

# Acute limb ischemia of the lower extremity associated with left upper lobe surgery for primary lung cancer

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## ABSTRACT

Thrombosis formation in the pulmonary vein stump after pulmonary lobectomy has recently been reported to be an extremely rare cause of arterial embolism. We herein report the first case series of acute limb ischemia encountered after video-assisted thoracoscopic left upper lobectomy or left upper division segmentectomy for primary lung cancer. The patients underwent embolectomy, and their perioperative courses were uneventful. It should be recognized that the pulmonary vein stump can cause acute limb ischemia after pulmonary lobectomy. (*J Vasc Surg Cases and Innovative Techniques* 2018;4:83-6.)

**Key words:** Multidetector computed tomography; Perioperative; Left upper lobectomy

Acute limb ischemia (ALI) can result from various causes, and emboli originate from the heart in >80% of cases.<sup>1</sup> Thrombosis formation in the pulmonary vein (PV) stump after pulmonary lobectomy has recently been reported as an extremely rare cause of acute arterial embolism.<sup>2-10</sup> To our knowledge, however, no cases of ALI of the lower extremities encountered after surgery for primary lung cancer have been reported in the English literature.

We herein report the first case series of ALI encountered after left upper lobectomy (LUL) or left upper division segmentectomy for primary lung cancer. The patients provided written consent for the publication of the case reports.

## CASE REPORTS

**Case 1.** A 64-year-old man underwent video-assisted thoracoscopic left upper division segmentectomy. The pathologic stage of the lung cancer was IA (pT1bN0M0). He had a history of hypertension and smoking. Three days after surgery, he complained of severe intermittent claudication on his left calf but did not report any paresthesia, paralysis, or rest pain. On Doppler flowmetry, the posterior tibial and dorsal pedal arteries were detected. Multidetector computed tomography (MDCT) showed occlusion of the left popliteal artery (Fig 1, A). MDCT also

showed a remnant of the long stump of the left superior PV (LSPV) without thrombosis (Fig 1, B and C). Subsequently, urgent embolectomy was performed with local anesthesia. His perioperative course was uneventful, and he was discharged with a continuation of anticoagulant therapy (ACT) with warfarin. A pathologic examination revealed that the explanted thrombus was composed of aggregated red blood cells and fibrin-thrombocytic components with no involvement of any mural components of blood vessels or carcinoma cells.

**Case 2.** A 68-year-old man underwent video-assisted thoracoscopic LUL for lung cancer (pT1aN1M0; pathologic stage IIA). He had a history of smoking. Three days after surgery, he complained of hypoesthesia and paresis in both legs. On Doppler flowmetry, neither the posterior tibial nor dorsal pedal arteries were detected. MDCT showed a remnant stump of the LSPV without thrombosis (Fig 2, A), and his plasma D-dimer level had increased to 4.0  $\mu\text{g}/\text{mL}$ . MDCT also showed occlusion of the terminal aorta and bilateral common iliac artery (Fig 2, B). Subsequently, emergent embolectomy was performed with general anesthesia. His perioperative course was uneventful, and he was discharged with continuation of ACT with direct oral anticoagulant (DOAC). Postoperative MDCT showed that no stenotic lesions remained (Fig 2, C).

**Case 3.** A 72-year-old man underwent video-assisted thoracoscopic LUL for lung cancer (pT1bN0M0; pathologic stage IA). He had a history of early gastric cancer. One year after surgery, contrast-enhanced computed tomography (CECT) revealed thrombosis at the remnant of the stump of the LSPV, and his plasma D-dimer level had increased to 3.5  $\mu\text{g}/\text{mL}$ . Subsequently, ACT with DOAC was started. As the thrombus on LSPV disappeared after ACT had been administered for about 1.5 months, ACT was discontinued. However, 17 months after LUL, CECT revealed recurrent thrombosis at the remnant stump of the LSPV (Fig 3, A), so ACT was restarted. At the same time, he became aware of severe intermittent claudication on his left calf, and ultrasound examination showed occlusion of the left popliteal artery. Urgent embolectomy was performed with local

