

## Percutaneous Coil Embolization of Traumatic Juxtacardiac Right Inferior Pulmonary Vein Pseudoaneurysm

**From:** Ivan Kuang Hsin Huang, MBBS, MMed, FRCR  
Mahendran Nadarajah, MBBS, FRCR  
Li Tserng Teo, MBBS, FRCS  
Dokev Basheer Ahmed Aneez Ahmed, MBBS, FRCS, FAMS  
Uei Pua, MBBS, MMed, FRCR, FAMS  
Department of Diagnostic Radiology (I.K.H.H., U.P.);  
Trauma and Acute Care Surgery Service, Department of  
General Surgery (L.T.T.); and Thoracic Surgery and Thoracic  
Oncology Service, Department of General Surgery (D.B.A.A.A.)  
Tan Tock Seng Hospital  
11 Jalan Tan Tock Seng  
Singapore 308433; and  
Department of Diagnostic and Interventional Neuroradiology  
(M.N.)  
National Neuroscience Institute  
Singapore

### Editor:

We report a case of an acute large juxtacardiac right inferior pulmonary vein pseudoaneurysm following blunt chest trauma that was successfully treated with direct percutaneous coil embolization. Our institution does not require ethics approval for case reports such as this.

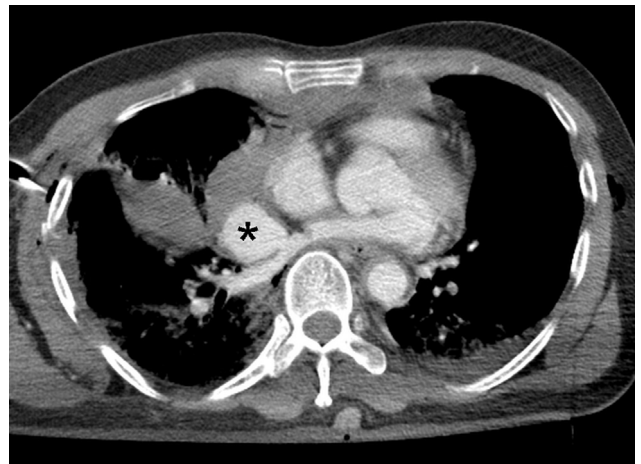
A 49-year-old man sustained blunt chest wall injury during a motor vehicle accident and presented with a flail chest. He was subsequently intubated at the emergency department because of an inability to maintain oxygen saturation despite supplementary oxygen. Contrast-enhanced computed tomography (CT) of the thorax revealed a 3.21-cm  $\times$  2.6-cm wide-necked juxtacardiac right inferior pulmonary vein pseudoaneurysm (Fig 1), together with multiple rib and sternal fractures, extensive pulmonary contusion, right hemothorax, left hydropneumothorax, and hemopericardium. After multidisciplinary consultation among trauma and cardiothoracic surgeons and interventional radiologists, it was agreed that surgical repair in the acute setting posed a high risk as a result of the central location of the lesion, current unstable hemodynamic status, and likely extensive adhesions from a previous pleurodesis. The consensus was to attempt embolization to stabilize the patient's condition for eventual surgical repair.

Direct percutaneous access followed by coil embolization was chosen after considering available resources and

expertise limitations for various endovascular approaches. For pulmonary venous access, the needle trajectory was planned by correlating internal landmarks on cone-beam CT with the thoracic CT images; the pseudoaneurysm was midway between the bifurcation of the right main bronchus and T6 vertebral body and was defined as the target on the navigation software.

The pseudoaneurysm was directly punctured via a right anterolateral chest wall approach with a 21-gauge needle (AccuStick set; Meditech, Watertown, Massachusetts) with CT navigation guidance (XperGuide; Philips Medical Systems, Eindhoven, The Netherlands; Fig 2a). The access was exchanged for a 6-F Brite-tip sheath (Cordis, Miami Lakes, Florida) over a Rosen wire (Cook, Bloomington, Indiana). Additionally, a 200-cm V18 wire (Boston Scientific, Natick, Massachusetts) was left outside the sheath with the tip in the left pulmonary vein to act as a safety wire, given the short purchase of the working sheath. The side arm of the sheath was used for imaging and monitoring of embolization. Angiography confirmed the wide-necked pseudoaneurysm with prompt opacification of the left heart chambers.

