ESC European Society of Cardiology
European Heart Journal - Case Reports
doi:10.1093/ehjcr/ytab129

CASE REPORT
Coronary heart disease

Coil embolization for ruptured coronary pseudoaneurysm causing haemopericardium: a case report

Takashi Nakagawa [1]*, Hisao Hara[1], Momoko Wakiya[2], and Yukio Hiroi[1]

[1]Department of Cardiology, National Center for Global Health and Medicine, 1-21-1 Toyama, Shinjuku-ku, Tokyo 162-8655, Japan; and [2]Division of Cardiovascular Medicine, Ohashi Medical Center, Toho University, Tokyo, Japan

Received 28 September 2020; first decision 2 November 2020; accepted 17 March 2021

Background Coronary artery pseudoaneurysm is a rare disease that can rupture and cause haemopericardium. It can occur principally as a complication after coronary artery instrumentation, but it can also result from trauma.

Case summary A 15-year-old male patient with a history of spontaneous pneumothoraces treated twice with video-assisted thoracoscopic thoracic surgery presented with pericarditis and increasing haemopericardium. During the hospitalization, he had developed cardiogenic shock and he underwent emergent pericardiocentesis. Coronary angiography revealed a small right coronary artery pseudoaneurysm. We successfully coil embolized the pseudoaneurysm.

Discussion This is a rare case of a ruptured coronary artery pseudoaneurysm associated with prior tube thoracostomy. The treatments for a coronary pseudoaneurysm should be tailored based on the pathologic and anatomical characteristics.

Keywords Pericardial effusion • Haemopericardium • Coronary artery pseudoaneurysm • Coil embolization • Case report

Learning points

- Cardiac injury due to non-cardiac procedures is a rare but significant cause of coronary pseudoaneurysm.
- Coronary angiography can be useful for identifying the cause of pericardial effusion that is challenging to determine.
- Coil embolization is a good treatment option for small peripheral coronary pseudoaneurysms.

Introduction

Acute pericarditis is often accompanied by pericardial effusion. It has a number of potential causes including infections, malignancies, trauma, and autoimmune diseases, such as rheumatoid arthritis.[1] Massive haemopericardium is common in tuberculosis or malignancy.[2,3] Coronary pseudoaneurysm is a rare condition and principally occurs as a late-term complication after coronary artery instrumentation. It may rupture and result in haemopericardium with impaired haemodynamics. We present a rare case of coronary pseudoaneurysm successfully treated with coil embolization.

* Corresponding author. Tel: +81-3-3202-7181, Fax: +81-3-3202-1038, Email: tnakagawa@hosp.ncgm.go.jp
Handling Editor: Marco De Carlo
Peer-reviewers: Andrew Peter Vanezis; Luigi Biasco; Ali Nazmi Calik; Derek Phan; Helle Søholm and Gavin Paul Raphael Manmathan
Compliance Editor: Gemina Doolub
Supplementary Material Editor: Ross Thomson

Timeline

Date	Event
3 months ago	He had undergone video-assisted thoracic surgery for bilateral spontaneous pneumothorax.
2 months ago	He had undergone video-assisted thoracic surgery for left pneumothorax.
Day 1	Presentation with sudden severe central chest pain with diffuse ST-segment elevation and significant pericardial effusion.
	White blood cell count (WBC) was elevated, but Troponin I, creatine kinase (CK), and CKMB were not elevated.
	He was managed conservatively initially with ibuprofen.
Day 3	Echocardiography showed decreasing pericardial effusion and electrocardiogram showed improvement of ST-elevation.
Day 4–10	He had only slight chest pain.
	His course was carefully monitored because he had near-fatal event.
Day 11	WBC and C-reactive protein were normalized.
Day 12	We confirmed that the pericardial effusion had decreased.
Day 13	He had severe chest pain with cardiac tamponade.
	Emergent pericardiocentesis was performed.
Day 34	Coronary angiography revealed right coronary artery (RCA) pseudoaneurysm.
Day 48	Coil embolization of RCA pseudoaneurysm was performed.
Day 49	The peak CK and CKMB after coil occlusion were 1077 U/L and 81 U/L, respectively.
	His chest pain was successfully managed with an opioid.
Day 50–58	We carefully monitored whether pericardial effusion recurred.
Day 59	He was discharged home without any complications.

