

## A Surgical Case of Lung Cancer in a Patient with the Left Superior and Inferior Pulmonary Veins Forming a Common Trunk

Isao Matsumoto, MD,<sup>1</sup> Yasuhiko Ohta, MD,<sup>1</sup> Yoshio Tsunozuka, MD,<sup>1</sup>  
Shigeharu Sawa, MD,<sup>2</sup> Susumu Fujii, MD,<sup>2</sup> Kenichiro Saito, MD,<sup>2</sup> Makoto Oda, MD,<sup>1</sup>  
and Go Watanabe, MD<sup>1</sup>

The anatomical abnormalities of the pulmonary veins may have a serious impact on complications that may arise during pulmonary lobectomy. We present a surgical case of left lung cancer in a patient, who was a 69-year-old male, with the left superior and inferior pulmonary veins forming a common trunk outside the pericardium. In this present case, because of extensive adhesions, incomplete lobulation, and tumor infiltration of the main pulmonary artery, we could not identify the common trunk with certainty before excising the left upper lobe. Although this patient was fortunately discharged without complications, there was no choice but to perform pneumonectomy because of the interruption of the inferior pulmonary vein. Retrospectively, the preoperative CT films showed the anatomical anomalies involving the pulmonary veins. However, since the length of the common trunk outside the pericardium was short and the inferior pulmonary vein was thinner than usual and its venous distribution conformed to a normal structure, the anatomy appeared normal. In excising the pulmonary lobe, it is mandatory to ascertain the distribution of the vascular system prior to surgery. (*Ann Thorac Cardiovasc Surg* 2005; 11: 316–9)

**Key words:** anatomical anomaly, pulmonary vein, lung cancer, surgery, common trunk

### Introduction

There are a large variety of aberrations in the morphology of the pulmonary veins. Their anatomical abnormalities may have a serious impact on complications that may arise during pulmonary lobectomy. The interruption of the drainage vein of a pulmonary lobe that should be preserved results in congestion and eventual destruction of the residual lung, which may prove to be fatal.<sup>1)</sup> Recently, we encountered a surgical case of lung cancer in a patient with the left superior and inferior pulmonary veins form-

ing a common trunk outside the pericardium.

### Case Report

The patient, a 69-year-old male, was examined at Sakae Kyousai Hospital for pollakiuria. He was diagnosed as having benign prostatic hypertrophy. When he had a prostatectomy for prostatic hypertrophy, a chest X-ray film detected an irregularly shaped tumor that was adjacent to the aortic arch (Fig. 1). A chest CT examination revealed an irregularly shaped tumor measuring 4.5 cm in diameter that was located at S<sup>1+2</sup> of the left lung and was adjacent to the aortic arch and left main pulmonary artery (Fig. 2). The blood cell count and the results of blood chemical analyses were normal. CEA, SCC, NSE, CYFRA measured 9.2 ng/m, 0.9 ng/m, 15.8 ng/ml, 2.4 ng/ml, respectively.

Based on the results of a transbronchial lung biopsy, a diagnosis of squamous cell carcinoma was given. There

*From <sup>1</sup>Department of General and Cardiothoracic Surgery, Kanazawa University, Kanazawa, and <sup>2</sup>Department of Thoracic Cardiovascular Surgery, Yokohama Sakae Kyousai Hospital, Yokohama, Japan*

Received August 27, 2004; accepted for publication May 23, 2005. Address reprint requests to Isao Matsumoto, MD: Department of General and Cardiothoracic Surgery, Kanazawa University, 13-1 Takara-machi, Kanazawa 920-8641, Japan.



