


## CASE REPORT

# Thoracoscopic decortication for the management of trapped lung caused by 14-year pneumothorax: A case report

Yan Tian<sup>1</sup>, Wenqi Zheng<sup>2</sup>, Nashunbayaer Zha<sup>3</sup>, Yufei Wang<sup>3</sup>, Shaojun Huang<sup>3</sup> & Zhanlin Guo<sup>3</sup> 

1 Hyperbaric Oxygen Therapy Center, The Affiliated Hospital of Inner Mongolia Medical University, Hohhot, China

2 Laboratory of Surgery, The Affiliated Hospital of Inner Mongolia Medical University, Hohhot, China

3 Department of Thoracic Surgery, The Affiliated Hospital of Inner Mongolia Medical University, Hohhot, China

## Keywords

Case report; decortication; pneumothorax; thoracoscopic; trapped lung.

## Correspondence

Zhanlin Guo, Department of Thoracic Surgery, The Affiliated Hospital of Inner Mongolia Medical University, 1 Tongdaobei Road, Hohhot, Inner Mongolia 010050, China.  
Tel: +86 471 345 1489  
Fax: +86 187 0471 0099  
Email: nmggz@163.com

Received: 8 April 2018;

Accepted: 25 April 2018.

doi: 10.1111/1759-7714.12770

Thoracic Cancer 9 (2018) 1074–1077

## Introduction

Trapped lung is defined by the lung's inability to expand and fill the thoracic cavity because of a restricting "peel" that prevents normal visceral and parietal pleural apposition.<sup>1–3</sup> This restriction may result from a benign inflammatory cortex or be caused by a malignant visceral pleural tumor.<sup>1–4</sup> In either case, the pathology leads to the formation of a fibrous visceral pleural peel that does not allow the lung to expand. The most common benign causes include immunologic diseases, such as rheumatoid pleurisy, improperly drained hemothorax, infections like bacterial empyema and tuberculous pleurisy, asbestos exposure, uremic pleurisy, and medications.<sup>4,5</sup> The formation of any case of trapped lung requires the presence of a pulmonary disease as well as chronicity and stability over time. The longer the lung has been trapped, the more difficult it is to make it re-expand, even after the restriction has been removed. However, trapped lung occurring secondary to pneumothorax is rarely reported.

## Abstract

Trapped lung is defined by the lung's inability to expand and fill the thoracic cavity because of a restricting "peel" caused by benign or malignant pleural disease. However, trapped lung secondary to pneumothorax is rarely reported. We present a case of trapped lung caused by a pneumothorax that occurred some 14 years before the patient presented to our hospital with a complaint of incapacitating dyspnea. Computed tomography (CT) scans revealed trapping of the right lung with abnormal thickening of the visceral pleura. In view of the patient's history of pneumothorax, we concluded that his dyspnea was attributable mainly to the trapping of his lung by the earlier pneumothorax. We therefore scheduled thoracoscopic decortication, which was successfully completed. The patient's recovery after the operation was uneventful, and seven weeks after surgery the right lung had re-expanded well.

Herein, we describe a case of trapped lung caused by a pneumothorax that developed 14 years before the patient presented to our hospital. After determining his diagnosis, we successfully performed thoracoscopic decortication and thus enabled the lung to re-expand. This experience shows that even when a lung has been trapped for a long time, it may still be possible to intervene successfully, enabling the lung to re-expand and to function.

## Case report

### Case presentation

In November 2012, a 61-year-old man was admitted to our hospital with shortness of breath, which he had reportedly experienced for 12 months. A month before admission he developed incapacitating dyspnea and had difficulty climbing even two flights of stairs. He denied frequent coughing, sputum production, chest pain, fever, or wheezing. He had a history of pneumothorax affecting the right lung that had occurred some 14 years earlier. However, he had not

received any treatment because at the time he had no symptoms. Moreover, he never had any follow-up review.