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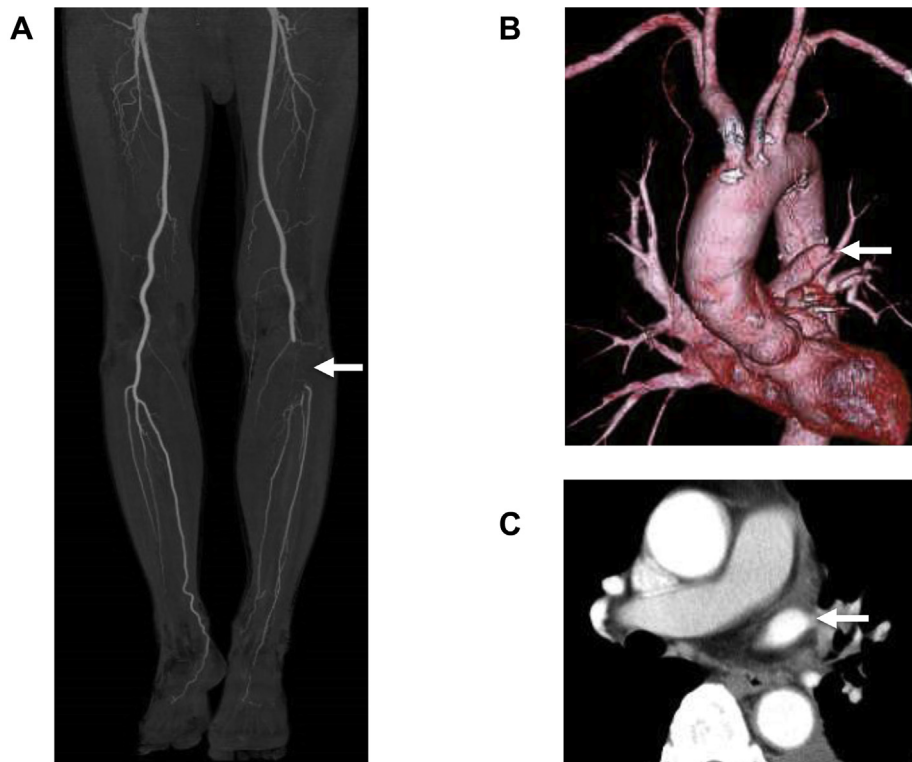
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**Fig 1.** Computed tomography (CT) images obtained at the onset of acute limb ischemia (ALI). **A**, CT angiography image of lower extremities. The *arrow* indicates the short-segment occlusion of left popliteal artery. **B**, CT angiography showing the remnants of the long stump of the left superior pulmonary vein (LSPV). **C**, Axial image showing the stump of the LSPV. There was no thrombus in the stump of the LSPV. The *arrow* indicates the stump of the LSPV.

anesthesia, and intraoperative angiography showed occlusion of the left popliteal artery (Fig 3, B). His perioperative course was uneventful, and he was discharged with continuation of ACT with DOAC.

## DISCUSSION

ALI is any sudden decrease in limb perfusion causing a potential threat to limb viability. It can be due to various causes, such as atrial fibrillation, old myocardial infarction, cardiac tumor, atheroembolism, aortic aneurysm, arteriosclerosis, and a hypercoagulable state.<sup>1</sup> These patients had no history of heart disease, such as atrial fibrillation, and lacked an identifiable embolic source from the aorta to the peripheral artery on MDCT. Regarding the pathologic findings, no mural components of blood vessels were found to be involved in the explanted thrombus. Xiomeritis et al<sup>11</sup> collected 104 cases of acute arterial obstruction by tumor embolus and reported that the major origins of tumor embolus were primary or metastatic lung cancer invading the PV or left atrium and spreading to the systemic circulation. Furthermore, 80% of arterial embolisms from lung cancer were caused by manipulation during the perioperative period.<sup>12</sup> However, these patients suffered from small lung cancer (T1: tumor size  $\leq 30$  mm), and the explanted embolus included no neoplastic cells.

In 1989, Seki et al<sup>13</sup> reported the first case of left femoral artery thrombosis after LUL in the Japanese literature and speculated that the thrombus had originated from the PV stump, although PV thrombus was not proved. Recently, cases of arterial embolism after pneumectomy have been attracting attention. Ohtaka et al<sup>14</sup> evaluated the frequency of thrombus formation in the PV stump in 193 patients after pulmonary lobectomy. All of the patients with thrombus had undergone LUL, and 13.5% of those who had undergone LUL developed thrombus in the PV stump. PV thrombus was confirmed on the basis of the imaging findings of one of these cases. Because of the lack of any other obvious causes of embolism, we also speculated that the thrombus that formed on the LSPV caused ALI in the other cases.

Thrombosis formation in the PV stump after pneumectomy has recently been reported as an extremely rare cause of acute arterial embolism.<sup>2-10</sup> Including the current cases, most of these patients underwent LUL, and two patients (17%) underwent left upper division segmentectomy. Although the brain, kidney, and spleen are frequent sites of embolism, the limbs are relatively rarely afflicted by embolism, and these are the first cases of ALI caused by PV thrombus after pneumectomy for primary lung cancer to be reported in English. On limiting our evaluation to the 60 patients undergoing

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