Case presentation

A 15-year-old male (height, 159 cm; weight, 43 kg) presented to the emergency department with sudden severe central chest pain radiating to the left shoulder. His blood pressure was 83/56 mmHg, pulse 84 beats/minute, and body temperature 36.1°C. His cardiovascular physical examination was unremarkable, and no evidence of connective tissue disorder and vasculitis was apparent.

He and his family history were unremarkable for cardiovascular disease, vasculitis, and connective tissue diseases including Marfan syndrome. He had undergone video-assisted thoracic surgery (VATS) for bilateral spontaneous pneumothorax 3 months before and for left pneumothorax 2 months before at the former hospital.

The initial electrocardiogram (ECG) showed sinus tachycardia with ST-segment elevation in leads I, II, III, aVF, and V2 to V6 (*Figure 1*). Laboratory investigations showed an elevated white blood cell count at 25.0 $\times$ 10^9/L (normal value: 3.3–8.6 $\times$ 10^9/L) and a normal level of C-reactive protein at 0.1 mg/L (normal value: 0.0–1.4 mg/L). Creatine kinase (CK), CKMB, and troponin I were within normal limits at 75 U/L (normal value: 59–248 U/L), 17 U/L (normal value: 0–20 U/L), 0.01 ng/mL (normal value: 0.00–0.09 ng/mL), respectively. Chest X-ray revealed a slightly enlarged cardiac silhouette (*Figure 2*). Contrast-enhanced computed tomography (CT) revealed significant pericardial effusion of which Hounsfield unit was approximately 50 HU, suggesting that it might be high protein fluid or bloody. There was no evidence of pulmonary embolism or aortic dissection. Transthoracic echocardiogram revealed a large pericardial effusion with normal left ventricular size and function with an ejection fraction of 68% (*Videos 1* and *2*).

Based on the clinical history and the ECG findings, our working diagnosis was pericarditis of unknown origin. The differential diagnosis included infectious pericarditis (viral or tubercular) and non-infectious pericarditis (autoimmune or autoinflammatory diseases, pericardial injury syndromes, and malignancies).

We managed him with a conservative strategy, including treatment with ibuprofen. On the third day after admission, echocardiogram showed decreasing pericardial effusion and ECG showed improvement of ST elevation. Laboratory investigations for bacteria, *Mycobacterium tuberculosis*, and collagen vascular diseases were negative. His course was carefully monitored because he was young and had near-fatal event. On the morning of the day 12, we confirmed that the pericardial effusion had decreased. On hospital day 13, he experienced sudden severe chest pain after vomiting, became diaphoretic, and developed cardiogenic shock. An echocardiogram revealed the pericardial effusion to have increased to > 30 mm with tamponade physiology. He underwent emergent pericardiocentesis and drainage of 300 mL of blood (haemoglobin of the fluid was 12.8 g/dL). Bacterial cultures and cytology were negative. A full body ^{18}F-fluorodeoxyglucose (FDG) positive emission tomography scan for detecting malignancies revealed no significant FDG uptake. Coronary angiography showed a 2 mm saccular-shaped pseudoaneurysm in the posterolateral (PL) branch of right coronary artery (RCA) (*Video 3*). We recognized that rupture of the coronary pseudoaneurysm caused the acute haemopericardium. Based on his past medical history, we speculated that the coronary pseudoaneurysm was caused by trauma associated with prior procedures for pneumothoraces.

We treated the coronary pseudoaneurysm by percutaneous management with coil embolization. The procedure was performed via the right femoral artery approach. Using Runthrough NS floppy (Terumo, Tokyo, Japan) guidewire with Heartrail II JR3.5 catheter (Terumo, Tokyo, Japan), the guidewire and Excelsior SL-10 (Stryker Neurovascular, Fremont, CA, USA) microcatheter were successfully inserted to the PL branch of RCA (Supplementary material online, *Video S1*). One detachable coil; 2 mm $\times$ 8 mm Trufill DCS Orbit® (Codman Neurovascular, Raynham, MA, USA) was delivered through a microcatheter (Supplementary material online, *Video S2*). A final angiogram showed obliteration of blood flow to the pseudoaneurysm (Supplementary material online, *Video S3*).

