

# Contralateral Spontaneous Rupture of the Esophagus Following severe Vomiting After Non-intubated Pulmonary Wedge Resection

**Lei Liu**

Yichang Central People's Hospital

**Wenbin Wu**

Xuzhou Central Hospital

**Longbo Gong**

Xuzhou Central Hospital

**Miao Zhang** (✉ [zhangmiaodr@163.com](mailto:zhangmiaodr@163.com))

Xuzhou Central Hospital <https://orcid.org/0000-0001-7431-5986>

---

## Case report

**Keywords:** Boerhaave's syndrome (BS), Spontaneous rupture of the esophagus, Non-intubated, Tubeless, Single port, Uniportal, Video-assisted thoracoscopic surgery (VATS)

**Posted Date:** June 25th, 2020

**DOI:** <https://doi.org/10.21203/rs.3.rs-37167/v1>

**License:**  This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

---

**Version of Record:** A version of this preprint was published on October 1st, 2020. See the published version at <https://doi.org/10.1186/s13019-020-01321-w>.

## Abstract

**Background:** Non-intubated thoracoscopic lung surgery has been widely applied as it is 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 assisted with a laryngeal mask for a solitary pulmonary nodule. Ultrasound-guided serratus anterior plane block was utilized for analgesia. The patient complained of hyperemesis followed by chest pain and acute dyspnea 6 hours after the surgery. Emergency chest x-ray revealed the right-sided hydropneumothorax. BS was confirmed by further chest tube drainage and computed tomography. The patient refused surgical intervention; therefore, conservative procedures including pleural evacuation through a naso-leakage drainage tube, antibiotics and tube feeding were administered. The healing of the esophagus was recorded 40 days later.

**Conclusions:** Perioperative antiemetic is an indispensable item of tubeless thoracic surgery. BS should be kept in mind when the patients suffer from sudden chest distress following severe vomiting after tubeless lung surgery.

## Background

Spontaneous rupture of the esophagus (Boerhaave's syndrome, BS), firstly described in 1724, is defined as the complete disruption of the esophageal wall, typically occurring after severe vomiting [1]. BS accounts for 15% of esophageal perforations, and the tear is usually located on the lower third of the esophagus [2]. Contrast esophagram and computed tomography (CT) are usually sufficient for the diagnosis of BS. Non-intubated or tubeless video-assisted thoracoscopic surgery (VATS) under intravenous/local anesthesia can be utilized to avoid the potential adverse effects of mechanical ventilation; whereas the complications of non-intubated procedure include intraoperative hypoxia, hypercapnia, and cough. A consensus recommendation regarding the preparation, surgical techniques, and postoperative management during non-intubated VATS has been established [3].

To the best of our knowledge, the onset of contralateral esophageal rupture after limited lung resection without mediastinal lymph node dissection is rare. Herein we presented a case of BS following severe vomiting after non-intubated lung surgery. Meanwhile, an updated review of the current evidence regarding the safety profile of non-intubated/tubeless thoracic surgery was conducted briefly.

## Case Presentation

The clinical data was treated anonymously for privacy concern. A 60-year-old previously healthy female non-smoker was admitted because the CT during the health examination revealed a ground-glass nodule about 0.5 cm in diameter in the left upper lobe (Fig. 1A), in suspicious of malignancy. The serum neuron-specific enolase, cytokeratin-19 fragment, carcinoembryonic antigen, and squamous cell carcinoma were all in normal range. According to the multi-disciplinary consultation after a preoperative workup, the patient was assigned to a timely pulmonary wedge resection. Fast-track protocol was introduced individually. Three-dimensional CT angiography of the target lung was established using the free OsiriX for non-invasive location of the nodule [4], and the mechanical labeling by microcoil or hook-wire was avoided. Then non-intubated uniportal VATS pulmonary wedge resection was performed using internal intercostal nerve block, vagal block, and targeted sedation as reported [5, 6]. The operation time was 30 minutes, without significant blood loss. Mediastinal lymph node dissection or sampling was avoided 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 or fistula was not recorded. However, the patient complained nausea and severe vomiting about 3 h after the operation, which was alleviated gradually after the injection of ondansetron (4 mg, once). However, the patient developed sudden tachycardia, tachypnea, acute dyspnea, and hypotension after oral feeding 6 h after the surgery. Emergency x-ray revealed hydropneumothorax in the right pleural space (Fig. 1B). The turbid yellow fluid from the chest tube and the identification of the perforation site in CT images confirmed the diagnosis of BS. The patient declined a timely surgical intervention for personal reasons; therefore, conservative procedures including pleural evacuation, antibiotics and tube feeding were administered. Endoscopy-guided naso-leakage drainage insertion was performed as reported [7], with the aim to rinse the vomica effectively. The healing of the esophageal perforation was recorded 40 days after the treatment (Fig. 1C). Then the patient was discharged from the hospital. During the follow up of a year, she demonstrated satisfactory quality of life.

