

## CASE REPORT

# Complete resection of primary pulmonary malignancy extending into the left atrium via the left pulmonary vein using cardiopulmonary bypass and single incision: A case series

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## Keywords

Cardiopulmonary bypass; left atrium extension; lung cancer; median sternotomy.

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## Abstract

If the best treatment for a patient with a primary pulmonary tumor extending into the left atrium via the left pulmonary vein is surgical resection, it is necessary to determine the appropriate approach, that is, whether cardiopulmonary bypass (CPB) or complete resection, would be more suitable. Lung resections under CPB are rarely performed because of the unpredictable prognosis. We report two successful cases of safe and rapid complete resection of primary pulmonary malignancy extending into the left atrium with the support of CPB via median sternotomy. Our experiences support the application of CPB in extended left pulmonary resections to achieve complete resection.

## Introduction

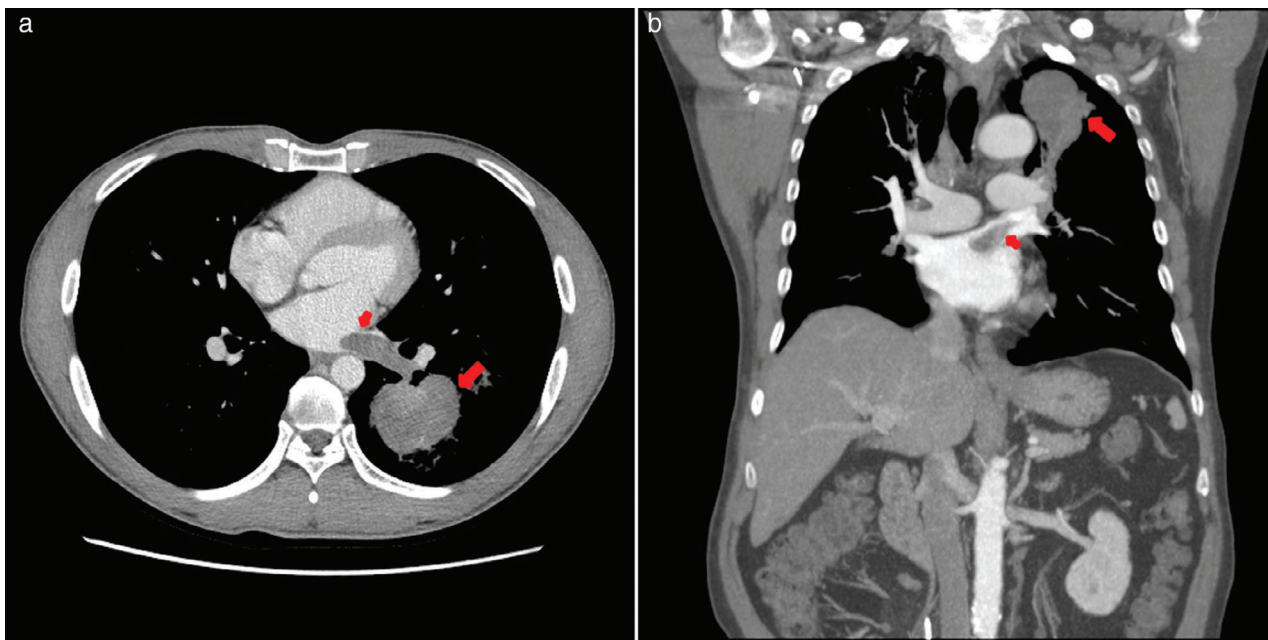
Although primary pulmonary malignancies extending into the left atrium via the pulmonary veins have been well documented, treatment decisions are difficult because of the prognosis of the patient, which varies according to pathologic outcomes,<sup>1,2</sup> and the number of possible surgical approaches. In this case report, we describe two successful cases of complete resection of primary pulmonary malignancy extending into the left atrium with the support of cardiopulmonary bypass (CPB) via median sternotomy.

## Case report

Two male patients, aged 34 and 66 years, reported with complaints of coughing and hemoptysis. The chest computed tomography (CT) scan of the 34-year-old patient

revealed a 5 × 5 cm pulmonary mass in the left lower lobe that had extensively invaded along the left inferior pulmonary vein extending into the left atrium (Fig 1a). The CT scan in the 66-year-old patient revealed a 4.5 × 5.5 cm pulmonary mass in the left upper lobe with extensive invasion in the left superior pulmonary vein extending into the left atrium (Fig 1b). In both cases, positron emission tomography scans showed no metastatic disease. The patients' conditions were discussed at a multidisciplinary conference, and as a result, despite the absence of a histological diagnosis, resection using CPB was considered a priority because of the risk of widespread emboli and circulatory impairment caused by outflow obstruction.

