

CASE REPORT

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Contralateral spontaneous rupture of the esophagus following severe emesis after non-intubated pulmonary wedge resection

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Abstract

Background: Non-intubated thoracoscopic lung surgery has been reported to be technically feasible and safe. Spontaneous rupture of the esophagus, also known as Boerhaave's syndrome (BS), is rare after chest surgery.

Case presentation: A 60-year-old female non-smoker underwent non-intubated uniportal thoracoscopic wedge resection for a pulmonary nodule. Ultrasound-guided serratus anterior plane block was utilized for postoperative analgesia. However, the patient suffered from severe emesis, chest pain and dyspnea 6 h after the surgery. Emergency chest x-ray revealed right-sided hydropneumothorax. BS was diagnosed by chest tube drainage and computed tomography. Besides antibiotics and tube feeding, a naso-leakage drainage tube was inserted into the right thorax for pleural evacuation. Finally, the esophagus was healed 40d after the conservative treatment.

Conclusions: Perioperative antiemetic therapy is an indispensable item of fast-track surgery. Moreover, BS should be kept in mind when the patients complain of chest distress following emesis after thoracic surgery.

Keywords: Boerhaave's syndrome (BS), Spontaneous ruptures of the esophagus, Three-dimensional CT angiography (3D-CTA), Single port, Uniportal, Video-assisted thoracoscopic surgery (VATS)

Background

Spontaneous rupture of the esophagus, also known as Boerhaave's syndrome (BS), typically occurs after severe emesis as a highly morbid emergency condition [1]. BS accounts for about 15% of esophageal perforations, and the tears are usually located in lower third of the esophagus [2]. Contrast esophagram and computed tomography (CT) are sufficient for the diagnosis of BS.

Non-intubated video-assisted thoracoscopic surgery (VATS) can be utilized to avoid ventilation-associated adverse effects, which has been reported to be technically feasible and safe [3]. The major complications of non-intubated procedure include intraoperative hypoxia, hypercapnia, and cough.

To our knowledge, the onset of contralateral esophageal rupture after lung resection without lymph node dissection is rare. Herein we presented a case of BS following severe emesis after non-intubated lung surgery. Meanwhile, the current evidence regarding the safety of non-intubated/tubeless thoracic surgery was reviewed briefly.

Case presentation

The clinical data of the patient were treated anonymously for privacy concern. A 60-year-old previously healthy female non-smoker was admitted because the CT revealed a ground-glass nodule (GGN) about 0.5 cm in the left upper lobe (Fig. 1a). The serum neuron-

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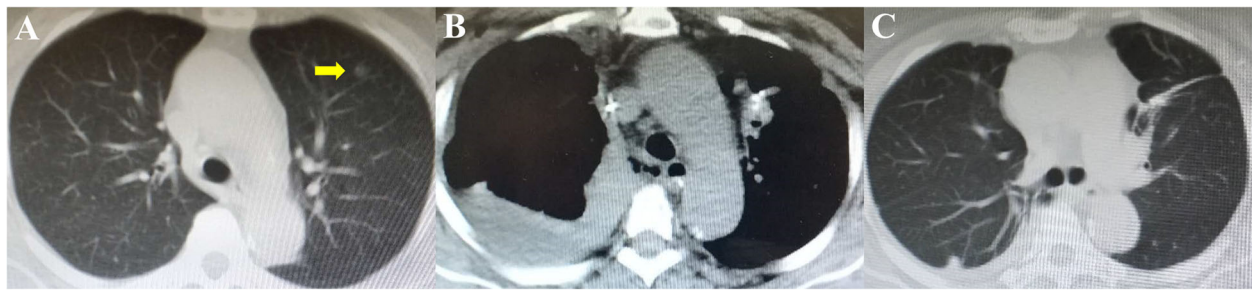


Fig. 1 The computed tomography images. **a** A nodule in the left upper lobe was indicated by arrow. **b** The right-sided hydro-pneumothorax. **c** The esophagus was healed

specific enolase, cytokeratin-19 fragment, carcinoembryonic antigen, and squamous cell carcinoma were in normal range. After a preoperative workup, the patient was assigned to lung resection. Fast-track protocol was introduced. Preoperative three-dimensional CT angiography (3D-CTA) was established by OsiriX [4]; therefore, invasive labeling of the GGN by microcoil or hook-wire was avoided. Non-intubated uniportal VATS pulmonary wedge resection was performed under internal intercostal nerve block and targeted sedation [5, 6]. The operation time was 30 min, without obvious blood loss. Mediastinal lymph node sampling wasn't performed because the frozen-section reported atypical adenomatous hyperplasia (AAH). Ultrasound-guided serratus anterior plane block (SAPB) using a bolus of 0.2% bupivacaine was utilized for postoperative analgesia.

