CASE REPORT

Cardiac CT for intraseptal pseudoaneurysm: impending double rupture of ventricular septum and left ventricular free wall

Hiroshi Yamada,¹ Asako Sakurai,² Aya Higurashi,² Kohji Takeda²

¹Critical Care Division, Fujisawa City Hospital, Fujisawa, Kanagawa, Japan

²Department of Anesthesiology, Fujisawa City Hospital, Fujisawa, Kanagawa, Japan

Correspondence to
Dr Hiroshi Yamada,
hiroymd52@gmail.com

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SUMMARY

A 71-year-old woman presented at our hospital with chest discomfort. Cardiac CT showed an impending double rupture; an intraseptal pseudoaneurysm had ruptured into the right ventricle, while the left ventricular free wall remained intact at this stage. After admission, the patient fell into cardiogenic shock. Emergency surgery was performed. The intraoperative findings included a double rupture of the ventricular septum and the left ventricular free wall. Double rupture is a rare but fatal complication of myocardial infarction. Early diagnosis is essential. Recently, cardiac CT has emerged as a valuable tool for patients with possible ischaemic disease. In this case, enhanced cardiac CT showed an impending double rupture of junctional-type. The static and dynamic images of intraseptal pseudoaneurysm by two-dimensional (2-D) CT, 3-D CT and 4-D CT presented here provide insights into the mechanisms behind, and the pathophysiology of, double ruptures. They also demonstrate the significance of cardiac CT for evaluating ischaemic heart disease.

BACKGROUND

Cardiac rupture is a rare but fatal complication of acute myocardial infarction. The different types of cardiac ruptures include ventricular free wall rupture (FWR), ventricular septal rupture (VSR) and papillary muscle rupture. Ventricular double rupture is defined as the coexistence of two of the aforementioned forms of cardiac rupture. As double ruptures carry a high risk of mortality, early diagnosis and surgical correction are essential.

CASE PRESENTATION

A 71-year-old Asian woman presented at our hospital with chest discomfort and dizziness. On admission, ECG demonstrated ST-segment elevation in leads II, III, aVF and V1–V4, but not in aVL, indicating inferobasal infarction and ventricular septal rupture.¹ Transthoracic echocardiography revealed Takotsubo-like cardiac movements. Cardiac rupture in patients with Takotsubo cardiomyopathy or with Takotsubo-like cardiac movements is more common

Figure 1 Axial, coronal, sagittal and oblique planes of enhanced cardiac CT. The oblique plane best indicates the ventricular septal rupture through the intraseptal pseudoaneurysm (LV, left ventricle; RV, right ventricle; ISPA, intraseptal pseudoaneurysm).

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Figure 2 Static images of reconstructed three-dimensional (3-D) CT showing the intraseptal pseudoaneurysm from several directions. Static images of the intraseptal pseudoaneurysm from various directions by reconstructed 3-D CT, and its dynamic images by 4-D CT (time series of 3-D CT), are available as on-line supplemental materials. (LV: left ventricle, RV: right ventricle, ISPA: intraseptal pseudoaneurysm)

than previously recognised.² Enhanced cardiac CT was thus performed for suspected ischaemic heart disease. Coronary CT

Video 1 A reconstructed three-dimensional CT; static image of the intraseptal pseudoaneurysm from various directions.

revealed 90% stenosis of the left anterior descending artery and total occlusion of the right coronary artery. Cardiac CT indicated a pseudoaneurysm in the ventricular septum, which had ruptured into the right ventricle, while the left ventricular free wall remained intact at this stage (figure 1). Three-dimensional (3-D) and 4-D cardiac CT, which was obtained by the same scan and reconstituted later, showed static and dynamic images of the intraseptal pseudoaneurysm (figure 2; videos 1 and 2, provided as digital supplements).