Both patients underwent surgery via the median sternotomy approach. They underwent right atriotomy and atrial septotomy to confirm the tumor in the left atrial cavity

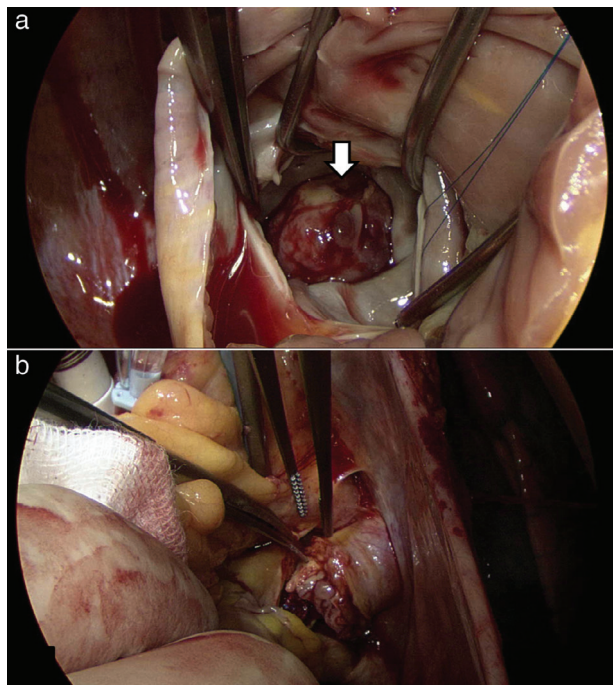


**Figure 1** Representative chest computed tomography images of the two cases of primary lung cancer extending into the left atrium: (a) a left lower lobe tumor and (b) a left upper lobe tumor encroaching into the left atrium.

following aorto-bicaval cannulation and aortic cross-clamp with cardioplegia. The tumor margins were confirmed through right atriotomy and atrial septotomy (Fig 2). The 34-year-old patient underwent left lower lobectomy with mediastinal lymph node dissection, and the 66-year-old patient underwent left upper lobectomy without additional incision, using CPB.

The total operation durations were 200 and 225 minutes, the total CPB durations were 109 and 127 minutes, and the total aortic cross-clamp times were 84 and 101 minutes in the 34-year-old and 66-year-old patients, respectively. Pathological examination revealed monomorphic synovial sarcoma and squamous cell carcinoma with clear resection margins in the 34-year-old and 66-year-old, respectively. Neither case showed evidence of lymph node metastasis. On postoperative day (POD) 1, both patients were weaned from the mechanical ventilator. The 34-year-old and 66-year-old were transferred to the general ward on PODs 1 and 2 and discharged without postoperative complications on PODs 9 and 12, respectively.

Subsequently, the 34-year-old patient, diagnosed with pulmonary synovial sarcoma, was administered two cycles of adjuvant chemotherapy. However, four months later, new nodules were discovered on the right lower and left upper lobes. He underwent wedge resection of the right lower and left upper lobes via bilateral video assisted thoracic surgery and received nine cycles of chemotherapy with a changed regimen. He has been alive for 24 months following the lobectomy.



**Figure 2** View from the surgical window of the left atrium and left superior pulmonary vein. (a) Right atriotomy and atrial septotomy to confirm the tumor in the left atrial cavity. The white arrow indicates the tumor extending into the left atrium from the pulmonary vein. (b) The tumor exposed from the left superior pulmonary vein.

The 66-year-old patient, diagnosed with squamous cell carcinoma, was administered six cycles of adjuvant chemotherapy, which he tolerated well, and no recurrence or metastasis was detected during that period. However, six months later, intussusception as a result of squamous cell carcinoma metastasis was discovered. He underwent multiple small bowel resections and received four cycles of chemotherapy with a changed regimen. However, multiple hepatic and mesenteric metastases were discovered four months later. Subsequently, he died 10 months after lobectomy.

## Discussion

Although left atrial extension of primary pulmonary malignancies via the pulmonary vein is well documented, the treatment choice and prognosis vary with the pathologic outcome.<sup>1,2</sup> Wiebe *et al.* reported a 30-day mortality rate of 15% and a five-year survival rate of 53% in 13 patients who underwent extended pulmonary resection of advanced thoracic malignancies with CPB.<sup>2</sup> However, the five-year survival rate for pulmonary sarcomas was 62.5% and varied according to the pathologic outcomes. In our cases, although no tissue diagnosis was made, both patients were considered candidates for immediate resection with CPB to prevent widespread tumor emboli because of the intra-cardiac extension. Sudden severe complications, including cerebral infarction, peripheral arterial occlusion, and syncope attack have been reported in patients with this type of extension.<sup>3,4</sup>

Left pulmonary resection, particularly left lower lobectomy with heart surgery via median sternotomy, is considered challenging.<sup>5,6</sup> Mei *et al.* suggested left anterolateral thoracotomy with right atrial-ascending aortic cannulation as a convenient approach.<sup>7</sup> Because the hilum tends to be obscured by the left ventricle, retraction for better visibility may induce dysrhythmias and hemodynamic compromise. On the other hand, in such cases, performing standard sternotomy could avoid the burden of two surgical incisions and difficulty in CPB cannulation. In addition, the margin of the tumor could be accurately confirmed and resected in the intra-cardiac view, making it an oncologically superior operation. Furthermore, during lobectomy, CPB allowed the left ventricle to remain in a collapsed state, which eliminated disruption of the surgical visual field by the left ventricle. It was also possible to dissect the mediastinal lymph nodes, including the subcarinal lymph nodes.

Muralidaran *et al.* reported long-term survival after lung resection for non-small cell lung cancer with CPB.<sup>1</sup> The five year-survival rates of planned and unplanned CPB were 54% and 11%, respectively. In our cases, we planned to use CPB after a multidisciplinary conference. Postoperative transfusion was not required, and there were no peri-operative complications, such as pneumonia. In addition, the pathologic examination confirmed complete resection.

In conclusion, in two cases of locally advanced lung cancer, CPB was performed safely and quickly. Left side lobectomy was possible without facing significant challenges via a median sternotomy. Our experiences support the application of CPB in extended left pulmonary resection to achieve complete resection.

## Disclosure

No authors report any conflict of interest.

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