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Delayed Ventricular Septal Perforation Following Completed Anterior Myocardial Infarction Complicated by Ventricular Aneurysm and Left Ventricular Thrombus

Masaaki Kobayashi
piko.piko18@gmail.com

Kishiwada Tokushukai Hospital
Satoshi Kuroyanagi
Kishiwada Tokushukai Hospital
Norihiko Hiramatsu
Kishiwada Tokushukai Hospital
Onichi Furuya
Kishiwada Tokushukai Hospital
Akinao Miki
Kishiwada Tokushukai Hospital
Satoshi Oiwa
Kishiwada Tokushukai Hospital
Goki Osita
Kishiwada Tokushukai Hospital

Case Report

Keywords: Ventricular septal perforation, myocardial infarction, ventricular aneurysm, left ventricular thrombus, coronary artery bypass grafting

Posted Date: August 6th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10274171/v1

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Additional Declarations: No competing interests reported.

Abstract

Background

Ventricular septal perforation is a rare but life-threatening mechanical complication of acute myocardial infarction that typically occurs within the first week after infarction. Delayed presentation after completed anterior myocardial infarction is uncommon, particularly in patients with concomitant left ventricular mural thrombus and ventricular aneurysm. We report a rare case of delayed ventricular septal perforation following completed anterior myocardial infarction despite surgical revascularization.

Case presentation

A 58-year-old Japanese man presented with progressive dyspnea and anorexia 9 days after symptom onset. Coronary angiography demonstrated total occlusion of the left anterior descending artery without collateral circulation and severe stenosis of the proximal right coronary artery. Emergency percutaneous coronary intervention under intra-aortic balloon pump support was unsuccessful, and emergency off-pump coronary artery bypass grafting using the left internal thoracic artery to the left anterior descending artery was performed. Intraoperatively, the anterior wall was already aneurysmal, and the left anterior descending artery showed severe fibrosis without distal back bleeding, indicating completed transmural infarction with poor distal runoff. One week after surgery, the bypass graft was found to be occluded, and transthoracic echocardiography revealed a 30 × 12 mm left ventricular mural thrombus within the apical aneurysm. Anticoagulation with heparin followed by warfarin resulted in gradual thrombus resolution. Four weeks after coronary artery bypass grafting, a new systolic murmur developed, and echocardiography demonstrated a 12 × 20 mm anteroapical ventricular septal perforation with a pulmonary-to-systemic flow ratio of 2.4. Semi-urgent surgical repair using a modified Daggett technique with a single Dacron patch was successfully performed. No residual shunt was detected postoperatively, and the patient was discharged in New York Heart Association functional class I.

Conclusions

This case demonstrates that patients with completed anterior myocardial infarction remain at risk for delayed mechanical complications despite surgical revascularization. Careful serial echocardiographic surveillance should be considered in patients with ventricular aneurysm and left ventricular mural thrombus, particularly when new cardiac murmurs develop or thrombus resolution is observed.

Background

Ventricular septal perforation (VSP) is a rare but devastating mechanical complication of acute myocardial infarction (MI). Although its incidence has markedly declined with the widespread use of early reperfusion therapy, VSP remains associated with substantial morbidity and mortality, and surgical repair is still the standard treatment for most patients. Contemporary studies have shown that VSP

typically develops within the first week after MI, most commonly between 3 and 7 days after symptom onset, whereas delayed presentation several weeks after infarction is uncommon.[1–4]

Extensive anterior MI is frequently accompanied by left ventricular (LV) aneurysm formation and LV mural thrombus because of severe regional wall-motion abnormalities. Current guidelines recommend anticoagulation therapy for LV thrombus to reduce the risk of systemic embolization.[5,6] However, the relationship between LV mural thrombus and delayed diagnosis of VSP has rarely been discussed. We report a rare case of delayed VSP after completed anterior MI complicated by ventricular aneurysm and LV mural thrombus. The patient underwent successful surgical repair using a modified Daggett technique, and this case highlights the importance of serial echocardiographic surveillance in patients with extensive anterior MI despite surgical revascularization.

Case presentation

A 58-year-old man presented to a local hospital with progressive dyspnea and anorexia that had persisted for approximately 9 days. Emergency coronary angiography revealed total occlusion of the left anterior descending artery (LAD) without collateral circulation (Fig. 1A) and severe stenosis (90%) of the proximal right coronary artery (segment 2) (Fig. 1B). Percutaneous coronary intervention (PCI) of the LAD was attempted under intra-aortic balloon pump support but was unsuccessful. The patient was referred to our institution for emergency surgical revascularization.