The next morning, the patient fell into cardiogenic shock. Transthoracic echocardiography showed massive pericardial effusion. Pericardiocentesis was carried out and emergency surgery was performed. Intraoperative transoesophageal

Video 2 A reconstructed four-dimensional (4-D) CT (time-series of reconstructed 3-D CT); dynamic image of the intraseptal pseudoaneurysm.

Figure 3 Intraoperative transoesophageal echocardiography. An intraseptal pseudoaneurysm and pericardial effusion are identified. Colour Doppler shows systolic blood flow (arrow) from the intraseptal pseudoaneurysm to the right ventricle. (LV: left ventricle, RV: right ventricle, ISPA: intraseptal pseudoaneurysm, PE: pericardial effusion)

echocardiography revealed a pseudoaneurysm in the ventricular septum ruptured in the pericardial space through the left ventricular free wall in addition to the right ventricle (figure 3). Observation during the operation confirmed the echocardiographic findings (figure 4). After the double patch repair of the septal rupture and modified infarct-exclusion-technique with a bovine pericardial patch, the left ventricular free wall was closed.

Unfortunately, the patient suffered from multiple organ failure in the postoperative course, and passed away on post-operative day 22.

DISCUSSION

Cardiac MRI is commonly used to assess the cardiac condition and provide information on myocardial viability. However, recently, cardiac CT has emerged as another valuable tool for patients with suspected ischaemic disease. Cardiac CT offers better spatial resolution and can convey information on the coronary arteries and the heart by one quick scan at any time. For patients with haemodynamic instability and at potential risk for ischaemia, cardiac CT may therefore be more appropriate. Moreover, it does not affect the cardiac monitoring equipment,

Figure 4 Intraoperative findings. (A) Left ventricular rupture is identified on the inferior part of the heart. (B) After the orifice of the left ventricular rupture was cut open, the inner surface of the intraseptal aneurysm was observed. A small hole from the left ventricle to the intraseptal pseudoaneurysm (top of the suction tube) and a small hole from the intraseptal pseudoaneurysm to the right ventricle (top of the tweezers) are identified.

and is less expensive than MRI. Technological advances in cardiac CT have enabled us to observe the heart precisely. The present case highlighted the significance of cardiac imaging by this modality.

The most frequent combination of ventricular double rupture is VSR followed by FWR. Mann classified double rupture of this type into two forms according to necropsy findings: true and junctional ruptures.³ In the true double rupture, distinct tears are observed in the ventricular septum and the left ventricular free wall, whereas in double rupture of the junctional type, the rupture is located in the junctional area of the left ventricular septum and free wall, as was observed in the present case.

The most probable scenario for the development of a double rupture of this type is that after myocardial infarction, preceding VSR causes left-to-right shunting and increased preload of the left ventricle. Maintained intraventricular pressure subsequently leads to the intraseptal pseudoaneurysm rupturing into the pericardial space through the left ventricular free wall. It has been reported that VSR in the apical region can be considered as a 'precursor' of double rupture.⁴ This scenario is consistent with our clinical experiences of double ruptures, but has never been confirmed by cardiac images until now. The static and dynamic images of the intraseptal pseudoaneurysm by cardiac CT presented here well illustrated this clinical course.

In summary, in the present case, cardiac CT showed an impending double rupture, in which an intraseptal pseudoaneurysm ruptured to the right ventricle before rupturing into the pericardium through the left ventricular free wall. Our findings indicate the significance of enhanced cardiac CT for evaluating ischaemic heart disease, and provide insights into the mechanisms behind and the pathophysiology of, double ruptures.

Learning points

- ▶ Enhanced cardiac CT showed an impending double rupture of junctional-type; the intraseptal pseudoaneurysm ruptured into the right ventricle before rupturing the left ventricular free wall.
- ▶ The static and dynamic images of the intraseptal pseudoaneurysm by two-dimensional (2-D) CT, 3-D CT and 4-D CT were presented.
- ▶ Cardiac CT for evaluating ischaemic heart disease is of great clinical significance.

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Competing interests None.

Patient consent None.

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