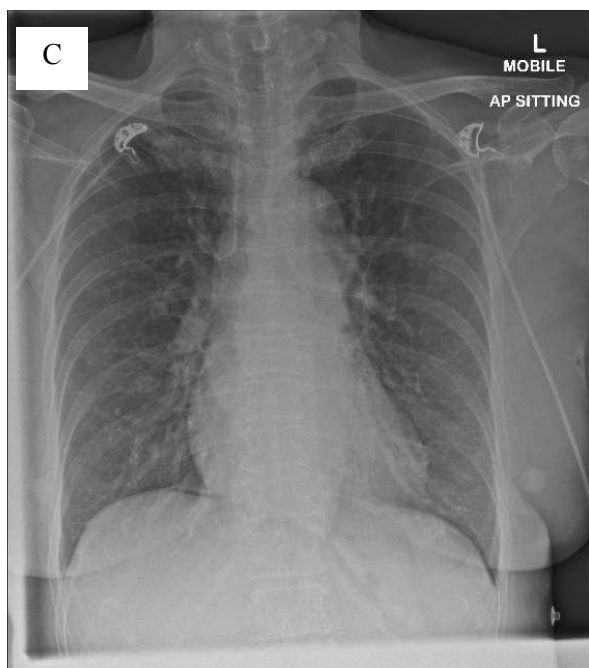
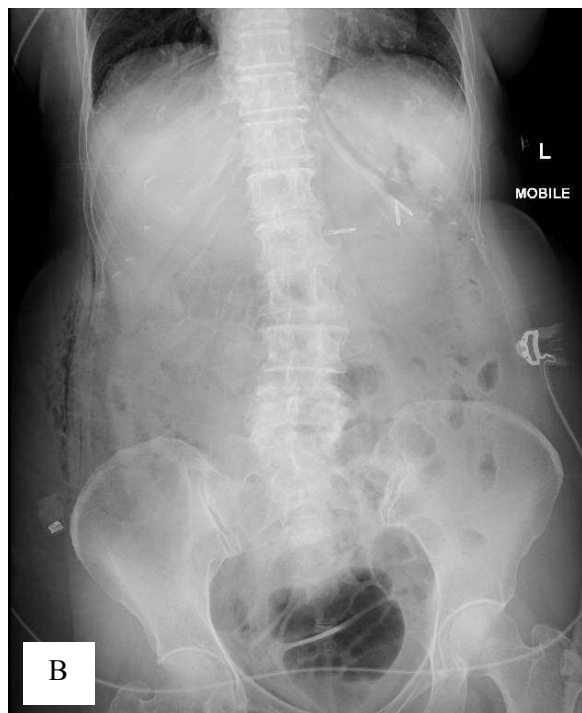
Acknowledgment

Financial disclosure: none.

Conflict of interest: none.

Our institution does not require Institute of Research Board approval for case reports. Informed written consent for publication of the case report has been given by the patient.

Figure 1. (A) Abdominal X-ray immediately postop (left), showing subcutaneous emphysema in right lateral abdominal wall; (B) Abdominal X-ray on postoperative day 1 (right), showing resolution of subcutaneous emphysema; (C) Chest X-ray immediately postoperative showing free under both hemidiaphragms indicated moderate pneumoperitoneum



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