## Discussion And Conclusions

For the present case, postoperative severe vomiting is presumed to be the reason for the onset of BS. BS mainly results from severe vomiting (forceful emesis) which is one of the most stressful complications of general anesthesia. The incidence of post-discharge vomiting after ambulatory surgery is approximately 30% [8]. Pain and vomiting always suggest the diagnosis of BS, but the patients don't always present with typical clinical features. A retrospective review showed that surgery should be considered regardless of the time after onset [9], especially for those who were admitted within 24 hours of perforation [10, 11]. Endoscopic management plays a vital role in the treatment of transmural defects [12], but evidence-based recommendation is still lacking to date. Moreover, naso-esophageal extraluminal drainage has been reported to be effective for the treatment of anastomotic leaks and subsequent mediastinal abscess [13].

Non-intubated VATS under minimal sedation with local or regional anaesthesia is useful to avoid postoperative nausea and vomiting [14]. However, the evidence supporting non-intubated VATS as the preferred approach for lung surgery is still limited. Previous meta-analyses reported that non-intubated procedure attenuated the inflammatory response and stress, followed by fewer postoperative complications as compared with the intubated VATS [15, 16]. Moreover, the indications for VATS could be extended by this less-invasive procedure. For example, patients with impaired lung function or chronic obstructive pulmonary disease are considered as high-risk for intubated general anesthesia; whereas the non-intubated VATS may be applied in these cases [17]. On the other hand, non-intubated VATS may be a better alternative to intubated surgery owing to its advantages [18]. However, given the potential emergencies including but not limited to the persistent hypoxemia, carbon dioxide retention, and extensive pleural adhesions, non-intubated anesthesia in lung resection surgery requires extra vigilance to ensure the safety of the patients [19]. Moreover, the other disadvantages of non-intubated thoracic surgery include cough and poor maneuverability due to the movements of the diaphragm and lung [20].

Although it is still premature to declare the superiority of non-intubated lung surgery versus the intubated procedure, there is an obvious trend for more and better studies to be introduced. The updated evidence in terms of the feasibility and safety of non-intubated thoracic surgery should be clarified. We searched PubMed, Web of Science, Scopus, Embase, Europe PMC, Cochrane Library and Google Scholar for randomized controlled trials (RCTs) up to June 2020 based on Population, Intervention, Comparator, and Outcomes framework according to the PRISMA Protocol. Key words and MeSH terms in title or abstract including “non-intubated” or “tubeless” or “awake” and “pulmonary” or “lung” and “surgery” were used. No restriction was made regarding the publication language. Finally a total of 13 reported RCTs were summarized in 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 the findings from the literature review, non-intubated VATS is technically feasible with a satisfactory safe profile; however, the results should be interpreted with caution due to the potential bias and small samples. Further studies are warranted to elucidate the specific indications of conversion from sedation to intubated general anaesthesia as well as the reliable management of perioperative emergencies such as persistent hypoxemia, and carbon dioxide retention. The registered trials regarding non-intubated thoracic surgery were listed in Table 2.

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	NA
Pompeo, 2007 [22]	21	28 ± 14	Locoregional anaesthesia	Bullectomy	0	TEA	1 (4.8%)
Vanni, 2010 [23]	25	57 (51–62)	TEA	NA	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%)	NA	0
Pompeo, 2013 [26]	20	67 ± 12	TEA at T4	Pleurodesis	0	NA	0
Cai, 2013 [27]	30	23.5 ± 10.6	Laryngeal mask anaesthesia	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	NA	0
Liu, 2015 [29]	167	NA	TEA	Wedge resection, lobectomy	0	NA	4 (2.4%)
Chen, 2016 [30]	85	23.3 ± 6.8	Intravenous anaesthesia	Sympathectomy	0	NA	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 anaesthesia	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	NA
	35	43.5 ± 10.5	General anaesthesia + TEA				
	35	44.0 ± 9.3	General anaesthesia + intercostal block infiltration				

Abbreviations: TEA, thoracic epidural anaesthesia; PCIA, patient controlled intravenous analgesia; NA, not available.

