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## Visualization of the Spinal Artery by CT During Embolization for Pulmonary Artery Pseudoaneurysm

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<b>Background:</b>	Spinal artery ischemia is a rare but serious complication of embolization for treatment of hemoptysis. When the spinal artery is visualized at angiography, embolization should not be performed. However, it has been reported that spinal artery feeders are not visible on angiography in patients with developing spinal infarction.
<b>Case Report:</b>	A 70-year-old man with a history of pulmonary aspergillosis had hemoptysis and underwent contrast-enhanced CT, revealing a pulmonary artery pseudoaneurysm (PAP) in the left upper lobe. Systemic angiography from the fifth left intercostal artery showed the PAP at the distal site, but the access route to the PAP was very tortuous and long. Although the spinal branch could not be observed with that angiography, CT during angiography was performed, and it visualized the posterior spinal artery obviously. Thus, the artery distal and proximal to the PAP was then successfully coil-embolized from the pulmonary artery.
<b>Conclusions:</b>	CT during angiography may be useful to confirm the presence of the spinal artery for treatment of hemoptysis by embolization.
<b>MeSH Keywords:</b>	Embolization, Therapeutic • Hemoptysis • Spine
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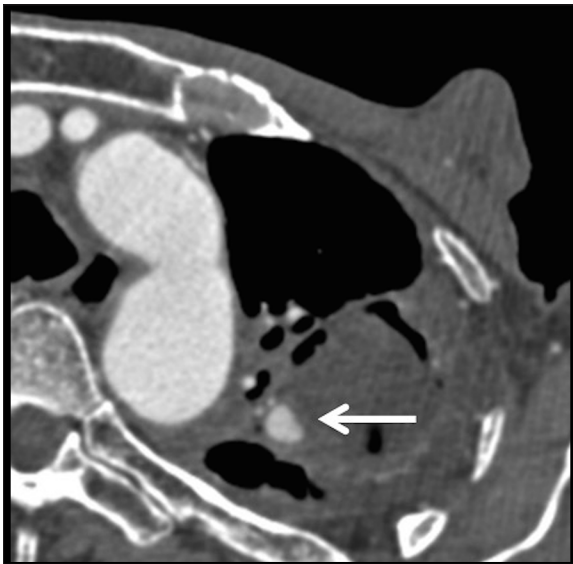
### Background

Pulmonary artery pseudoaneurysm (PAP) is a rare cause of massive hemoptysis in chronic lung disease with pulmonary cavitation, and the mortality rate after PAP rupture is high [1]. Recently, the microcatheter has been developed and superselective transcatheter embolization has been possible [2,3]. Thus, embolization is widely performed to treat hemoptysis but there is a risk of spinal ischemia [4]. Here, we present a case of PAP with visualization of the posterior spinal artery by CT during angiography in an embolization procedure.