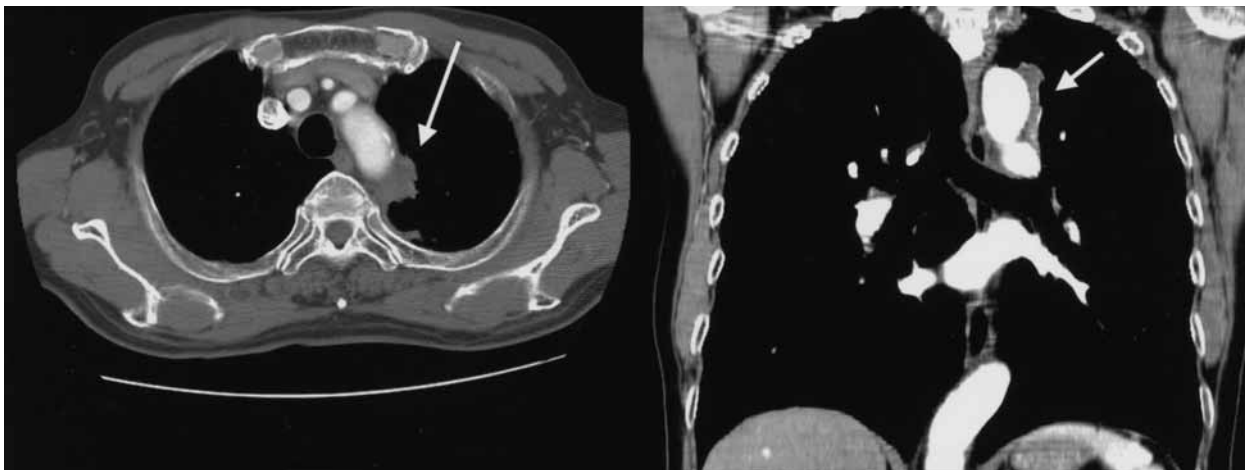
**Fig. 1.** Chest X-ray films detected an irregularly shaped tumor that was adjacent to the aortic arch (arrow).

were no distant metastases, and an operation was performed. A left postero-lateral skin incision was made and thoracotomy was conducted. The lower lobe of the left lung was adherent to the thoracic wall or mediastinal pleura. The cancer of the upper pulmonary lobe had infiltrated the main pulmonary artery and mediastinal pleura, hindering the opening of the mediastinal side. Additionally, upper and lower lobes were incompletely lobulated. Therefore, we were forced to separate the superior pulmonary vein before the state of the vascular system was ascertained. The apparent normal superior pulmonary vein was separated and an interlobular space had to be created using an automatic suturing device. Next, the left upper bronchus was separated by employing the same device. While the main pulmonary artery was temporarily interrupted, the pulmonary artery and the pleura that had been infiltrated by cancer were excised. After completing the upper left lobectomy, the main pulmonary artery was reconstructed. When the patient was released from isolation ventilation, we found that the carbon dioxide partial pressure of the expired air was extremely low and we suspected that pulmonary circulation of the lower lobe was interrupted. We then found that the normal inferior pulmonary vein was absent, and instead the superior and inferior pulmonary veins had formed a common trunk outside the pericardium and drained into the left atrium