Through the sheath, embolization coils were deployed with the use of a Headway microcatheter (MicroVention, Aliso Viejo, California) and PX Slim microcatheter (Penumbra, Alameda, California). Coils deployed included four long detachable coils (22–32-mm diameter; Penumbra), one 18 Cosmos Complex coil (24-mm diameter; MicroVention), and two MicroPlex VFC coils (24-mm diameter; MicroVention). Completion pulmonary angiography showed near-complete thrombosis of the pseudoaneurysm with minimal flow in the superior aspect of the sac (Fig 2b). This is because the pseudoaneurysm lacked a true wall and we had deli-



**Figure 1.** Contrast-enhanced CT of the thorax shows a 3.2-cm  $\times$  2.6-cm wide-necked juxtacardiac right inferior pulmonary vein pseudoaneurysm (asterisk) with a hematoma surrounding it. Pulmonary contusions, left moderate hydropneumothorax, right hemothorax, sternal fracture, and multiple bilateral rib fractures were also detected.

Figures E1 and E2 are available online at [www.jvir.org](http://www.jvir.org).

None of the authors have identified a conflict of interest.

<http://dx.doi.org/10.1016/j.jvir.2015.01.003>

berately kept the packing density low to avoid excessive pressure to reduce the risk of rupture. In view of the minimal residual perfusion and stabilization of the patient's hemodynamic status, the procedure was terminated. The pulmonary parenchyma tract was then embolized with coils to prevent pulmonary hemorrhage.

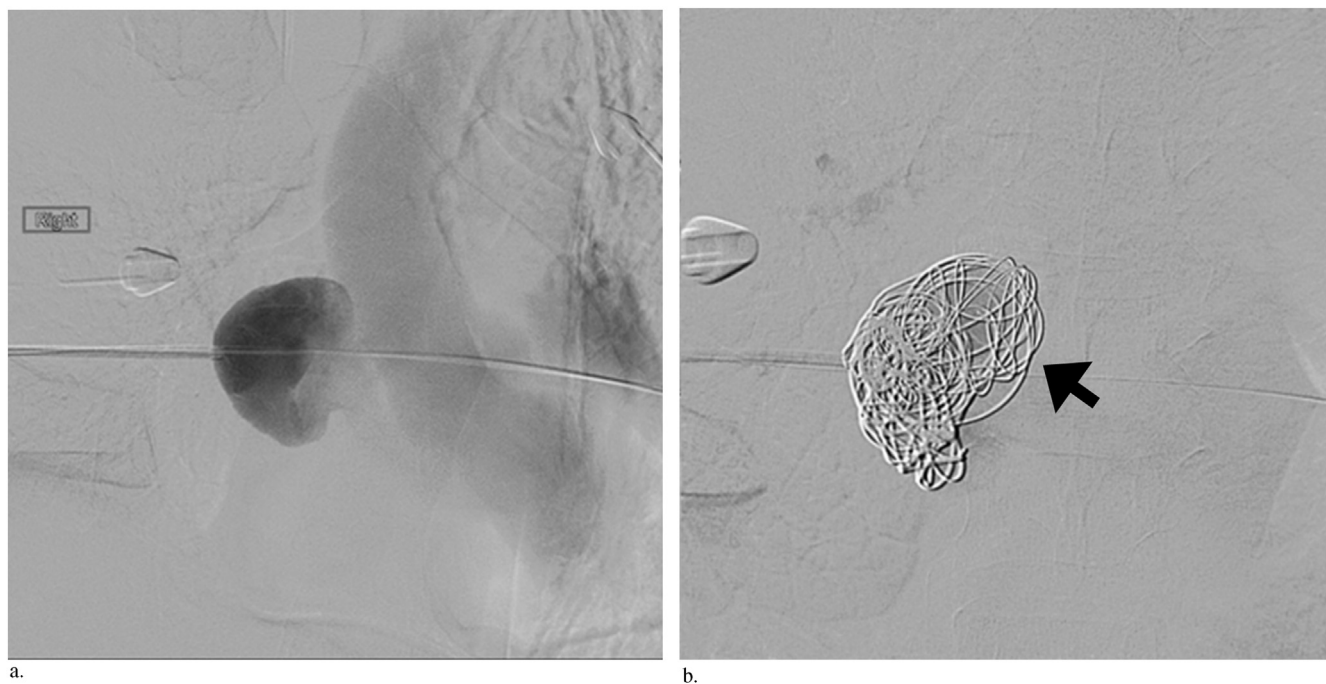
The patient's condition stabilized following embolization, and he underwent internal fixation. Repeat pulmonary angiography performed on day 3 and day 10 showed similar findings as the completion angiography (**Fig 3a**). However, no further surgical intervention was undertaken because the patient was recovering well. He was discharged with minimal chest symptoms after a total of 5 days in the surgical intensive care unit and another 10 days in the rehabilitation ward. He returned to work 3 weeks after discharge. An outpatient follow-up pulmonary angiogram 4 months later showed complete thrombosis of the pseudoaneurysm and coil stability (**Fig 3b**). The patient declined further angiographic surveillance and was scheduled for clinical and chest radiographic follow-up at 1 year.

