

# Progressive Chest Wall Bleeding Caused by Bronchial Stump Nails after Lobectomy

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## Abstract

**Background** Postoperative intrathoracic active bleeding is a serious complication after general thoracic surgery. Yet, progressive chest wall bleeding caused by a bronchial stump nail after lobectomy has rarely been reported. The purpose of this report was to review the causes, surgical treatment, and prevention of progressive chest wall bleeding caused by a bronchial stump nail in patients after lobectomy.

**Methods** Between January 2011 and February 2013, approximately 5,000 patients underwent lobectomies for various thoracic diseases in the Department of Thoracic Surgery of Shanghai Pulmonary Disease Hospital in China. Among the 5,000 patients, four required reexploration for progressive postoperative chest wall bleeding caused by bronchial stump nails.

**Results** Staples were used without covers for the bronchial stumps in these patients. At the time of reoperation, we noted that the main site of bleeding was the pleura corresponding to the bronchial stump. The bleeding pleura sites were coagulated and sutured, and complete hemostasis of the pleura was achieved. The nails on the staple that may have caused the bleeding were removed. Then, muscle or hemostatic material was applied to separate the bronchial stump and corresponding pleura.

**Conclusions** Performing surgery carefully and understanding the risk from bronchial stump nails are keys to preventing progressive postoperative bleeding.

## Keywords

- ▶ reoperation
- ▶ surgery
- ▶ complications
- ▶ thoracoscopy/VATS

## Introduction

Postoperative intrathoracic active bleeding is a serious complication after general thoracic surgery. Postoperative intrathoracic active bleeding is also the most common cause of reoperation in patients having thoracic surgery.<sup>1</sup> If postoperative intrathoracic active bleeding is not detected in a timely fashion and given effective treatment, serious consequences can occur. Yet, progressive chest wall bleeding caused by a bronchial stump nail after lobectomy has rarely been reported. The purpose of this report was to review the causes, surgical treatment, and prevention of progressive chest wall

bleeding caused by a bronchial stump nail in patients after lobectomy.

## Materials and Methods

Between January 2011 and February 2013, approximately 5,000 patients underwent lobectomies for various thoracic diseases in the Department of Thoracic Surgery of Shanghai Pulmonary Disease Hospital in China. Among the 5,000 patients, four required reexploration for progressive postoperative chest wall bleeding caused by bronchial stump nails. The additional 10 patients required reexploration for

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progressive postoperative bleeding mostly caused by incision or chest wall adhesion bleeding.

The four patients who required reexploration for progressive postoperative chest wall bleeding were men, ranging in age from 41 to 66 years, with an average age of  $62 \pm 9.67$  years. The preoperative liver and kidney functions, platelet count, and prothrombin time were normal.

Three patients had lung cancer. The other patient had pulmonary aspergilloma. One patient underwent a right upper lobectomy, two patients underwent video-assisted right lower lobectomies, and one patient underwent a video-assisted left upper lobectomy. Stapler devices without covers were used for the bronchial stump in four patients, loaded with a 45-mm green cartridge (Endo Gia Universal Reticulator 45–2.0, Tyco Healthcare Group LP, Mansfield, Massachusetts, United States). The staples were usually used from the frontier incision in video-assisted thoracic surgery (VATS) operation.

The protocol was approved by the ethics committee of Shanghai Pulmonary Disease Hospital, Tongji University School of Medicine. All patients gave their written informed consent before inclusion in the study.

## Results

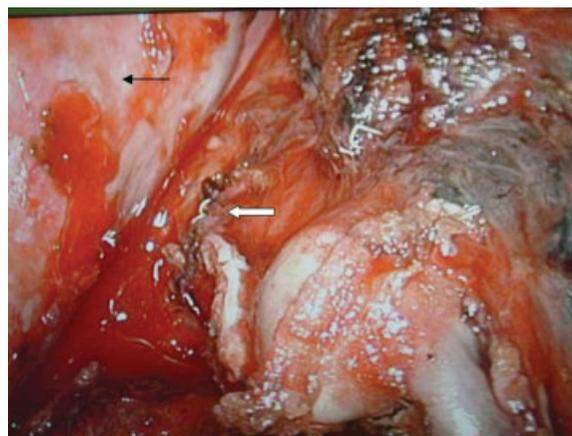
This group of patients had increased drainage, mostly on the second day after surgery, after sitting up and especially after coughing. Most of the patients had some evidence of hemorrhagic shock. All of the patients had a more rapid heart rate and decreased blood pressure. The ipsilateral breath sounds were significantly weakened. Different levels of the ipsilateral pleural dense shadows were noted on bedside chest radiography. The drainage bleeding before thoracotomy was 1,000 to 1,800 mL. The drainage was  $> 100$  mL/h in three of four patients.

