



## A Giant Left Atrial Thrombus after Left Upper Lobectomy for Lung Cancer

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### Abstract

Solitary thrombus formation in the pulmonary vein stump is a rare complication after lung resection. Some case reports have described thrombus formation in the left upper pulmonary vein stump. We report a rare case of multiple thrombi formation in the left atrium and proximal pulmonary artery. A 75-year-old man developed a giant intracardiac thrombus after undergoing left upper lobectomy for lung cancer. He had received anticoagulation therapy for 5 years because of chronic atrial fibrillation. One year ago, he had undergone video-assisted thoracoscopic left upper pulmonary lobectomy for primary lung squamous cell carcinoma. Follow-up computed tomography revealed a giant thrombus located in the left atrium along with multiple thrombi in the left upper pulmonary vein stump and pulmonary artery stump. Surgery was performed because the left atrial thrombus was too large to be treated with conventional anticoagulants. All intracardiac thrombi were removed along with closure of the left upper pulmonary vein orifice. Postoperatively, no recurrence was observed after 1 year.

**Keywords:** Thrombus; Pulmonary vein stump; Pulmonary artery stump; Lobectomy

### Background

Solitary thrombus formation in the pulmonary vein stump is a rare complication after lung resection [1-4]. In all previously reported cases, thrombus formation occurred in the left upper pulmonary vein stump. We report a rare case of multiple thrombi formation in the left atrium and proximal pulmonary artery.

### Case Presentation

A 75-year-old man underwent resection of the left upper lobe for primary lung squamous cell carcinoma. The postoperative course was uneventful, and he had received anticoagulation therapy because of chronic atrial fibrillation. At 1-year follow-up, enhanced computed tomography revealed mural thrombi in the proximal left pulmonary artery along with a giant left atrial thrombus (Figures 1, 2C and 2D). Transesophageal echocardiography revealed that the left atrial thrombus was associated with the left upper pulmonary vein stump (Figure 2A, 2B). Electrocardiography revealed an atrial fibrillation rhythm, and the F-wave on the V1 lead was <0.1 mV. On echocardiography, the left ventricular end-diastolic and end-systolic diameters were found to be 44 and 31 mm, respectively. The left ventricular ejection fraction was 58%, and mild aortic and tricuspid regurgitation was observed. The left atrium was 65 mm in size. Surgery was performed because the left atrial thrombus was too large to be treated with conventional anticoagulants.

During median sternotomy, a thrombus was observed in the proximal left pulmonary artery, which was associated with the left upper pulmonary artery stump. The giant left atrial thrombus had originated from the left upper pulmonary vein stump. However, no thrombus was found in the left atrial appendage. All intracardiac thrombi were removed. The size of the left atrial thrombus was 60 mm × 45 mm × 35 mm. The attached area of the left atrial thrombus and left atrial appendage were closed by two-layer sutures to prevent further thrombus formation. Simultaneously, the maze procedure was performed in the right and left atria. The patient recovered uneventfully, and warfarin therapy was resumed postoperatively. The patient had received anticoagulation therapy for atrial fibrillation for 5 years previously; however, the precise history of atrial fibrillation was not clear. Preoperative electrocardiography showed that the F-wave on the V1 lead was <0.1 mV, and the left atrial diameter was 60 mm. Therefore, we assumed a low probability of restoration of sinus rhythm despite performing the maze procedure; however, we believed that the restoration

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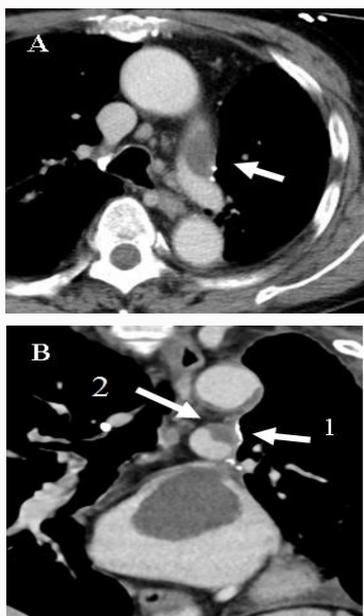
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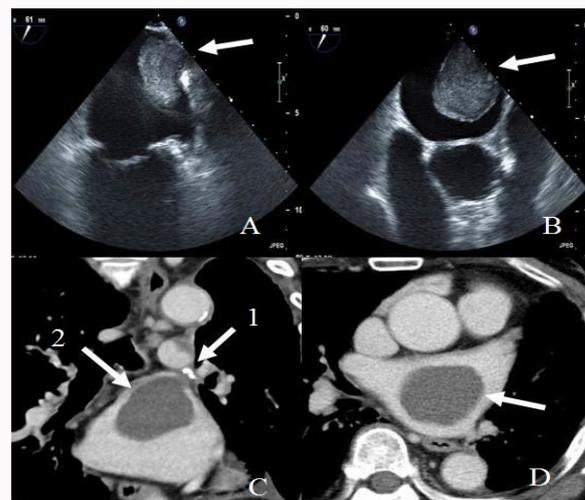