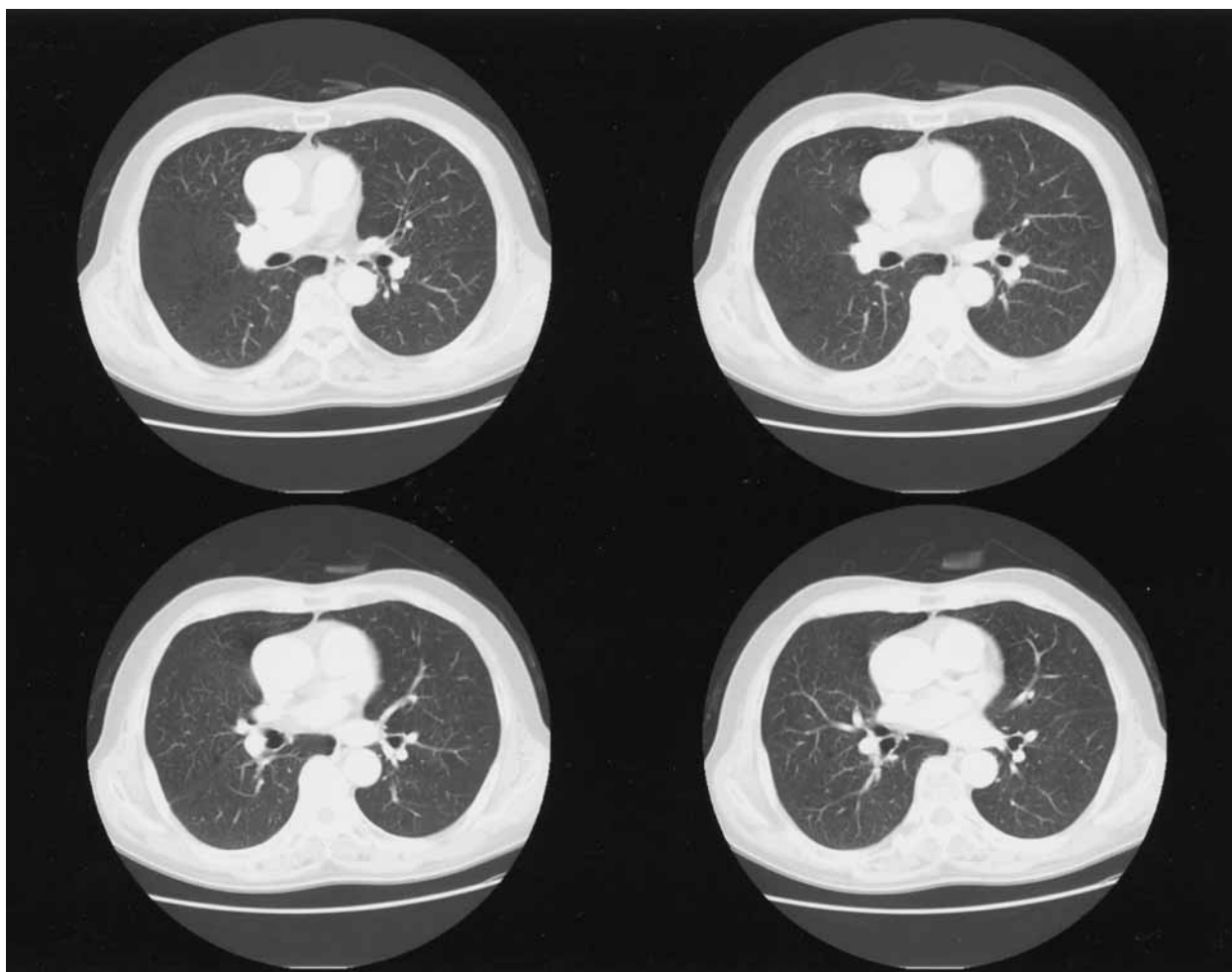
in the location of the normal superior pulmonary vein. Reconstruction of the lower pulmonary vein was considered but because the residual pulmonary vein was not a single independent vein and the blood flow had already been interrupted for too long, there was no choice but to add excision of the lower lobe. Following surgery, the patient was successfully managed. A pathological examination revealed that the inferior pulmonary vein was thinner than usual, joining the superior pulmonary vein immediately after leaving the incompletely lobulated lung. Venous distribution in the lungs appeared normal. The histopathological diagnosis was poorly differentiated squamous cell carcinoma with metastasis to the lymph nodes of the lobular bronchi and invasion to the pulmonary artery. Final pathologic staging was stage IIIB (T4N1M0). Following discharge, he underwent chemotherapy on an outpatient basis.