On admission, transthoracic echocardiography demonstrated extensive akinesis of the anterior and apical left ventricular (LV) walls with an LV ejection fraction (LVEF) of 38%. Although the angiographic findings suggested completed anterior myocardial infarction (MI), myocardial viability could not be completely excluded because of the relatively short interval from symptom onset. Therefore, emergency off-pump coronary artery bypass grafting (OPCAB) was performed using the left internal thoracic artery (LITA) to the LAD.

Intraoperatively, the anterior wall and apex were markedly thinned and aneurysmal, indicating extensive transmural infarction. Arteriotomy of the LAD demonstrated severe intimal fibrosis without distal back bleeding, suggesting extremely poor distal runoff despite technically feasible graft anastomosis. Nevertheless, LITA-LAD bypass grafting was completed in anticipation of preserving any potentially viable myocardium.

One week after surgery, follow-up coronary computed tomography demonstrated occlusion of the LITA-LAD graft. Transthoracic echocardiography revealed a 30 × 12 mm mural thrombus within the apical ventricular aneurysm (Fig. 2A, B). Intravenous unfractionated heparin was initiated and subsequently transitioned to warfarin. Serial echocardiography demonstrated gradual reduction of the thrombus without evidence of ventricular septal perforation (VSP).

Four weeks after OPCAB, a newly developed harsh systolic murmur was detected during routine physical examination. Repeat transthoracic echocardiography demonstrated a 12 × 20 mm VSP located in the

anteroapical septum with a significant left-to-right shunt (Qp/Qs, 2.4) (Fig. 3A, B, C). The LV mural thrombus had almost completely resolved, and LVEF had decreased to 24%. Although the patient remained hemodynamically stable without cardiogenic shock, the magnitude of the shunt prompted semi-urgent surgical intervention.

Following median resternotomy, cardiopulmonary bypass was established with ascending aortic and bicaval cannulation. After aortic cross-clamping, cardiac arrest was achieved using antegrade cold blood cardioplegia. Left ventriculotomy through the infarcted anterior wall exposed a 12 × 20 mm perforation in the anteroapical septum (Fig. 4). The septal defect was repaired using a modified Daggett technique with a single Dacron patch. Cardiopulmonary bypass and aortic cross-clamp times were 177 and 62 minutes, respectively.

The postoperative course was uneventful. Follow-up transthoracic echocardiography demonstrated complete closure of the septal defect without residual shunting (Fig. 5A, B). The patient was discharged 10 days after surgery in New York Heart Association functional class I. LVEF at discharge was 20%.

Discussion

Ventricular septal perforation (VSP) remains one of the most catastrophic mechanical complications of acute myocardial infarction (MI). Although the incidence has markedly declined in the era of primary reperfusion therapy, VSP continues to be associated with high mortality because of extensive myocardial necrosis and subsequent heart failure. Contemporary studies have shown that VSP most commonly develops within 3–7 days after MI, whereas diagnosis beyond several weeks is uncommon. Surgical repair remains the standard treatment despite advances in perioperative management and mechanical circulatory support.[1–4]

Several findings suggested that our patient had already developed completed anterior transmural infarction at the time of referral. Coronary angiography demonstrated total occlusion of the left anterior descending artery (LAD) without collateral circulation, and emergency PCI was unsuccessful. Intraoperatively, the anterior wall was already aneurysmal, and arteriotomy of the LAD demonstrated severe fibrosis without distal back bleeding, indicating extremely poor distal runoff. Despite these findings, surgical revascularization was performed because residual myocardial viability could not be completely excluded based on the clinical presentation. However, early postoperative occlusion of the LITA-LAD graft suggested that irreversible myocardial injury and advanced ventricular remodeling had already occurred. This sequence illustrates the limited efficacy of surgical revascularization once extensive transmural infarction has become established.

