Delayed patch repair of a ruptured mitral subvalvular pseudoaneurysm caused by infective endocarditis: a case report

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Background
Ruptured subvalvular pseudoaneurysm is a rare but significantly fatal complication of infective endocarditis. We report a successful surgical case of ruptured subvalvular pseudoaneurysm with infective endocarditis.

Case summary
A 46-year-old man presenting with high fever was admitted to a local hospital. Physical examination revealed small erythema and petechiae on his lower limbs. Transthoracic echocardiogram did not show any visible vegetation and valvular disease; however, magnetic resonance imaging (MRI) showed multiple acute cerebral infarctions, and methicillin-susceptible Staphylococcus aureus was detected in the blood culture. Infective endocarditis was suspected, and an antibacterial medication was initiated. Twelve days later, he suffered from a sudden cardiogenic shock due to cardiac tamponade. Bloody pericardial effusion (1600 mL) was drained, and his condition improved substantially. Transoesophageal echocardiography after pericardial drainage revealed severe mitral regurgitation and a subvalvular aneurysm at the posteromedial side of the mitral annulus; these were not detected at the time of admission. He was transferred to our hospital for surgery; however, since fresh cerebral bleeding was observed in MRI, the surgery was delayed. Three weeks later, after confirming that the blood culture was negative for any growth, patch repair of the subvalvular pseudoaneurysm and mitral valve repair were performed. Post-operatively, no complication or arrhythmia was observed; he was discharged 25 days later.

Discussion
We report a rare case of successful delayed surgery for a ruptured subvalvular pseudoaneurysm at the posteromedial side of the mitral annulus, which presented complications for infective endocarditis by S. aureus.

Keywords
Infective endocarditis • Subvalvular pseudoaneurysm • Cardiac tamponade • Mitral regurgitation • Ruptured subvalvular pseudoaneurysm • Case report

Learning points
• Subvalvular pseudoaneurysm at the posteromedial side of the mitral annulus is rarely caused by infective endocarditis.
• A subvalvular pseudoaneurysm can be detected more accurately by transoesophageal echocardiography or contrast-enhanced computed tomography than by transthoracic echocardiography.
• The possibility of a surgical patch closure after controlling the bacterial infection can be considered for treating a ruptured subvalvular pseudoaneurysm.

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Introduction

Subvalvular pseudoaneurysm at the posteromedial side of the mitral annulus is rarely observed as a complication along with infective endocarditis. However, since the pseudoaneurysm has the risk of presenting complications due to rupture, emergency surgery is generally recommended for the pseudoaneurysm. In this report, we present a successful case of delayed surgery for a ruptured subvalvular pseudoaneurysm after controlling the bacterial infection.

Timeline

| Date       | Event Description                                                                 |
|------------|-----------------------------------------------------------------------------------|
| 6/6/2019   | The patient was diagnosed with infective endocarditis. The antibacterial medication was initiated. |
| 6/18/2019  | Cardiac tamponade occurred suddenly. Bloody pericardial effusion (1600 mL) was drained using pericardiocentesis. |
| 8/15/2019  | The patient was transferred to our hospital. Ruptured subvalvular pseudoaneurysm and perforation of the mitral valve with severe mitral regurgitation (MR) were revealed; these were not detected on admission. |
| 8/18/2019  | Cerebral bleeding was observed and the surgery was postponed for 3 weeks. |
| 9/9/2019   | A patch repair and mitral annuloplasty were performed. |
| 10/2/2019  | The post-operative echocardiography and computed tomography revealed a closed pseudoaneurysm and the disappearance of MR. |
| 10/4/2019  | The patient was discharged. |

Case presentation

A 46-year-old man with no previous history of cardiac diseases was admitted to a local hospital with high fever. On physical examination, small erythema and petechiae were observed on his limbs. Laboratory tests revealed elevated C-reactive protein (CRP) (30.59 mg/dL) and leucocyte count (11 940/µL) indicating an inflammatory reaction. Other general and systemic findings were unremarkable. Transthoracic echocardiography (TTE) showed no valvular disease; vegetation and abscesses were not observed. However, multiple acute cerebral infarctions were seen in magnetic resonance imaging (MRI), and blood cultures showed growth of methicillin-susceptible Staphylococcus aureus. Infective endocarditis was suspected, and antibacterial medications were initiated for the patient. After 12 days, a sudden drop in blood pressure was observed. Echocardiography showed massive pericardial effusion indicating cardiac tamponade. Pericardiocentesis was performed, and 1600 mL of bloody pericardial effusion was drained over a period of 2 days. A transoesophageal echocardiogram (TOE) showed severe mitral regurgitation (MR) and a subvalvular aneurysm. Thus, the rupture of the subvalvular pseudoaneurysm caused the cardiac tamponade. After his condition stabilized, he was transferred to our hospital for surgical treatment. Upon admission to our hospital, laboratory tests revealed a well-controlled inflammatory condition with a CRP value of 0.14 mg/dL and a leucocyte count of 3900/µL. Transoesophageal echocardiogram showed the pseudoaneurysm located at the posteromedial side of the mitral annulus; significant MR was seen through the pseudoaneurysm (Figure 1). Contrast-enhanced computed tomography (CT) revealed that the ostium of the mitral subvalvular pseudoaneurysm was located on the ventricular septum below the mitral valve. It was connected with the left atrium through the perforation site of the mitral leaflet and extended from the interatrial septum to the posterior left ventricular wall just under the right coronary artery (Figure 2). However, fresh multiple microbleeds were seen on the MRI due to which the surgery was delayed by 3 weeks from the day when the microbleeds were detected (Figure 3). Consequently, because antibacterial therapy was continued, bacteria were not observed in the blood culture before the operation.