Endovascular treatment of pulmonary venous lesions differs from their arterial counterparts in that access to the pulmonary veins is less straightforward (1,2). The Brockenbrough technique, which uses interatrial transseptal puncture from the right atrium, is most commonly used (3). This option was first considered in the present case. However, the required equipment and expertise

were not immediately available at our institution because the patient presented after hours and was deemed to be in too unstable a condition to be transferred to another institution. Another possibility was to obtain a delayed pulmonary angiogram with a catheter in the right pulmonary artery and access the pseudoaneurysm under fluoroscopic guidance. However, the juxtacardiac position of the pseudoaneurysm with overlapping cardiac structures would have made fluoroscopic guidance difficult and perhaps hazardous.

The initial plan was to embolize across the neck of the pseudoaneurysm, but we were unable to access the upstream segment of the vein. Direct exclusion of the neck with a vascular plug, such as the Amplatzer Septal Occluder device (St. Jude Medical, Plymouth, Minnesota), was also considered. However, we were hampered by difficulty in obtaining an exact measurement of the pseudoaneurysm neck on CT and angiography, and we were cautious against inflating a sizing balloon over the pseudoaneurysm neck. A decision to perform direct coil embolization was therefore made in view of these limitations and considerations.

For postprocedural assessment, we were unable to obtain diagnostic CT images despite cardiac gating and various postprocessing techniques (eg, subtraction/metal hardware algorithm; **Figs E1 and E2**; available online at [www.jvir.org](http://www.jvir.org)). Hence, catheter pulmonary angiography was the best option. We concede that coil embolization



**Figure 2.** (a) Direct percutaneous puncture on the first attempt from right anterolateral chest wall approach under cone-beam CT guidance (guide wire is coursing into the left atrium). Contrast agent injection into the right inferior pulmonary vein pseudoaneurysm delineates its outline and shows prompt opacification of the left heart chambers and aorta. (b) Pulmonary angiogram obtained after coil embolization shows minimal flow and partial thrombosis of the pseudoaneurysm sac. Minimal residual flow was detected in the superior aspect of the sac, where the packing density was lowest (arrow). There was a deliberate attempt to reduce the packing density in view of the fact that this pseudoaneurysm had no true wall. In retrospect, additional coil packing might have been helpful in obliterating the superior aspect of the sac.



**Figure 3.** (a) Catheter pulmonary angiogram obtained 10 days after coil embolization shows limited perfusion within the superior aspect of the pseudoaneurysm (arrow; similar to Fig 2b). Note the presence of sternal and rib fracture internal fixations. (b) Surveillance pulmonary angiogram obtained 4 months after coil embolization shows complete thrombosis of the pseudoaneurysm (arrow), including the previously perfused region (arrow, in a). There is no further increase in size of the pseudoaneurysm.

with residual flow may be considered a suboptimal angiographic endpoint. However, the initial plan was not for embolization as a definitive measure, but rather as a temporizing measure to stabilize the patient's condition for definitive surgery. Embolization was terminated because of hemodynamic improvement and stabilization of the patient's condition despite the presence of minimal residual flow. Our intent to perform interval surgery could be also seen in that our needle trajectory traversed only the right lower lobe, with extensive coil embolization of the parenchyma tract, as right lower lobe lobectomy was an expected outcome. It was fortuitous that the patient's condition not only stabilized, but that he went on to show a full recovery following embolization, averting surgical intervention altogether. We postulate that the low pressure and slow flow of the pulmonary venous system allowed eventual thrombosis of the pseudoaneurysm despite the incomplete embolization.