Large anterior MI is strongly associated with ventricular aneurysm formation and LV mural thrombus because of severe regional wall-motion abnormalities and blood stasis. Current guidelines recommend systemic anticoagulation for LV thrombus to reduce the risk of systemic embolization.[5,6] In the present case, anticoagulation with heparin followed by warfarin resulted in gradual resolution of a 30 × 12 mm mural thrombus. Subsequently, a 12 × 20 mm VSP in the anteroapical septum became evident. Whether

the septal defect developed during follow-up or had already been present but remained undetected cannot be determined. Nevertheless, the temporal relationship between thrombus resolution and VSP detection raises the possibility that the mural thrombus obscured the septal defect during the early postoperative period. To our knowledge, this mechanism has rarely been discussed in the literature. Importantly, we do not suggest that anticoagulation induced septal rupture; rather, thrombus resolution may have facilitated recognition of a previously occult defect.

Although the patient remained hemodynamically stable, the substantial left-to-right shunt (Qp/Qs 2.4) justified surgical intervention because of the risk of progressive heart failure. At the time of operation, the infarcted septum had become sufficiently fibrotic to permit secure patch fixation. Repair using a modified Daggett technique with a single Dacron patch achieved complete closure without residual shunting. Previous studies have demonstrated that delayed repair may improve operative conditions in carefully selected hemodynamically stable patients by allowing maturation of infarcted tissue, whereas urgent intervention remains mandatory in patients with cardiogenic shock.[1,2,4,7,8]

This case highlights two important clinical lessons. First, patients with completed anterior MI remain at risk for delayed mechanical complications despite successful initial stabilization and surgical revascularization. Second, serial echocardiographic surveillance should be considered in patients with ventricular aneurysm and LV mural thrombus, particularly during thrombus resolution or when a new systolic murmur develops. Careful follow-up may facilitate early recognition of delayed mechanical complications and timely surgical intervention.

Conclusion

Delayed ventricular septal perforation may occur even after surgical revascularization in patients with completed anterior myocardial infarction complicated by ventricular aneurysm and left ventricular mural thrombus. Serial echocardiographic follow-up is essential for the early detection of delayed mechanical complications, particularly when new cardiac murmurs develop or ventricular thrombus resolves.

Declarations

Ethics approval and consent to participate

According to the institutional policy of our hospital, ethical review and approval were waived for this single-patient case report. Written informed consent for publication of this case report and the accompanying images was obtained from the patient.

Clinical Trial Number

Clinical trial number: not applicable.

Consent for publication

Written informed consent for publication of this case report and accompanying images was obtained from the patient.

Funding

The authors received no specific funding for this work.

Conflicts of interest/Competing interests

The authors declare that they have no competing interests.

Date Availability Statement

All relevant data are within the manuscript and its Supporting Information files.

Authors' contributions

MK performed the surgery, conceived the study, performed the literature review, and drafted the manuscript. SK and OF critically revised the manuscript. NH and AM interpreted the echocardiographic findings and revised the manuscript. SO and GO collected the clinical data. All authors read and approved the final manuscript.