The patient experienced chest pain for 1 day after the procedure, although post-procedural echocardiogram did not show any

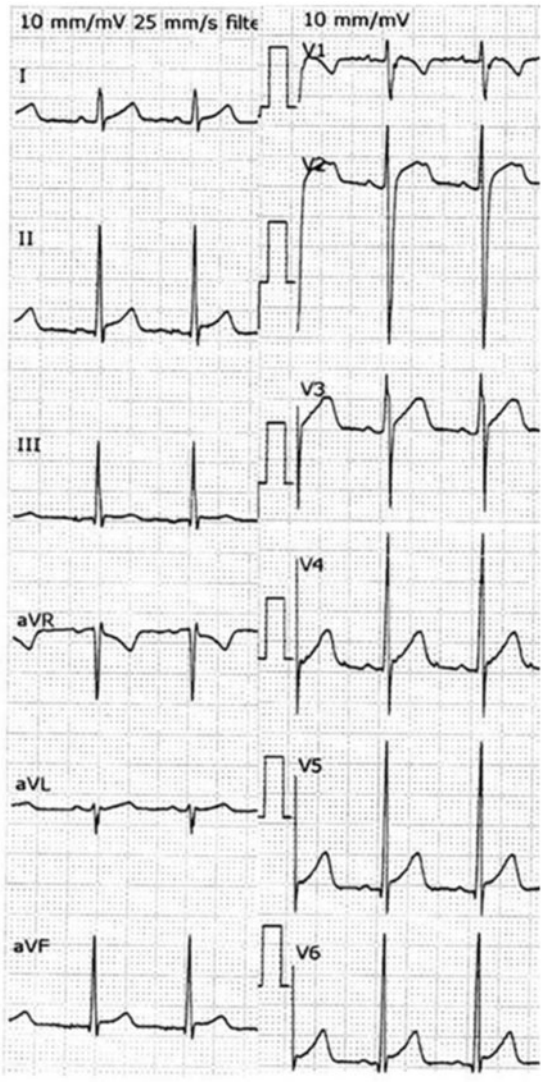


Figure 1 Initial electrocardiogram showing ST-segment elevation in leads I, II, III, aVF, and V2–6.

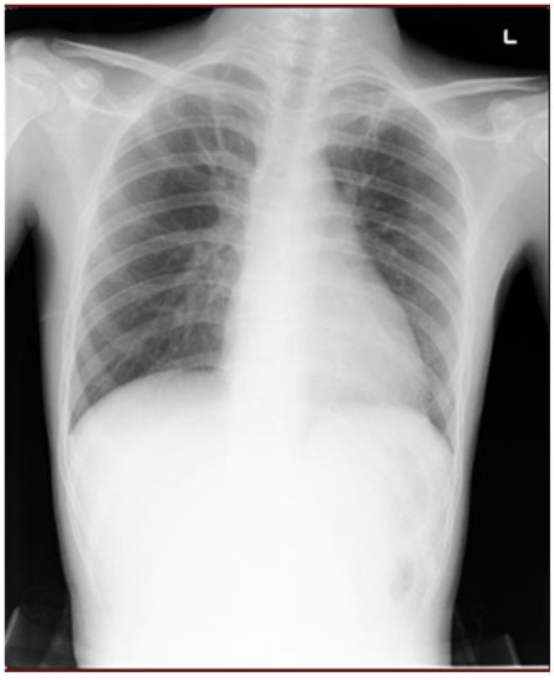


Figure 2 Initial chest X-ray (AP view) showing a slightly enlarged cardiac silhouette.

abnormality (Supplementary material online, *Videos S4* and *S5*). He had no symptoms on the second post-procedural day. Post-procedural electrocrdiogram showed inverted T waves in leads III, aVF (*Figure 3*). He was discharged 12 days after the procedure.