## REFERENCES

1. Guyader A, Bertin F, Laskar M, et al. Blunt chest trauma: a right pulmonary vein rupture. *Eur J of Cardiothor Surg* 2001; (1054-6 B).
2. McKeown P, Rosemurgy A, Conant P. Blunt traumatic rupture of pulmonary vein, left atrium and bronchus. *Ann Thorac Surg.* 1991; 52: 1171-1172.
3. Brockenbrough EG, Braunwald. E. A new technic for left ventricular angiography and transseptal left heart catheterization. *The Am J of Cardiol* 1960; 6:1062-1064.

## Isolated Common Iliac Aneurysm and Spontaneous Ilioiliac Arteriovenous Fistula in a Patient with Subsequent Type II Endoleak and Successful Endovascular Management

**From:** Jonathan K. Park, MD

Margaret Lee, MD

Alexandra So

Hsin-Yi Lee, MD

Division of Interventional Radiology, Department of Radiological Sciences (J.K.P.)

Ronald Reagan University of California, Los Angeles (UCLA), Medical Center

David Geffen School of Medicine at UCLA  
Los Angeles, California

Imaging Service (A.S., H.-Y.L.)

Veterans Affairs Greater Los Angeles Healthcare System  
Los Angeles, California; and

Department of Radiology (M.L.)

Olive View-UCLA Medical Center  
Sylmar, California

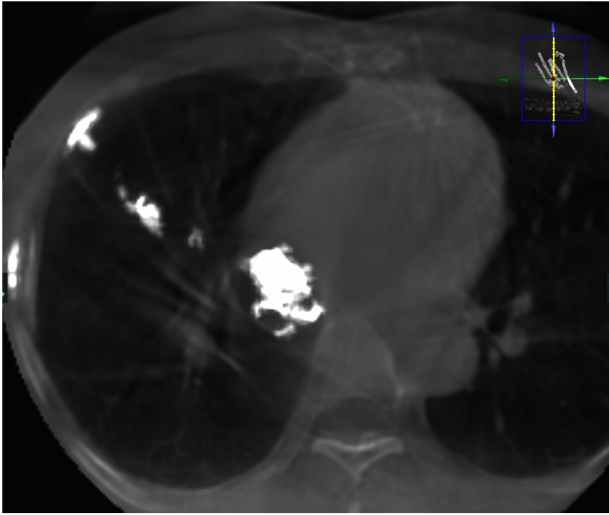
## Editor:

Common iliac artery aneurysms (CIAAs) complicated by spontaneous ilioiliac arteriovenous (AV) fistulae (IIAVFs) are rare (1). The present report describes a

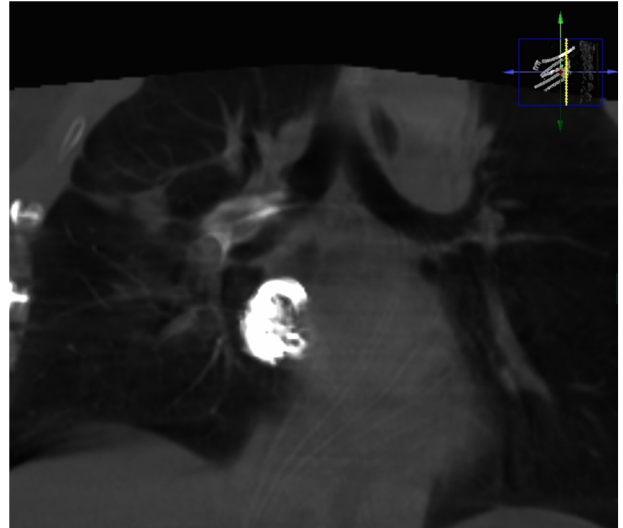
None of the authors have identified a conflict of interest.

<http://dx.doi.org/10.1016/j.jvir.2015.01.002>





**Figure E1.** Contrast-enhanced axial CT image obtained 4 months after embolization. Blooming artifact from the embolization coils limited the assessment of pseudoaneurysm. This is despite the use of cardiac gating and metal subtraction algorithm.



**Figure E2.** Coronal image reconstructed from the same CT dataset as **Fig E1**. Assessment of the residual area of perfusion within the pseudoaneurysm (**Fig 3a**, arrow) was not possible. Complete thrombosis of the pseudoaneurysm could only be confirmed using catheter angiography (**Fig 3b**).