Acknowledgements

Not applicable

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Figures

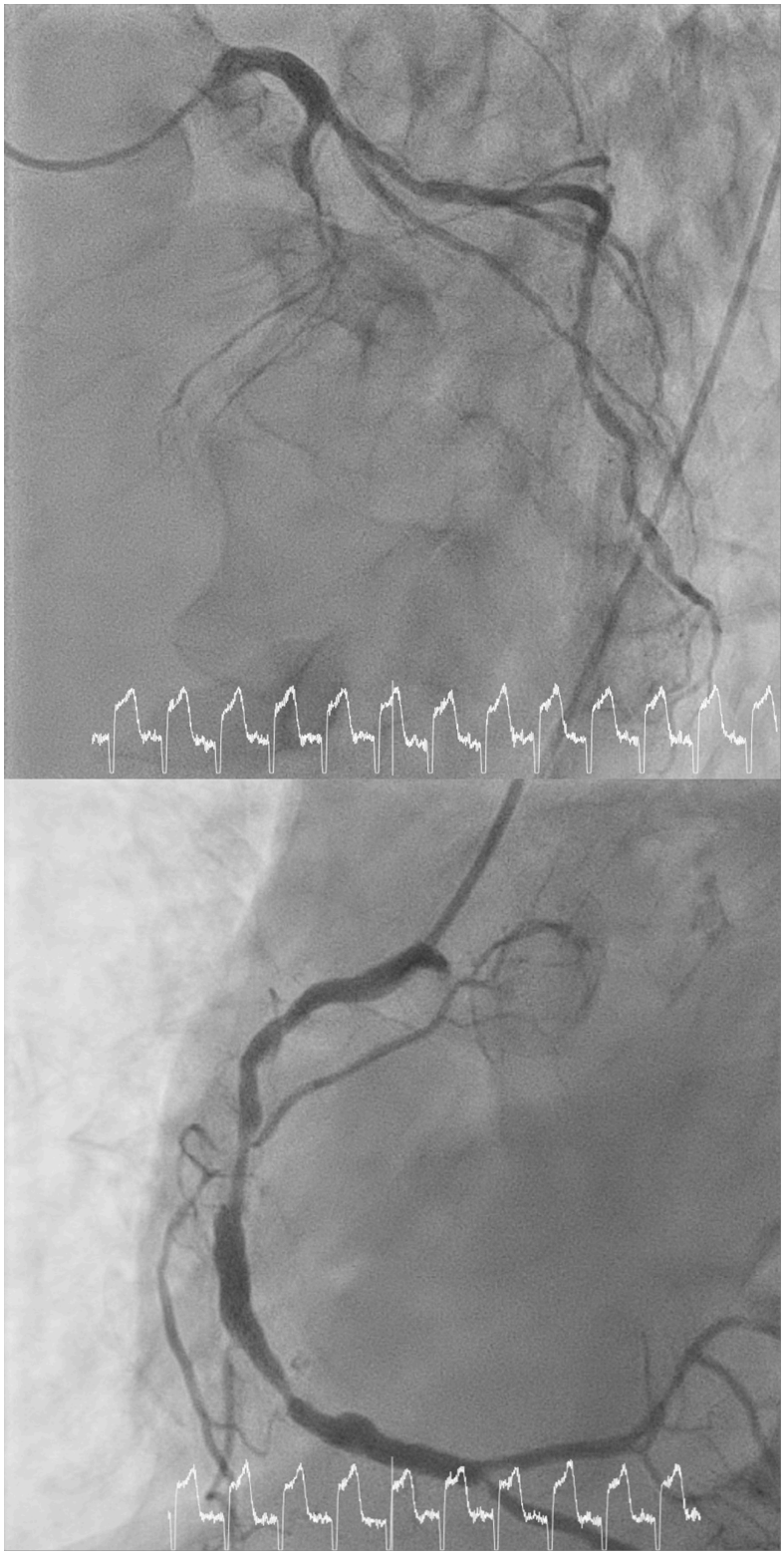