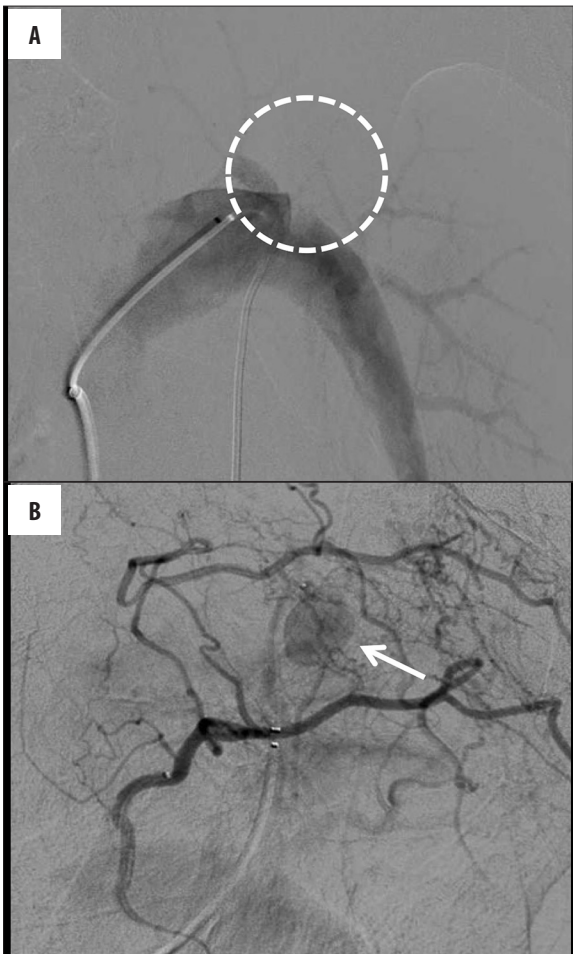
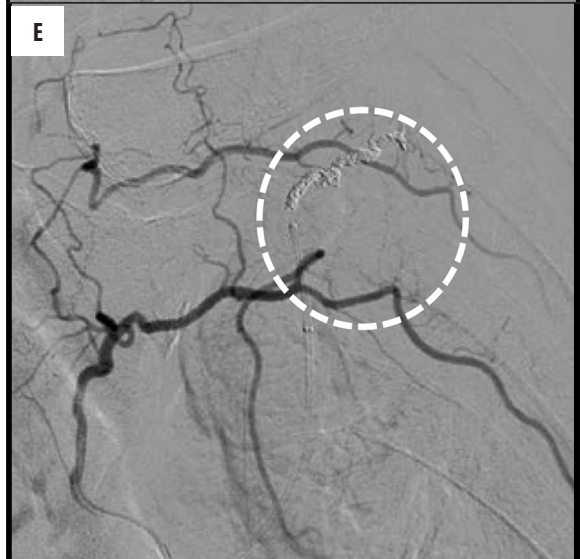
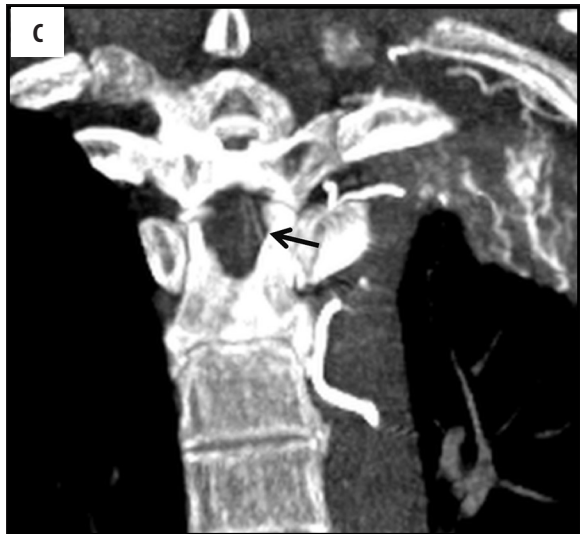
### Case Report

A 70-year-old man with a history of pulmonary aspergillosis had hemoptysis and underwent contrast-enhanced CT, revealing a PAP in the left upper lobe (Figure 1). Pneumonectomy was considered but he was not a surgical

candidate due to his chronic heart failure. Thus, an interventional radiological procedure was planned, and both systemic angiography and pulmonary angiography were performed. Systemic angiography was approached via the femoral artery with a 4-Fr. sheath (SuperSheath; Medikit, Tokyo, Japan) and a 4-Fr. catheter (Broncho; Medikit). Pulmonary angiography was approached via the femoral vein with an 8-Fr. sheath (SuperSheath; Medikit), a 5-Fr. guiding sheath (Flexor Ansel; Cook Medical, Bloomington, IN, USA), and a 4-Fr. catheter (Cerulean G; Medikit). Pulmonary angiography from the left pulmonary artery did not show the branch of the left upper lobe due to reverse flow from the systemic artery (Figure 2A). Systemic angiography using a 2.7-Fr. microcatheter (Sniper2; Terumo, Tokyo, Japan) from the fifth left intercostal artery showed the PAP at the distal site (Figure 2B). However, the access route to the PAP was very tortuous and long, making it difficult to advance the microcatheter. Thus, the use of glue for embolization of the PAP instead of coils was considered.



**Figure 1.** Contrast-enhanced CT shows the pulmonary artery pseudoaneurysm (PAP) due to pulmonary aspergillosis in the left upper lobe (arrow).