Discussion

Pericarditis is an inflammation of the pericardium, often accompanied by pericardial effusion. Accumulation of pericardial fluid or blood in the pericardial space increases the pressure in the pericardial space, causing diastolic dysfunction, resulting in shock due to decreased cardiac output and decreased coronary blood flow. In most cases, the cause of acute pericarditis is thought to be so-called idiopathic i.e. suspected occult viral infection. Major known causes include infections such as viruses and tuberculosis, autoimmune diseases, malignancies, and injuries such as myocardial infarction and cardiac surgery.[1] Massive pericardial effusion with impaired haemodynamics is common in pericarditis due to tuberculosis or malignancy.[2,3] In this case, a large haemopericardium worsened during hospitalization. Tuberculosis and malignancy were ruled out, and finally, coronary angiography confirmed a coronary pseudoaneurysm in the distal RCA, whose rupture was considered to be the cause of the haemopericardium. This is a rare case in which a coronary pseudoaneurysm was considered to be associated with chest drain insertion.

Coronary pseudoaneurysm is a rare condition, and it has been reported to be a late-term complication after percutaneous catheter intervention or coronary artery bypass surgery. It may also be caused by infection, trauma, connective tissue disease, or during pregnancy.[4] In this case, since there were no underlying diseases such as vasculitis or connective tissue disease, and there was no history of prior coronary artery instrumentation, traumatic coronary pseudoaneurysm formation due to chest drain insertion before hospitalization was presumed to be the mechanism. There is no doubt that the tube has reached the surface of the heart (*Figure 4*). We speculated that the placement of the drain may have caused damage to the exact location of the coronary pseudoaneurysm. There are few reports of perioperative cardiac complications of tube thoracostomy or VATS. There is report of left ventricular perforation with a thoracostomy tube,[5] but no coronary pseudoaneurysm has been reported thus far. Coronary pseudoaneurysms are often asymptomatic and are often found incidentally during coronary angiography or CT.[6] However, as in this case, it is also known that the rupture of a coronary pseudoaneurysm causes cardiac tamponade and acute coronary syndrome. In this case, the patient had vomiting before developing cardiogenic shock, and one may therefore postulate a causative link given the

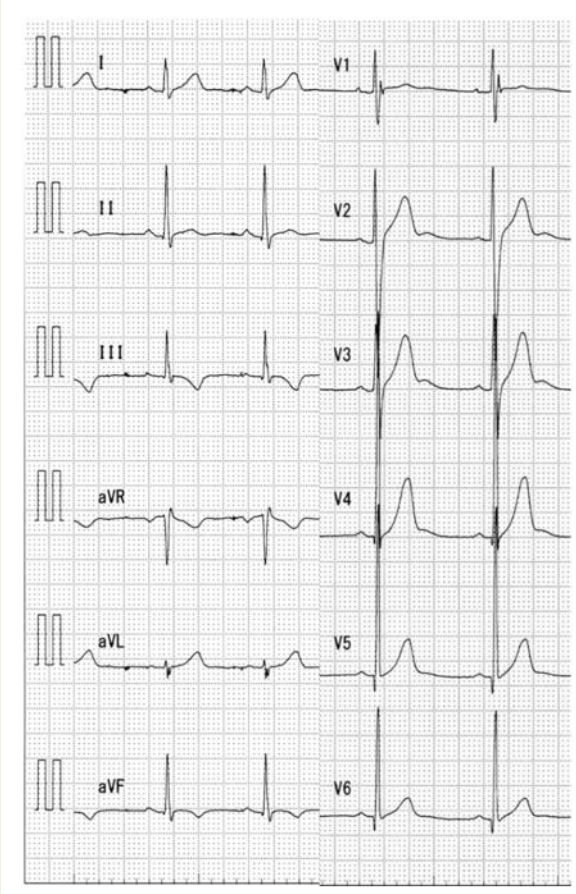
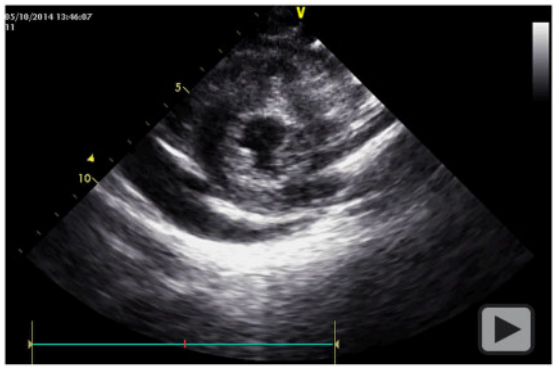


Figure 3 Follow-up electrocardiogram showing inverted T waves related to coil embolization of pseudoaneurysm in leads III, aVF.