Physical examination revealed an absence of breath sounds on the right side but no dullness on percussion. The rest of the examination was unremarkable. The patient's vital signs were as follows: blood pressure, 124/68 mm Hg; pulse, 99 beats per minute; respiratory rate, 21 breaths per minute; and temperature, 36.9°C. Arterial blood gas analysis showed the following: PO<sub>2</sub>, 56 mm Hg; PCO<sub>2</sub>, 44 mm Hg; and oxygen saturation, 92% on room air. Chest x-ray showed a “vanished” right lung (Fig 1a). Further computed tomography (CT) scans revealed a trapped right lung with abnormal thickening of the visceral pleura (Fig 1b, arrows). Considering the history of pneumothorax and the absence of other possible etiologies, our clinical diagnosis was trapped lung caused by remote pneumothorax. After comprehensive assessment of the patient's physical status, we concluded that his incapacitating dyspnea was mainly attributable to the trapped lung. Therefore surgical decortication was planned via a minimally invasive thoracoscopic procedure.

### Surgical procedure

The patient was placed in the left lateral decubitus position and general anesthesia was administered through a double-lumen endotracheal tube to obtain single-lung ventilation. An incision for the 1.5 cm thoracoscopic observation port was made in the seventh intercostal space at the midaxillary line, while two utility incisions were placed: a 2 cm main utility incision was made at the anterior axillary line in the fourth intercostal space, and a 1.5 cm assistant utility incision in the seventh intercostal space at the subscapular line.

Thoracoscopic exploration revealed fibrous peels lying on both the parietal and visceral pleura, restricting the right lung (Fig 2a, arrows). Thoracoscopic decortication

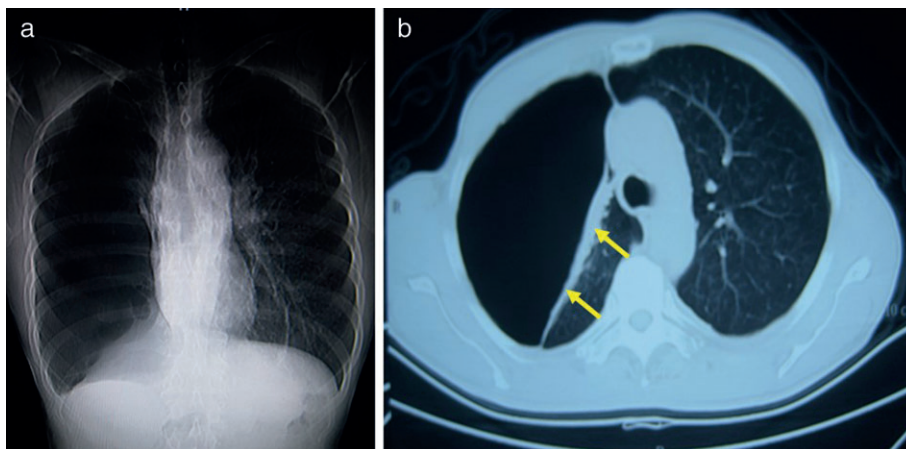
was successfully performed, removing the fibrous cortex and debris. During the process, laceration of the lung was unavoidable but was immediately repaired. The postoperative pathology report noted fibrous connective tissue with glass-like changes in the visceral and parietal pleura; no tuberculous or malignant tumors were found.