Figure 1

preoperative CAG

A; LAD, B; RCA

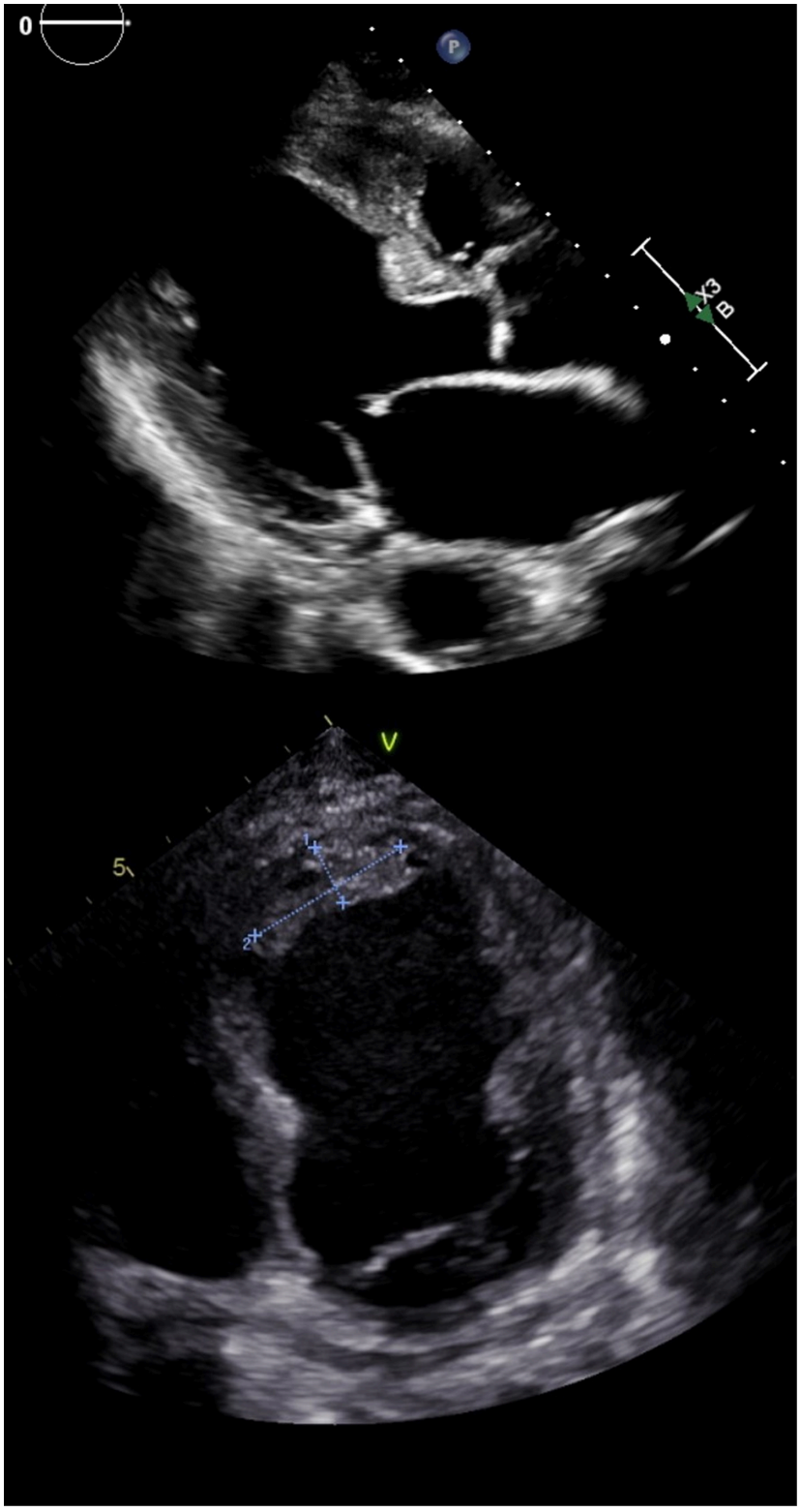


Figure 2

mural thrombus

A, B; TTE