Video 1 Transthoracic echocardiogram (parasternal short-axis view) showing a large pericardial effusion.

temporal association between rupture of the pseudoaneurysm and the retching associated with vomiting. Coronary angiography is most commonly used to detect a coronary pseudoaneurysm. Cardiac CT, which allows for a more accurate evaluation of a coronary pseudoaneurysm may also be useful for diagnosis.[4,6] Coronary CT was

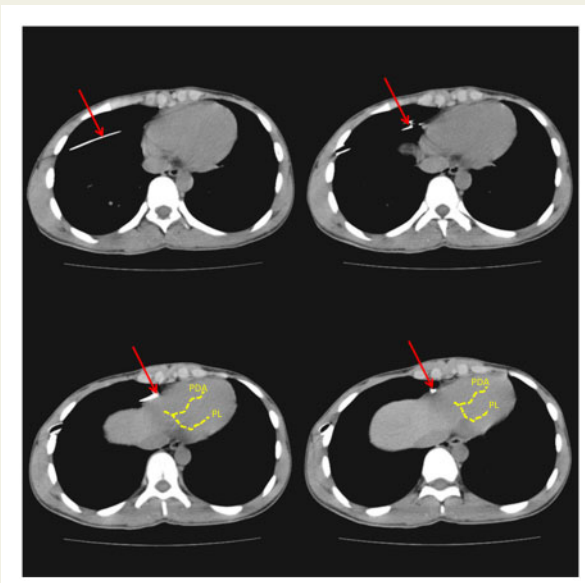
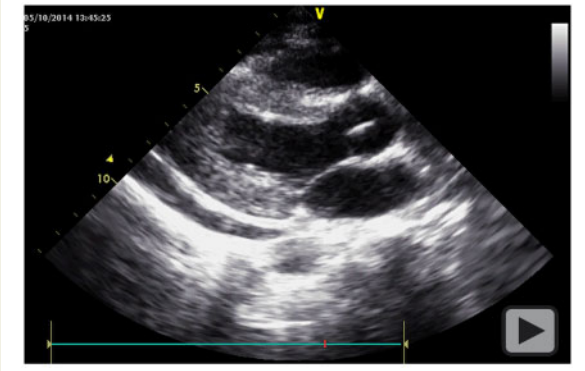


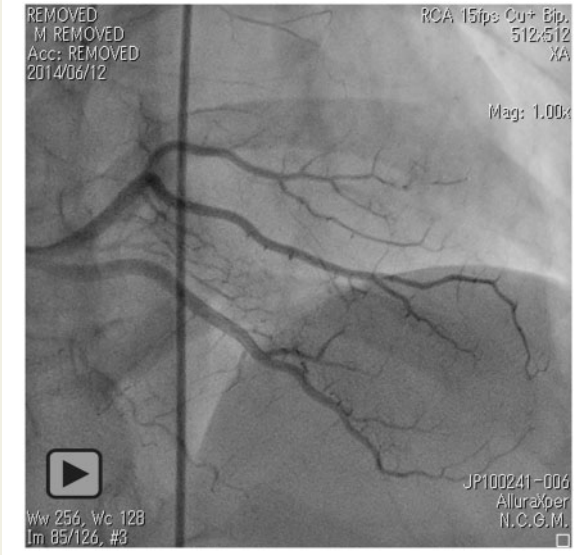
Figure 4 Computed tomography showing the tip of the thoracostomy tube located adjacent to the anteroinferior mediastinum (arrow). PDA, posterior descending artery; PL, posterolateral artery.



Video 2 Transthoracic echocardiogram (parasternal long-axis view) showing a large pericardial effusion.

performed in this case, but no coronary pseudoaneurysm was identified, probably because of its small size.