## Discussion

The pulmonary vein develops by the 27th to 29th days of the embryonic stage. The common pulmonary vein originates from the left atrium, after which it continues to develop behind the heart to complete its branching. It has been reported that this common pulmonary vein is absorbed into the wall of the left atrium, leaving four pul-



**Fig. 2.** A chest CT examination revealed an irregularly shaped tumor measuring 4.5 cm in diameter that was located at S<sup>1+2</sup> of the left lung adjacent to the aortic arch and left main pulmonary artery (arrows). (Left side: axial view, right side: coronal view)



**Fig. 3.** The retrospective review of the preoperative CT films showed the thin inferior pulmonary vein joined the superior pulmonary vein immediately after leaving the incompletely lobulated lung.

monary veins draining directly into the left atrium.<sup>2)</sup>

In the present case, the superior and inferior pulmonary veins had formed a common trunk outside the pericardium. A 'single left pulmonary vein' has been known<sup>3)</sup> as an example of this type of anatomical abnormality, where the superior and inferior pulmonary veins form a single pulmonary vein to flow into the left atrium. However, our patient revealed no abnormality in the branching of the inferior pulmonary vein within the lung, and therefore it was not a case of 'single left pulmonary vein'. Presumably, the confluence of the superior and inferior pulmonary veins observed in our case developed due to an anomaly during the absorptive stage of the common pulmonary vein. In other reported cases similar to our patient, the superior and inferior pulmonary veins become a common trunk at a location above the normal superior pulmonary vein.<sup>4,5)</sup> When such condition is accompanied by incomplete lobulation, surgeons tend to overlook the influx of the lower pulmonary vein when handling the pulmonary veins. In our case, an automatic suturing device was used to create an interlobular fissure, but the procedure closed both the lung and lower pulmonary vein. Furthermore, because of extensive adhesions and tumor infiltration of the pulmonary artery, we could not be certain before excising the left upper lobe whether or not the superior and inferior pulmonary veins formed a common trunk. There was no choice but to perform pneumonectomy because of the interruption of the inferior pulmonary vein although this patient was fortunately discharged without complications.

Retrospectively, the preoperative CT films did show the anatomical anomalies involving pulmonary veins (Fig. 3). Since the length of the common trunk outside the pericardium was short and the inferior pulmonary vein was thinner than usual and its venous distribution conformed to a normal structure, the anatomy appeared normal. In excising the pulmonary lobe for lung cancer, it is mandatory to ascertain the distribution of the vascular

system, in addition to the spreading of the cancer prior to surgery. Recently, it has become possible to construct three-dimension images of the pulmonary vascular system with the aid of CT radiography for better understanding of the anatomical structure.<sup>6)</sup> Such an approach may be useful to avoid overlooking an anomaly of the pulmonary vascular system, and is recommended for all cases prior to surgery. Thoracoscopic surgery of lung cancers is being conducted with increasing frequency. Closer attention is required in such a procedure because the surgical field is more limited than in a thoracotomy. The closer the anatomical feature of a common trunk of the left pulmonary veins conforms to a normal structure, the more likely it is that one may overlook such an anomaly.

## References

1. Sugimoto S, Izumiyama O, Yamashita A, Baba M, Hasegawa T. Anatomy of inferior pulmonary vein should be clarified in lower lobectomy. *Ann Thorac Surg* 1998; **66**: 1799–800.
2. Neill CA. Development of the pulmonary veins; with reference to the embryology of anomalies of pulmonary venous return. *Pediatrics* 1956; **18**: 880–7.
3. Trethewey DG, Francis GS, MacNeil DJ, Vieweg WV. Single left pulmonary vein with normal pulmonary venous drainage: a roentgenographic curiosity. *Am J Cardiol* 1974; **34**: 237–9.
4. Ohno K, Yamasaki Y, Yamasaki H, Fukui Y, Kuwata K. A resected case of lung cancer with an extrapericardial single trunk formed by the left pulmonary veins. *Kyobu Geka* 2000; **53**: 877–9. (in Japanese)
5. Meguro H, Koshiyama R, Abe N, Takemoto N, Miyata M. A case of single left pulmonary vein with deficiency of left inferior pulmonary vein. *Jpn J Chest Surg* 1998; **12**: 529–34. (in Japanese)
6. Watanabe S, Arai K, Watanabe T, Koda W, Urayama H. Use of three-dimensional computed tomographic angiography of pulmonary vessels for lung resections. *Ann Thorac Surg* 2003; **75**: 388–92.