At the time of reoperation, we noted that the main site of bleeding was the pleura corresponding to the bronchial stump and deep to the intercostal artery. In patients with one-lung ventilation, the bronchial stump was not in contact with the pleural parts; however, in patients with two-lung ventilation, the nail on the bronchial stump was in contact with the pleura in the back wall, especially when patients sat up and coughed early in the morning. When the nails in the staple were not closed completely, the nails would hook to the pleura and cause active bleeding (**Fig. 1**). The thoracotomies revealed 800 to 1,500 mL of blood within the chest. The bleeding pleura sites were coagulated and sutured, and complete hemostasis of the pleura was achieved (**Fig. 2**). The nails on the staple that may have caused the bleeding were removed. Then, muscle or hemostatic material was applied to separate the bronchial stump and corresponding pleura.

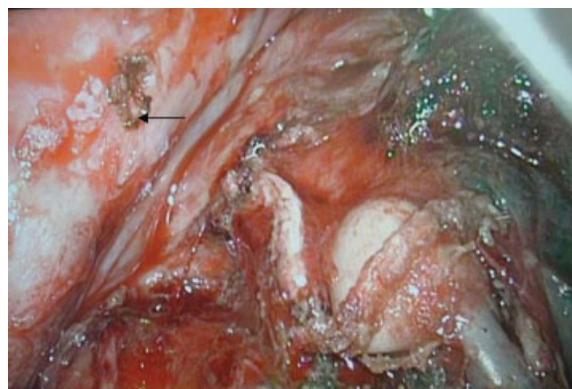
Hemostasis was achieved after the thoracotomies, and the four patients were considered cured.

## Discussion

With the extensive development of general thoracic surgery, postoperative intrathoracic active bleeding occurs in all hospitals. The reported incidence of postoperative intratho-



**Fig. 1** Progressive chest wall bleeding caused by a bronchial stump nail after video-assisted right lower lobectomy. Black arrow represents progressive bleeding site in the back chest wall corresponding to the bronchial stump. White arrow represents bronchial stump nail.



**Fig. 2** Arrows represent complete hemostasis of the pleura in the back chest wall was achieved. Arrows represent complete hemostasis of the pleura in the back chest wall corresponding to the bronchial stump.

racic active bleeding is 2.6%.<sup>2</sup> Although the incidence is low, it tends to have more serious consequences without timely treatment.

VATS was introduced in the early 1990s.<sup>3</sup> Minimally invasive techniques for lung resection have gradually been accepted over the past 20 years and have been included in the National Comprehensive Cancer Network lung cancer surgery treatment guidelines.<sup>4–6</sup> Thoracoscopic lobectomy has been performed in most hospitals.

Due to the operating angle, the bronchial stump was slightly longer after VATS than after thoracotomy. In patients with one-lung ventilation, the bronchial stump did not touch the pleural parts; however, when patients sat up and coughed early in the morning, the nails hooked to the pleura and caused active bleeding (**Fig. 1**). Three of four patients in our group had thoracoscopic lobectomies. To prevent progressive chest wall bleeding caused by bronchial stump nails after lobectomy, the short bronchial stump should be retained. The bronchial stump nail, which may cause bleeding, should be removed. Muscle or hemostatic material should be applied to separate bronchial stumps and the corresponding pleura if necessary.

## Conclusion

Performing surgery carefully and understanding the risk from bronchial stump nails are keys to preventing progressive postoperative bleeding.

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### Authors' Contributions

Guangyu Chen, Gening Jiang, and Jichen Qu participated in the design of the study and performed the statistical analysis. Boxiong Xie and Jiaan Ding conceived of the study, participated in its design and coordination, and helped to draft the manuscript. All authors read and approved the final manuscript.

### Conflict of Interest

All authors have no competing interest to declare.

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