The treatments for coronary pseudoaneurysm include medical management, percutaneous intervention, and surgical intervention. There are no clear guidelines for optimal treatment. It is important to tailor the approach for each individual based on pathologic and anatomical characteristics.[4,6] Invasive treatments for coronary pseudoaneurysm include surgical intervention and percutaneous intervention. Surgical treatments include ligation of coronary pseudoaneurysm and coronary artery bypass grafting.[4,6,7] Percutaneous intervention techniques include exclusion of coronary artery pseudoaneurysm with a covered stent graft,[8] thrombosis of the pseudoaneurysm with a bare metal stent,[9] or coil embolization.[10] In this case, treatment with coil embolization was successful. Surgery was an alternative treatment option, but considering the invasiveness of median sternotomy and



Video 3 Coronary angiogram (RAO cranial view) showing the pseudoaneurysm in the posterolateral branch of right coronary artery.

cardiopulmonary bypass (if needed) and the size of the coronary pseudoaneurysm, coil embolization was a reasonable option for this case.

Conclusion

This is a rare case of acute haemopericardium caused by the rupture of an RCA pseudoaneurysm resulting from trauma associated with prior tube thoracostomy. Coronary angiography should be considered to perform when the cause of the haemopericardium could not be identified by other imaging modalities. We were able to treat the pseudoaneurysm without any complications by coil embolization.

Lead author biography

Takashi Nakagawa graduated from Kyoto Prefectural University of Medicine, Japan. Since 2011, he works as a cardiologist at the Department of Cardiology, National Center for Global Health and Medicine, Japan. His area of interest is coronary interventions and cardiac rehabilitation.

Supplementary material

Supplementary material is available at *European Heart Journal—Case Reports* online.

Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as Supplementary data.

Consent: The authors confirm that written consent for submission and publication of this case report including images and associated text has been obtained from the patient in line with COPE guidance.

Conflict of interest: None declared.

Funding: None declared.

References

1. Khandaker MH, Espinosa RE, Nishimura RA, Sinak LJ, Hayes SN, Melduni RM *et al.* Pericardial disease: diagnosis and management. *Mayo Clin Proc* 2010;**85**:572–593.
2. Oh PC, Baek SJ, Moon J, Han SH, Park KY, Koh KK. Idiopathic pericarditis presenting large hemorrhagic pericardial effusion. *Int J Cardiol* 2013;**168**:4467–4469.
3. Sagristà-Sauleda J, Mercé AS, Soler-Soler J. Diagnosis and management of pericardial effusion. *World J Cardiol* 2011;**3**:135–143.
4. Kar S, Webel RR. Diagnosis and treatment of spontaneous coronary artery pseudoaneurysm: rare anomaly with potentially significant clinical implications. *Catheter Cardiovasc Interv* 2017;**90**:589–597.
5. Shin-Kim J, Zapolsky N, Wan E, Steinberg E, Heller M, Jacoby JL. Left ventricular perforation with catheter decompression. *Am J Emerg Med* 2019;**37**:377.e5-377.e6–377.e6.
6. Kawsara A, Nunez Gil IJ, Alqahtani F, Moreland J, Rihal CS, Alkhouli M. Management of coronary artery aneurysms. *JACC Cardiovasc Interv* 2018;**11**:1211–1223.
7. Sasaguri S, Nishimori H, Wariishi S, Yamamoto M, Kondo N, Kihara K *et al.* A surgical case report of off-pump onlay patch grafting for pseudoaneurysm with diffusely calcified coronary artery. *Ann Thorac Cardiovasc Surg* 2011;**17**:94–96.
8. Yatsynovich Y, Valencia D, Schwartz BP, Wadiwala N, Ali M. Successful percutaneous treatment of a large coronary artery pseudoaneurysm with a covered stent graft. *Int J Cardiovasc Imaging* 2019;**35**:237–238.
9. Shintani Y, Kawasaki T. The effects of a bare metal stent on the healing of a huge coronary pseudoaneurysm: a case report. *Catheter Cardiovasc Interv* 2012;**80**:621–625.
10. Sallam T, Levi D, Tobis J. Coil embolization of left coronary artery pseudoaneurysms arising as a complication of percutaneous coronary intervention. *Catheter Cardiovasc Interv* 2012;**80**:1228–1231.