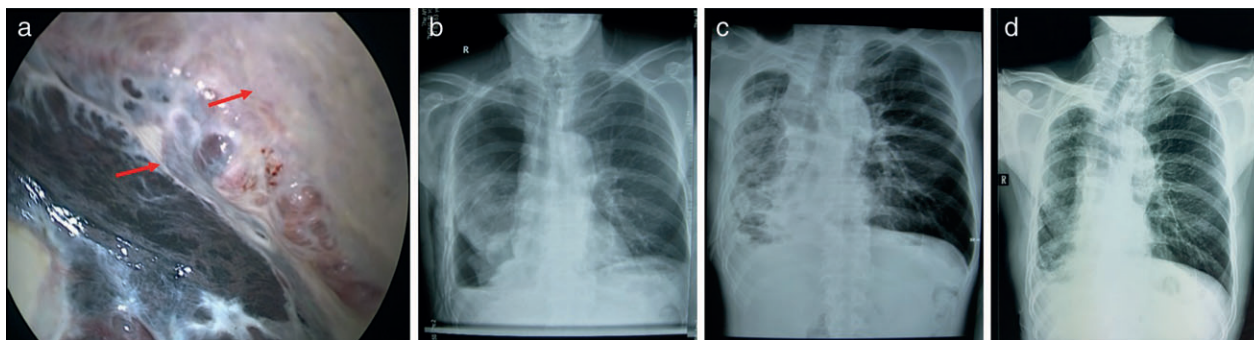
Before closing the incisions, two drainage tubes were inserted to the upper and posterior costophrenic angles of the thoracic cavity, respectively. Surgical duration was 130 minutes and blood loss was approximately 200 mL. After surgery the patient was transferred to the ward and treated with antibiotics, expectorant, and analgesics. A chest x-ray taken on postoperative day 1 showed that the right lung was only partially expanded (Fig 2b). Persistent air leakage was documented over the following five days. Exercises to promote respiratory function and vacuum suction were implemented to promote lung expansion. After appropriate hospitalization the patient no longer experienced incapacitating dyspnea. However, his lung had not expanded fully, even a month after surgery. Given the stable situation, he was discharged from the hospital with the lower drainage tube in place, to be monitored at home. Seven weeks after surgery, the patient's chest x-ray showed full expansion of the right lung and the lower chest tube was removed (Fig 2c). The most recent follow-up (4 years after surgery) showed the patient to be in good physical condition; his chest x-ray indicated a fully expanded right lung (Fig 2d).

### Discussion

Trapped lung is a sequela of a previous inflammation of the pleural space that has resulted in the formation of a fibrous membrane on the visceral pleura that does not allow the lung to expand.<sup>3</sup> Thus, we concluded in this case that the trapped lung was secondary to the formation of a fibrous membrane that impeded the full apposition of both

**Figure 1** (a) Preoperative x-ray of the chest showing a “vanished” right lung. (b) Thoracic computed tomography with air contrast demonstrating the trapped right lung with abnormal thickening of the visceral pleura (yellow arrows).





**Figure 2** (a) Intraoperative exploration demonstrated a fibrous cortex on both the parietal and visceral pleura (red arrows). X-ray of the chest (b) on postoperative day 1 shows a partially re-expanded right lung, (c) seven weeks after surgery shows a fully expanded right lung, and (d) four years after surgery shows full expansion of the right lung.

pleural layers. Lung entrapment is usually caused by pleural disease, such as hemothorax, or a malignant or inflammatory disease.<sup>1–3</sup> If these diseases are not treated in time, the mechanisms for repairing the pleura may fail and cause the formation of a fibrous layer along the surface of the visceral pleura. Therefore lung entrapment and trapped lung represent a continuity of the same process.<sup>4</sup> However, trapped lung attributed to a much earlier pneumothorax is rarely reported.<sup>2,3</sup>

Our patient had developed a pneumothorax 14 years before admission to our hospital. It had not been appropriately drained, leaving a persistent collection of air that built up, separating the visceral from the parietal pleura. As a result, expansion of the lung was impeded. In many cases, as with our patient, individuals with lung entrapment are asymptomatic and the condition remains untreated. During the early stage of his disease, signs and symptoms were not obvious and the patient neglected his condition. Over time, he developed chronic pleural inflammation as well as the fibrous cortex that prevented re-expansion of the lung. Because the time frame for the development of trapped lung was unknown and the patient was asymptomatic, the condition remained undiagnosed. As the patient aged, his shortness of breath became more obvious as a result of his decreasing pulmonary function. By the time he came to us, he had developed hypoxemia. We concluded that the earlier pneumothorax had contributed to the trapped lung.