Table 2  
The registered trials of non-intubated or tubeless thoracoscopic 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	NA	TEA	40	Grade of medical care	Completed	Italy
NCT01677442	2011	NA	TEA at the T5/T6	500	Recovery time	Unknown	China
NCT01533233	2012	Lung cancer	NA	100	Complication and morbidity	Unknown	China
NCT02109510	2014	Pneumothorax	Sedation anesthesia + intercostal nerve block	40	Postoperative discomforts	Completed	Korea
NCT02123173	2014	Lung neoplasms	NA (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	NA (Tubeless)	100	Postoperative hospital stay	Not yet recruiting	China
NCT03275428	2017	Lung nodule	Intravenous sedation	40	Arterial oxygen pressure	Unknown	China
NCT03083080	2017	NA	Intercostal nerve plane block	30	Pain, time to lose skin sensation	Unknown	China
NCT03086213	2017	NA	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	NA	NA	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	NA	NA (one-lung spontaneous breathing)	30	Quality of lung collapse	Recruiting	China
ChiCTR1800018198	2018	NA	Paravertebral nerve block + laryngeal mask	110	Glottal injury, sore throat	Recruiting	China
NCT03653494	2018	NA	General anesthesia + paravertebral block + surface spray anesthesia + vagus block with or without phrenic block	80	Anesthetic drugs needed	Enrolling by invitation	China

TEA, thoracic epidural anaesthesia; FEV1, Forced expiratory volume in one second; NA, not available.

Registration identifier	Year	Disease	Anaesthesia method	Estimated enrollment	Major outcomes	Status	Country
ChiCTR1800018204	2018	NA	Serratus anterior plane/erector spinae plane/paravertebral block	90	Nerve block time	Not yet recruiting	China
ChiCTR1800017854	2018	T1a (≤2 cm) peripheral lung adenocarcinoma	NA (Tubeless)	200	Complications	Not yet recruiting	China
NCT03874403	2019	NA	Intercostal nerve block	60	The density spectral array	Recruiting	China
NCT04057586	2019	NA	NA (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 dose, recovery time	Recruiting	China
ChiCTR1900022020	2019	Thoracic disease	General anesthesia	120	Glottal injury incidence, lung collapse score	Recruiting	China
NCT03958162	2019	Interstitial lung disease	NA (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; NA, not available.

In summary, perioperative antiemetic should be considered as an indispensable item of fast-track thoracic surgery; meanwhile, a strict supervision is necessary in the ongoing trials. BS should be kept in mind when the patients report severe vomiting after non-intubated lung surgery.

## List Of Abbreviations

CT, computed tomography; BS, Boerhaave's syndrome; VATS, video-assisted thoracoscopic surgery; AAH, atypical adenomatous hyperplasia; SAPB, serratus anterior plane block; RCTs, randomized controlled trials

## Declarations

## Ethics approval and consent to participate

This report was approved by the Institutional Review Board of Xuzhou Central Hospital, and written informed consent was obtained from the patient.

### Consent for publication

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

### Availability of data and materials

The data of the present case is available from the corresponding author on reasonable request.

### Competing interests

The authors declare that they have no competing interests.

## Funding

Not applicable.

## Authors' contributions

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.