**Figure 2.** (A) Pulmonary angiography from the left pulmonary artery does not show the branch of the left upper lobe due to reverse flow from the systemic artery. (B) Systemic angiography from the fifth left intercostal artery shows the PAP (arrow). (C) Coronal maximum intensity projection CT image during angiography from the fifth left intercostal artery shows the posterior spinal artery (arrow). (D) A microcatheter was successfully advanced to the distal site of the PAP, and PAP was visualized obviously (arrow). Then, coil embolization was performed. (E) After coil embolization, angiography from the fifth left intercostal artery shows the disappearance of the PAP.



**Figure 3.** Contrast-enhanced CT performed 5 days later shows the disappearance of the PAP (arrow).

Although the spinal branch could not be observed with this angiography, CT during angiography was performed from this vessel to check it. CT images were obtained with a 16-MDCT scanner (0.8 s/rotation, pitch factor 1.0625; ECLOS, Hitachi Medical Systems, Tokyo, Japan), installed in an angiography room, with collimation of 1.25 mm. The scanned arterial images were reconstructed with a slice thickness of 1.25 mm and a slice interval of 1.25 mm, and coronal maximum intensity projection images were produced instantly using a three-dimensional (3D) workstation (Aquarius iNtuition Viewer, Aquarius, TeraRecon, San Mateo, CA, USA). As a result, the CT images allowed visualization of the posterior spinal artery (Figure 2C), and the plan was changed to embolization from the pulmonary artery. Catheterization in the pulmonary artery was performed with reference to the angiographic image obtained for the intercostal artery. The procedure time was long, approximately 3 hours. Advancement of the microcatheter to the feeding branch of the pulmonary artery to the PAP was challenging due to the narrow orifice of the branch. Finally, however, a 1.6-Fr. microcatheter (MARVEL; Tokai Medical, Kasugai, Japan) was successfully advanced through the 2.7-Fr. microcatheter (Sniper2; Terumo) to the distal site of the PAP (Figure 2D). The artery distal and proximal to the PAP was then successfully embolized using 0.010-inch coils (Target coil, Stryker, Fremont, CA, USA) to exclude it from circulation. Postembolization angiography showed no PAP filling (Figure 2E). Follow-up contrast-enhanced CT performed 5 days later revealed disappearance of the PAP (Figure 3). After embolization, the patient had no recurrence of hemoptysis during a 9-month follow-up period, and was without spinal ischemia.

## Discussion

Spinal artery ischemia is an important symptom, and it might occur as a complication of spinal surgery and also embolization for hemoptysis [5–8]. When the anterior spinal artery is visualized during angiography, embolization should not be performed [9]. However, several authors have found that spinal artery feeders are not visible on angiography in patients with developing spinal infarction [10,11]. On the other hand, the development of the angio-CT system, in which angiography and CT systems are located in the same room, was an epoch-making technology for interventional radiology due to the elimination of the need to move the patient to the CT room [12]. In the present case, the posterior spinal artery was not visualized with angiography but was successfully visualized by CT during angiography using the angio-CT system. A cone-beam CT has recently been developed and reported to be useful in the detection of not only tumors, but also feeding branches [13]. Thus, we believe the cone-beam CT may also be used as a substitute in the angio-CT system for treatment of hemoptysis by embolization.

Shin et al. [14] classified PAPs into four different types based on systemic and pulmonary angiography findings. In their study, pulmonary artery embolization after bronchial or nonbronchial systemic artery embolization was effective for type A and B PAPs; type A can be detected by pulmonary angiography, and type B can be detected by selective pulmonary angiography. Bronchial and nonbronchial systemic artery embolizations were recommended for type C and D PAPs; type C can be detected only by systemic angiography, and type D cannot be detected by either pulmonary angiography or systemic angiography. According to this classification, of which Tsukada et al. [15] has recently reported the usefulness, the present case was a type B PAP. Although pulmonary arterial embolization was successfully performed, the procedure took a long time. Thus, had there been no information on the posterior spinal artery from the internal costal artery, we may have chosen to perform the embolization from the internal costal artery rather than pulmonary arterial embolization. Posterior spinal artery embolization may be less likely to develop spinal infarction due to anastomosis [16], compared with anterior spinal artery embolization. However, there have been some reports on spinal cord infarction by posterior spinal artery syndrome [17,18]. Thus, we believe that posterior spinal artery embolization should be avoided if possible.

## Conclusions

CT during angiography may be useful to confirm the presence of the spinal artery for treatment of hemoptysis by embolization.

## Conflict of interest

We do not have any conflict of interest.

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