Next-day discharge was scheduled because air leak was not recorded. Postoperative pathological staining of the specimen confirmed the diagnosis of AAH. The patient complained of nausea and emesis about 3 h after the operation, which was alleviated gradually after intravenous ondansetron (4 mg, once). However, 6 h after the surgery, she developed sudden tachycardia, tachypnea, dyspnea and hypotension after oral feeding. Emergency CT revealed right-sided hydro-pneumothorax (Fig. 1b). The turbid, yellow fluid drained from the chest tube further confirmed the diagnosis of BS.

The patient refused a timely surgical intervention. Besides antibiotics and tube feeding, endoscopy-guided naso-leakage drainage of the pleural effusion was utilized, which had been reported to be effective to rinse vomica [7]. Finally, the esophagus was healed 40d after the treatment (Fig. 1c). During the 1-year follow up, tumor recurrence or metastasis was not recorded.

Discussion and conclusions

We identified a patient with BS after severe emesis following minimally invasive lung surgery. Severe emesis

is a stressful complication of anesthesia or analgesia. A retrospective study presented 10 patients with esophageal perforation after emesis associated with large volume of food and alcohol intake [8]. Moreover, every perforation was longitudinal tears (about 1–4 cm), locating in the left lower-third of the esophagus. Then the authors hypothesized that esophageal perforation probably resulted from emesis through a pathophysiological reaction within the upper digestive tract. Furthermore, they proposed that BS should be defined as post-emetic esophageal perforation. Therefore, we concluded that the present BS was probably secondary to the uncontrolled emesis rather than the surgical procedure itself.

The incidence of post-discharge emesis after ambulatory surgery is approximately 30% [9]. Chest pain and emesis always suggest the onset of BS, but the patients don't always present with typical clinical features. The major treatment options for BS were conservative, endoscopic and surgical approach; whereas the survival rate of the patients using these treatments was 75, 100 and 81%, respectively [10]. Surgery should be considered especially for those who are admitted within 24 h of perforation [11]. In addition, endoscopy also plays a role in the treatment of transmural defects [12], although an evidence-based recommendation is still lacking. Besides surgical and endoscopic interventions, naso-esophageal extraluminal drainage has been reported to be effective for the treatment of esophageal leaks and subsequent mediastinal abscess [13].

On the other hand, non-intubated thoracic surgery under minimal sedation with regional anaesthesia is useful to avoid nausea and emesis [14]. However, the evidence supporting non-intubated VATS as the preferred approach for lung surgery is still limited. Previous meta-analyses show that non-intubated procedures could attenuate surgery-related stress responses and decrease postoperative complications compared to intubated surgery [15, 16]. Moreover, for patients who are considered as high-risk under

intubated general anesthesia due to their compromised lung function, non-intubated procedure could be considered [17]. A meta-analysis indicates that non-intubated VATS may be a better alternative to intubated surgery [18], although it requires extra vigilance to ensure the safety of the patients [19]. The disadvantages of non-intubated thoracic surgery include cough and poor maneuverability due to the movements of diaphragm and lung [20].

We searched PubMed, Web of Science, Scopus, Embase, Europe PMC, Cochrane Library and Google Scholar for randomized controlled trials (RCTs) up to June 2020 according to the PRISMA Protocol for updated evidence of nonintubated lung surgery. Key words in title or abstract include “non-intubated” or “tubeless”

or “awake” and “pulmonary” or “lung” and “surgery”. Finally a total of 13 RCTs were obtained (Table 1), which covered 627 patients who underwent non-intubated or tubeless VATS. Among them, 11 (1.8%) morbidities due to gastrointestinal reactions were recorded. Based on these findings, non-intubated VATS is technically feasible and safe; however, the results should be interpreted with caution due to small samples in the trials and potential publication bias. Well-designed studies are warranted. The registered trials of non-intubated thoracic surgery were listed in Table 2, which might further elucidate the specific indications and contraindications of tubeless thoracic surgery.