## Acknowledgements

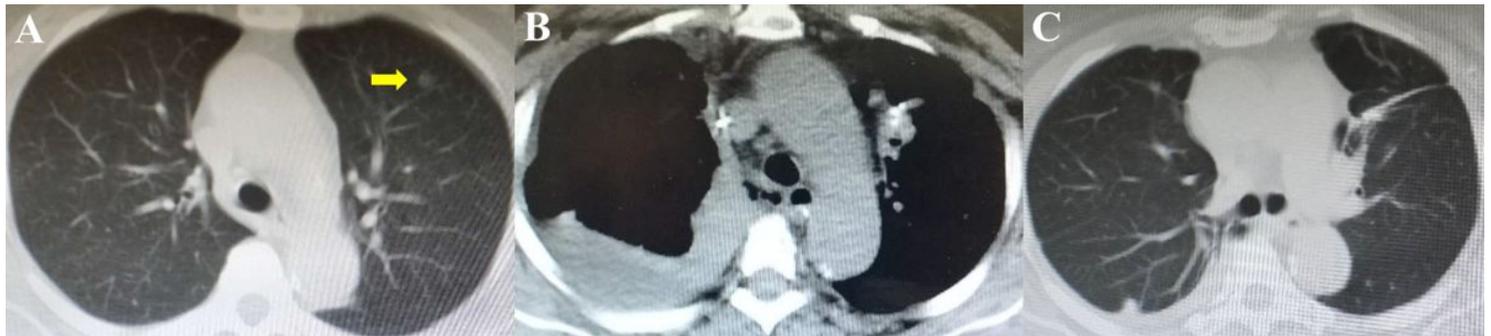
Not applicable.

## References

1. Shiber JR, Fontane E, Ra JH, Kerwin AJ. Hydropneumothorax Due to Esophageal Rupture. *J Emerg Med.* 2017;52:856–8.
2. Chirica M, Kelly MD, Siboni S, et al. Esophageal emergencies: WSES guidelines. *World J Emerg Surg.* 2019;14:26.
3. He J, Liu J, Zhu C, et al. Expert consensus on tubeless video-assisted thoracoscopic surgery (Guangzhou). *J Thorac Dis.* 2019;11:4101–8.
4. Zhang M, Liu D, Wu W, Zhang H, Mao N. Preoperative 3D-CT bronchography and angiography facilitates single-direction uniportal thoracoscopic anatomic lobectomy. *Ann Transl Med.* 2019;7:526.
5. Longo F, Piliago C, Tomaselli E, Martuscelli M, Agro FE. Erector spinae plane block allows non-intubated vats-wedge resection. *J Clin Anesth.* 2020;60:89–90.
6. Hung MH, Hsu HH, Chan KC, et al. Non-intubated thoracoscopic surgery using internal intercostal nerve block, vagal block and targeted sedation. *Eur J Cardiothorac Surg.* 2014;46:620–5.
7. Zhang Y, Zhang YX, Hu JW, et al. Endoscopic naso-leakage drainage: a safe and effective method for the management of intrathoracic anastomotic leakage after esophagectomy. *J Thorac Dis.* 2017;9:3052–61.
8. Mattila K, Toivonen J, Janhunen L, Rosenberg PH, Hynynen M. Postdischarge symptoms after ambulatory surgery: first-week incidence, intensity, and risk factors. *Anesth Analg.* 2005;101:1643–50.
9. Pate JW, Walker WA, Cole FH Jr, Owen EW, Johnson WH. Spontaneous rupture of the esophagus: a 30-year experience. *Ann Thorac Surg.* 1989;47:689–92.
10. Khan AZ, Strauss D, Mason RC. Boerhaave's syndrome: diagnosis and surgical management. *Surgeon.* 2007;5:39–44.
11. Nakano T. [Surgical Techniques of Spontaneous Esophageal Rupture]. *Kyobu Geka.* 2019;72:878–85.
12. Bemelman WA, Baron TH. Endoscopic Management of Transmural Defects, Including Leaks, Perforations, and Fistulae. *Gastroenterology.* 2018; 154: 1938–1946 e1931.
13. Shuto K, Kono T, Akutsu Y, et al. Naso-esophageal extraluminal drainage for postoperative anastomotic leak after thoracic esophagectomy for patients with esophageal cancer. *Dis Esophagus.* 2017;30:1–9.
14. Irons JF, Martinez G. Anaesthetic considerations for non-intubated thoracic surgery. *J Vis Surg.* 2016;2:61.
15. Yu MG, Jing R, Mo YJ, et al. Non-intubated anesthesia in patients undergoing video-assisted thoracoscopic surgery: A systematic review and meta-analysis. *PLoS One.* 2019;14:e0224737.
16. Wen Y, Liang H, Qiu G, et al. Non-intubated spontaneous ventilation in video-assisted thoracoscopic surgery: a meta-analysis. *Eur J Cardiothorac Surg.* 2020;57:428–37.
17. Wang ML, Hung MH, Hsu HH, Chan KC, Cheng YJ, Chen JS. Non-intubated thoracoscopic surgery for lung cancer in patients with impaired pulmonary function. *Ann Transl Med.* 2019;7:40.
18. Zhang K, Chen HG, Wu WB, et al. Non-intubated video-assisted thoracoscopic surgery vs. intubated video-assisted thoracoscopic surgery for thoracic disease: a systematic review and meta-analysis of 1,684 cases. *J Thorac Dis.* 2019;11:3556–68.
19. Shi Y, Yu H, Huang L, et al. Postoperative pulmonary complications and hospital stay after lung resection surgery: A meta-analysis comparing nonintubated and intubated anesthesia. *Med (Baltim).* 2018;97:e10596.
20. Pompeo E, Sorge R, Akopov A, et al. Non-intubated thoracic surgery-A survey from the European Society of Thoracic Surgeons. *Ann Transl Med.* 2015;3:37.
21. Pompeo E, Mineo D, Rogliani P, Sabato AF, Mineo TC. Feasibility and results of awake thoracoscopic resection of solitary pulmonary nodules. *Ann Thorac Surg.* 2004;78:1761–8.