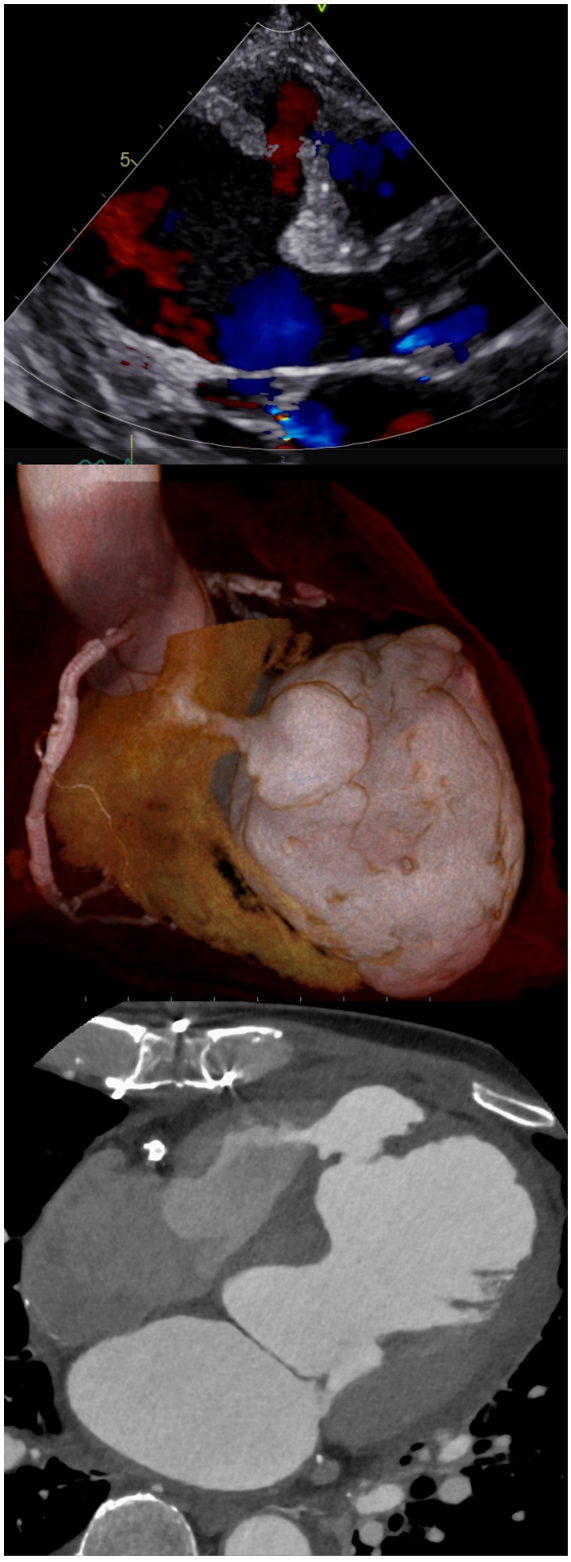


Figure 3

VSP

A; preoperative TTE, B, C; preoperative CT

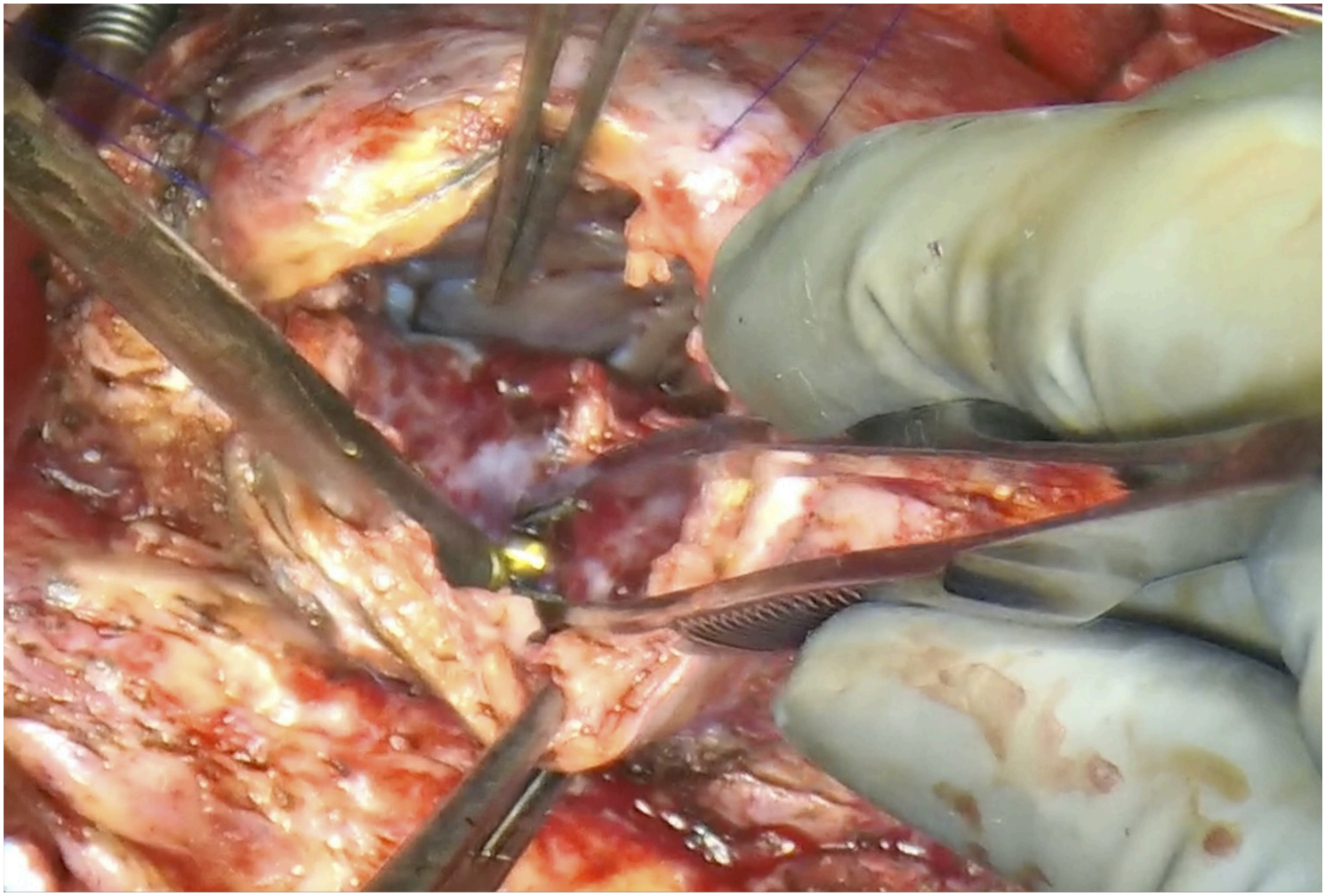


Figure 4