In summary, perioperative antiemetic with strict supervision should be considered as an indispensable

Table 1 The reported randomized clinical trials regarding non-intubated thoracoscopic lung surgery

| First author, year | Sample | Age, year | Anaesthesia method | Surgical procedure | Conversion to intubation | Postoperative analgesia | Morbidity due to gastrointestinal reactions |
|--------------------|--------|-------------|--|---|--------------------------|--------------------------|---|
| Pompeo, 2004 [21] | 30 | 60 (45–68) | TEA at T4–T5 | Pulmonary nodule resection | 4 (13.3%) | TEA | NR |
| Pompeo, 2007 [22] | 21 | 28 ± 14 | Locoregional anaesthesia | Bullectomy | 0 | TEA | 1 (4.8%) |
| Vanni, 2010 [23] | 25 | 57 (51–62) | TEA | NR | 0 | PCIA | 0 |
| Tacconi, 2010 [24] | 11 | 48 (43–55) | TEA | Lung nodule resection, bullectomy, pleura-lung biopsy | 0 | PCIA | 0 |
| Pompeo, 2011 [25] | 32 | 64 ± 9 | TEA at T4–5 | Lung volume reduction | 2 (6.3%) | NR | 0 |
| Pompeo, 2013 [26] | 20 | 67 ± 12 | TEA at T4 | Pleurodesis | 0 | NR | 0 |
| Cai, 2013 [27] | 30 | 23.5 ± 10.6 | Laryngeal mask anesthesia | Bullectomy | 0 | PCIA | 3 (10.0%) |
| Wang, 2014 [28] | 50 | 43.2 ± 14.7 | General anaesthesia; laryngeal mask | Bullectomy, lobectomy, biopsy, mediastinal mass excision | 0 | NR | 0 |
| Liu, 2015 [29] | 167 | NR | TEA | Wedge resection, lobectomy | 0 | NR | 4 (2.4%) |
| Chen, 2016 [30] | 85 | 23.3 ± 6.8 | Intravenous anesthesia | Sympathectomy | 0 | NR | 0 |
| Mao, 2018 [31] | 30 | 21 ± 3.2 | General anaesthesia + laryngeal mask | NUSS procedure | 0 | PCIA | 3 (10.0%) |
| Hwang, 2018 [32] | 21 | 17 (17–45) | Sedation anesthesia | Bullectomy | 0 | Local analgesia | 0 |
| Mogahed, 2019 [33] | 35 | 42.9 ± 9.6 | General anaesthesia | Lung resections, excision/biopsy of mediastinal mass, foreign body extraction and pericardial window. | 0 | Intramuscular ketoprofen | NR |
| | 35 | 43.5 ± 10.5 | General anaesthesia + TEA | | | | |
| | 35 | 44.0 ± 9.3 | General anaesthesia + intercostal block infiltration | | | | |

Abbreviations: TEA thoracic epidural anesthesia; PCIA patient controlled intravenous analgesia; NR not reported

Table 2 The registered trials of non-intubated or tubeless thoroscopic lung surgery