22. Pompeo E, Tacconi F, Mineo D, Mineo TC. The role of awake video-assisted thoracoscopic surgery in spontaneous pneumothorax. *J Thorac Cardiovasc Surg.* 2007;133:786–90.
23. Vanni G, Tacconi F, Sellitri F, Ambrogi V, Mineo TC, Pompeo E. Impact of awake videothoracoscopic surgery on postoperative lymphocyte responses. *Ann Thorac Surg.* 2010;90:973–8.
24. Tacconi F, Pompeo E, Sellitri F, Mineo TC. Surgical stress hormones response is reduced after awake videothoracoscopy. *Interact Cardiovasc Thorac Surg.* 2010;10:666–71.
25. Pompeo E, Rogliani P, Tacconi F, et al. Randomized comparison of awake nonresectional versus nonawake resectional lung volume reduction surgery. *J Thorac Cardiovasc Surg.* 2012;143:47–54. 54 e41.
26. Awake Thoracic Surgery Research Group  
Pompeo E, Dauri M. and Awake Thoracic Surgery Research Group. Is there any benefit in using awake anesthesia with thoracic epidural in thoracoscopic talc pleurodesis? *J Thorac Cardiovasc Surg.* 2013; 146: 495–497 e491.
27. Cai K, Wang X, Ye J, et al. [Laryngeal mask anesthesia in video-assisted thoracoscopic surgery for pulmonary bulla: comparison with intubation anesthesia]. *Nan Fang Yi Ke Da Xue Xue Bao.* 2013;33:756–60.
28. Wang S, Zhang J, Cheng H, Yin J, Liu X. A clinical evaluation of the ProSeal laryngeal mask airway with a Coopdech bronchial blocker for one-lung ventilation in adults. *J Cardiothorac Vasc Anesth.* 2014;28:900–3.
29. Liu J, Cui F, Li S, et al. Nonintubated video-assisted thoracoscopic surgery under epidural anesthesia compared with conventional anesthetic option: a randomized control study. *Surg Innov.* 2015;22:123–30.
30. Chen J, Du Q, Lin M, et al. Transareolar Single-Port Needlescopic Thoracic Sympathectomy Under Intravenous Anesthesia Without Intubation: A Randomized Controlled Trial. *J Laparoendosc Adv Surg Tech A.* 2016;26:958–64.
31. Mao S, Du X, Ma J, Zhang G, Cui J. A comparison between laryngeal mask airway and endotracheal intubation for anaesthesia in adult patients undergoing NUSS procedure. *J Thorac Dis.* 2018;10:3216–24.
32. Hwang J, Shin JS, Son JH, Min TJ. Non-intubated thoracoscopic bullectomy under sedation is safe and comfortable in the perioperative period. *J Thorac Dis.* 2018;10:1703–10.
33. Mogahed MM, Elkahwagy MS. Paravertebral Block Versus Intercostal Nerve Block in Non-Intubated Uniportal Video-Assisted Thoracoscopic Surgery: A Randomised Controlled Trial. *Heart Lung Circ.* 2020;29:800–7.

## Figures



**Figure 1**

The radiographic examinations of the patient. (A) The CT on admission revealed a nodule in the left upper lobe, as indicated by arrow. (B) The chest x-ray showed right-sided hydropneumothorax. (C) The CT images confirmed the healing of the esophagus.

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [CAREChecklist.docx](#)