intraoperative photo

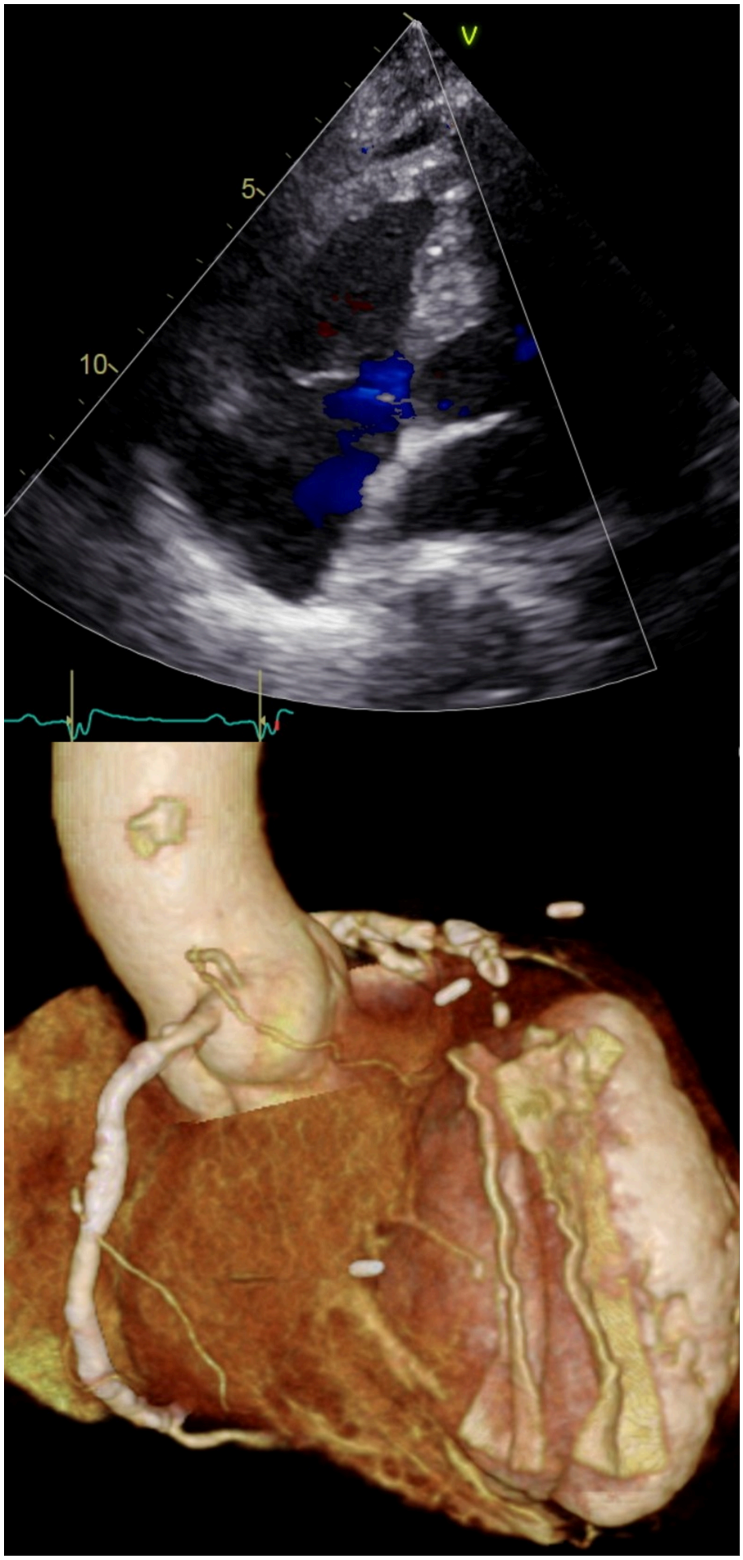


Figure 5

postoperative findings

A; postoperative TTE, B; postoperative CT