**Figure 1:** Preoperative enhanced computed tomography of chest: (A) Arrow indicates the mural thrombus in the pulmonary artery; (B) Arrow (1) indicates the staple line of the pulmonary artery resection and Arrow (2) indicates the thrombus in the pulmonary artery following the staple line.

of sinus rhythm would prevent thrombus formation. Unfortunately, electrocardiography showed persistent atrial fibrillation. The patient was discharged due to the absence of any complications. The patient continued to receive conventional anticoagulant therapy, and no recurrence of intracardiac thrombus was observed at 1-year follow-up. After surgery, we performed warfarin control in our institution, and the target level was set at approximately 2.0. The Prothrombin Time-International Normalized Ratio (PT-INR) was between 1.8 and 2.4, and the control was good.

## Discussion

Pulmonary vein thrombus is a relatively rare complication after pulmonary lobectomy [1-4]. Some causes of pulmonary vein thrombus include idiopathic diseases, radiofrequency ablation for atrial fibrillation, pulmonary arteriovenous malformation, and pulmonary arteriovenous fistula. Ohtaka et al. [5] reported thrombosis in 3.3% of patients who underwent lobectomy and in 17.9% of those who underwent left upper lobectomy. On univariate analyses, left upper lobectomy and operative time were identified as risk factors for thrombus formation in the pulmonary vein stump, whereas adjuvant chemotherapy was found to be a marginal risk factor for thrombus formation [5]. In the present case, adjuvant chemotherapy was not administered. Pulmonary vein stump thrombus has rarely been reported as a cause of embolic stroke [5]. Nagaoka et al. [1] reported a patient who developed renal embolism 13 months after resection of the left upper lobe for lung cancer. Ohira et al. [3] reported a case of cerebral embolism that occurred 6 months after resection of the left upper lobe for lung cancer. Anatomically, the length of the left superior pulmonary vein stump after left upper lobectomy was longer than that of the other parts of the lobectomy. They reported a median left superior pulmonary vein stump length of 1.71 cm, a left inferior length of 0.54 cm, a right superior length of 0.56 cm, and a right inferior length of 0.50 cm; the length of the left superior pulmonary vein stump was significantly longer than that of



**Figure 2:** Preoperative transthoracic echocardiography: (a) Arrow indicates the thrombus in the left atrium following the left upper pulmonary venous stump and (b) Arrow indicates the giant thrombus in the left atrium. Pre-operative enhanced computed tomography: (c) Arrow (1) indicates the staple line of the pulmonary vein resection; Arrow (2) indicates a thrombus in the left atrium following the left upper pulmonary venous staple line; and (d) Arrow indicates a giant thrombus in the left atrium.

the other stumps [5]. Therefore, they speculated that the turbulent flow or stasis of blood in the long pulmonary vein stump was the probable cause of thrombosis. In the case of short pulmonary vein stump, blood in the left atrium tends to flow evenly through the entire pulmonary vein stump. Contrarily, turbulent flow or stasis may occur in the long pulmonary vein stump because blood in the left atrium does not spread throughout the pulmonary vein stump [6]. A similar mechanism of thrombus formation has been reported in the case of long pulmonary artery stump [7]. In our patient, thrombus formation associated with cancer-related coagulopathy or Trousseau's syndrome was initially suspected because the patient had a history of lung resection for lung cancer 1 year previously [8]. However, the cancer was completely resected, and no active malignancy was detected. Other factors associated with thrombus formation such as protein C activity and antigen, protein S activity and antigen, antinuclear antibody, antithrombin III, antiplatelet antibody, and anticardiolipin antibody were also found to be negative. The only risk factor for thrombus formation was chronic atrial fibrillation. Atrial fibrillation was the most likely cause of the thrombus. Our patient had received anticoagulation therapy for 5 years. The PT-INR had been maintained around 1.8, and the control was good. Therefore, it is unlikely that poor warfarin control was the cause of thrombus formation. However, no definitive conclusion on the specific cause of the multiple and giant intracardiac thrombi formation in this case could be reached.

## Conclusion

In summary, we report a rare case of multiple and giant intracardiac thrombi that developed after lobectomy for lung cancer. Most guidelines pertaining to follow-up of lung cancer after lung resection recommend follow-up with or without plain computed tomography [5]. A potential risk of left atrial thrombus formation should be considered in patients with chronic atrial fibrillation after left upper lobectomy.

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