| Registration identifier | Year | Disease | Anaesthesia method | Estimated enrollment | Major outcomes | Status | Country |
|-------------------------|------|--|---|----------------------|--|-------------------------|---------|
| NCT00566839 | 2007 | Emphysema | TEA | 60 | Mortality, FEV1, dyspnea index | Completed | Italy |
| NCT01469728 | 2011 | NR | TEA | 40 | Grade of medical care | Completed | Italy |
| NCT01677442 | 2011 | NR | TEA at the T5/T6 | 500 | Recovery time | Unknown | China |
| NCT01533233 | 2012 | Lung cancer | NR | 100 | Complication and morbidity | Unknown | China |
| NCT02109510 | 2014 | Pneumothorax | Sedation anesthesia + intercostal nerve block | 40 | Postoperative discomforts | Completed | Korea |
| NCT02123173 | 2014 | Lung neoplasms | NR (one lung ventilation) | 71 | Cardiac output | Completed | China |
| NCT02393664 | 2015 | Lung neoplasms | General anesthesia + intercostal/vagal blocks | 300 | Quality of recovery | Unknown | China |
| NCT02817048 | 2016 | Solitary lung nodule | NR (Tubeless) | 100 | Postoperative hospital stay | Not yet recruiting | China |
| NCT03275428 | 2017 | Lung nodule | Intravenous sedation | 40 | Arterial oxygen pressure | Unknown | China |
| NCT03083080 | 2017 | NR | Intercostal nerve plane block | 30 | Pain, time to lose skin sensation | Unknown | China |
| NCT03086213 | 2017 | NR | Paravertebral/intercostal nerve block | 48 | The change of stress response markers | Unknown | China |
| NCT03016858 | 2017 | Bulla | Intravenous anesthesia | 320 | Complications | Recruiting | China |
| NCT03137576 | 2017 | Lung neoplasms | Erector spinae plane block/paravertebral block and sedation | 172 | Percentage of sedation escalation | Recruiting | Italy |
| ChiCTR-INR-17012747 | 2017 | Thoracic diseases | General anesthesia | 30 | Length of hospital stay | Recruiting | China |
| ChiCTR-IPR-17013325 | 2017 | Lung nodule | Intravenous anesthesia | 120 | CD3+, CD8+, CD4+, CD19+, NK cell concentration | Not yet recruiting | China |
| NCT03711461 | 2018 | NR | NR | 32 | Impedance changes (swallowing) | Recruiting | China |
| NCT03432637 | 2018 | Lung cancer | Spontaneous ventilating anesthesia | 450 | Hypoxemia or hypercapnia | Recruiting | China |
| NCT03471884 | 2018 | Lung cancer | General anesthesia | 82 | Lung function | Recruiting | China |
| NCT03469323 | 2018 | NR | NR (one-lung spontaneous breathing) | 30 | Quality of lung collapse | Recruiting | China |
| ChiCTR1800018198 | 2018 | NR | Paravertebral nerve block + laryngeal mask | 110 | Glottal injury, sore throat | Recruiting | China |
| NCT03653494 | 2018 | NR | General anesthesia + paravertebral block + surface spray anesthesia + vagus block with or without phrenic block | 80 | Anesthetic drugs needed | Enrolling by invitation | China |
| ChiCTR1800018204 | 2018 | NR | Serratus anterior plane/erector spinae plane/paravertebral block | 90 | Nerve block time | Not yet recruiting | China |
| ChiCTR1800017854 | 2018 | T1a (<2 cm) peripheral lung adenocarcinoma | NR (Tubeless) | 200 | Complications | Not yet recruiting | China |
| NCT03874403 | 2019 | NR | Intercostal nerve block | 60 | The density spectral array | Recruiting | China |
| NCT04057586 | 2019 | NR | NR (one lung ventilation) | 240 | Intraoperative cerebral oxygenation | Recruiting | China |
| ChiCTR1900027350 | 2019 | Lung cancer | Intercostal/paravertebral nerve block + general anesthesia using laryngeal mask | 80 | Hemodynamics, general anesthetic | Recruiting | China |

Table 2 The registered trials of non-intubated or tubeless thoroscopic lung surgery (*Continued*)

| Registration identifier | Year | Disease | Anaesthesia method | Estimated enrollment | Major outcomes | Status | Country |
|-------------------------|------|---------------------------|--------------------|----------------------|--|--------------------|---------|
| ChiCTR1900022020 | 2019 | Thoracic disease | General anesthesia | 120 | dose, recovery time Glottal injury incidence, lung collapse score | Recruiting | China |
| NCT03958162 | 2019 | Interstitial lung disease | NR (tubeless) | 60 | Diagnostic yield after biopsy | Not yet recruiting | China |
| NCT03902470 | 2019 | Lung cancer | TEA | 30 | Recovery time | Not yet recruiting | Egypt |

TEA thoracic epidural anaesthesia; FEV1 Forced expiratory volume in one second; NR not reported

item of fast-track thoracic surgery. Moreover, the occurrence of BS and a timely intervention should be kept in mind when the patients report chest distress after severe emesis following lung surgery.

Abbreviations

CT: Computed tomography; BS: Boerhaave's syndrome; VATS: Video-assisted thoroscopic surgery; AAH: Atypical adenomatous hyperplasia; SAPB: Serratus anterior plane block; RCTs: Randomized controlled trials

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MZ performed the surgery and wrote this paper. LL contributed to the preparation of the figures and tables. All authors contributed to preparation of the paper and to the perioperative treatment of the patient. All authors approved the final manuscript.

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Availability of data and materials

The data used in this report are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

This report was approved by the Institutional Review Board of Xuzhou Central Hospital.

Consent for publication

Written informed consent was obtained from the patient for publication of this report and any accompanying images.

Competing interests

The authors declare that they have no competing interests.

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