A diagnosis of trapped lung requires chronicity and stability over time. With a definite history of lung entrapment and chronicity, the diagnosis of trapped lung was easily established in our case by clinical examination including chest x-ray and CT.<sup>6</sup> Air-contrast chest CT scans showed abnormal visceral and pleural thickening in the setting of the trapped lung from an unresolved pneumothorax. Treatment of trapped lung is dictated by the underlying process that caused the condition. Because we found no evidence of other possible causes and there were no

contraindications to surgery, we determined that the only effective therapy would be surgical decortication with the aim of removing the fibrous cortex lying on the pleura.<sup>7</sup> With recent advancements in medical technology, a thoracoscopic procedure is now a feasible choice for decortications.<sup>8–10</sup> According to current reports, it has produced rewarding results in many cases. Because it is minimally invasive, it has also made surgical intervention a more acceptable treatment from the patient's viewpoint. One of our major concerns in this case was whether the trapped lung could actually re-expand.<sup>11</sup> Although we were relieved to note that it could, it failed to fill the whole thoracic cavity immediately after surgery, and only re-expanded fully after seven weeks of rehabilitation.

## Conclusion

In conclusion, our case demonstrates the successful thoracoscopic decortication of a trapped lung caused by a much earlier pneumothorax. The successful outcome indicates that although the lung had been trapped for as long as 14 years, there was still an opportunity to re-expand it and thus to recover its function.

## Acknowledgments

This report was supported by a grant from the Inner Mongolia Science and Technology Department, Inner Mongolia Medical University, People's Republic of China (No. KJT15 SF02). We would like to thank LetPub ([www.LetPub.com](http://www.LetPub.com)) for providing linguistic assistance during the preparation of this manuscript.

## Disclosure

No authors report any conflict of interest.

## References

- 1 Huggins JT, Doelken P, Sahn SA. The unexpandable lung. *F1000 Med Rep* 2010; **2**: 77.
- 2 Pereyra MF, Ferreiro L, Valdés L. Unexpandable lung. *Arch Bronconeumol* 2013; **49**: 63–9.
- 3 Doelken P, Sahn SA. Trapped lung. *Semin Respir Crit Care Med* 2001; **22**: 631–6.
- 4 Doelken P. Clinical implications of unexpandable lung due to pleural disease. *Am J Med Sci* 2008; **335**: 21–5.
- 5 Jantz MA, Antony VB. Pleural fibrosis. *Clin Chest Med* 2006; **27**: 181–91.
- 6 Huggins JT, Sahn SA, Heidecker J, Ravenel JG, Doelken P. Characteristics of trapped lung: Pleural fluid analysis, manometry, and air-contrast chest CT. *Chest* 2007; **131**: 206–13.
- 7 Rathinam S, Waller DA. Pleurectomy decortication in the treatment of the "trapped lung" in benign and malignant pleural effusions. *Thorac Surg Clin* 2013; **23**: 51–61.
- 8 Tong BC, Hanna J, Toloza EM *et al.* Outcomes of video-assisted thoracoscopic decortication. *Ann Thorac Surg* 2010; **89**: 220–5.
- 9 Chambers A, Routledge T, Dunning J, Scarci M. Is video-assisted thoracoscopic surgical decortication superior to open surgery in the management of adults with primary empyema? *Interact Cardiovasc Thorac Surg* 2010; **11**: 171–7.
- 10 Kim BY, Oh BS, Jang WC, Min YI, Park YK, Park JC. Video-assisted thoracoscopic decortication for management of postpneumonic pleural empyema. *Am J Surg* 2004; **188**: 321–4.
- 11 Sharma S, Smith R, Al-Hameed F. Fibrothorax and severe lung restriction secondary to lupus pleuritis and its successful treatment by pleurectomy. *Can Respir J* 2002; **9**: 335–7.