A patch repair of the subvalvular pseudoaneurysm and mitral valve repair were performed using a median full sternotomy. Dense adhesions were observed in the pericardial cavity; however, the adhesions around the pseudoaneurysm were not peeled off because of the risk of re-rupture of the pseudoaneurysm. Under standard cardiopulmonary bypass, the mitral valve was exposed through the transseptal approach. The perforation of the mitral valve was seen at the posterior commissure, while the rest of the mitral valve leaflet and annulus were intact (Figure 4A). The anterior mitral leaflet was temporarily detached from the annulus itself, about 2 cm around the perforation site, and the ostium of the pseudoaneurysm was clearly visible below the mitral valve (Figure 4B). No vegetation was observed around the pseudoaneurysm; hence, the complicated debridement of the infected tissues was not required. A 1 cm × 1 cm bovine pericardium patch was sutured to close the ostium of the pseudoaneurysm using interrupted and continuous sutures (Figure 4C). After the incision of the anterior leaflet was reconstructed, mitral annuloplasty was performed using CG Future band 30 mm (Medtronic, Minneapolis, MN, USA).

In the post-operative TOE and CT scan, the regurgitation disappeared and there was no blood inflow to the pseudoaneurysm (Figure 5). He was discharged 25 days post-surgery without any complications. Six months after the surgery, he was well, and no regurgitation was seen on the follow-up echocardiography.

Discussion

In the present case, two important clinical issues were noted. Firstly, this was a rare case of infective endocarditis complicated by subvalvular pseudoaneurysm that arose from the posteroomedial side of the mitral annulus. The most important risk factors for perivalvular complications were the prosthetic valve, aortic valve, and infection with coagulase-negative staphylococci. Most commonly, perivalvular extension develops in the mitral-aortic intervalvular fibrosa with aortic infective endocarditis. A case of pseudoaneurysm formation with native mitral valve endocarditis is unusual, and as a result, it is difficult to diagnose correctly. Previous reports have indicated that TTE
cannot detect pseudoaneurysm accurately (sensitivity of TTE is <50%). In fact, in this case, primary TTE could not even detect the perivalvular extension, and this may have led to the delay in the diagnosis of the pseudoaneurysm. However, TOE and CT scans are useful in the diagnosis of perivalvular extension. A previous study has reported that the diagnostic sensitivity of TOE is 90%. In this case, we could detect the pseudoaneurysm correctly by TOE and obtain anatomical information with CT scans. Therefore, we suggest routine use of TOE or CT scans for the detection of subvalvular pseudoaneurysm even if vegetation, abscess, and perivalvular complications are not observed in TTE.

Secondly, this is a very rare case of survival that involved delayed surgery for cardiac rupture. In previous studies, patients of cardiac rupture with infective endocarditis had to undergo urgent surgery because the cardiac rupture would have been fatal without surgery. However, in our case, the patient’s condition was stabilized by medical treatment without surgery in the acute phase. Moreover, we had to postpone the surgery because cerebral microbleeds (multiple hypointense areas with diameter <10 mm) were detected on MRI T2*-weighted image. While, it is controversial whether the surgery should be delayed in case of infective endocarditis complicated with asymptomatic microbleeds, we postponed the surgery to prevent post-operative cerebral complications. Although we were concerned that a re-rupture of the pseudoaneurysm may occur during the medical treatment, the severe adhesions in the pericardium after tamponade may have helped in preventing the re-rupture. Consequently, after confirming negative blood culture, we could perform the surgery. The delayed surgery may have proved beneficial in preventing the sutures from cutting the fragile tissue. Moreover, due to the controlled infection, debridement around the ostium of the pseudoaneurysm and complicated surgical ventricular restoration to exclude the entire pseudoaneurysm were not required. Thus, delayed surgery has some advantages in cases of ruptured subvalvular pseudoaneurysm with infective endocarditis. However, follow-up after discharge is important because the pseudoaneurysm has not completely resolved.
Figure 2  Contrast-enhanced computed tomography. (A, B) The mitral subvalvular pseudoaneurysm (yellow arrow) and the perforated mitral valve (red arrow) is seen. The pseudoaneurysm was enhanced by the contrast agent and shows communication with the left ventricle and the atrium. *Left atrium; **Left ventricle; ***Subvalvular pseudoaneurysm. (C, D) Lateral and anteroposterior view by three-dimensional imaging. The mitral subvalvular pseudoaneurysm extends from the interatrial septum to the posterior left ventricle wall just under the right coronary artery (blue arrow).

Figure 3  Multiple microbleeds in cerebral infraction detected on magnetic resonance imaging of the head (yellow arrow). (A, B) FLAIR image. (C, D) T2*-weighted image.
To conclude, even if the surgical treatment for a cardiac rupture with subvalvular pseudoaneurysm has to be postponed for any reason, the possibility of delayed surgery can still be considered.

**Lead author biography**

Dr. Yu Hohri graduated from the Kyoto Prefectural University of Medicine, Japan, in March 2014. From April 2014 to 2016, he was a resident at the Kyoto Daini Red Cross Hospital, Japan. From 2016 to 2019, he was a fellow of cardiovascular surgery at the Kyoto Daini Red Cross Hospital, Japan. Since 2019, he has been a fellow of cardiovascular surgery at the Kyoto Prefectural University of Medicine.

**Patient perspective**

The patient was very satisfied with our treatment but was worried about the recurrence of infective endocarditis and mitral regurgitation in future.

**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 image(s) and associated text has been obtained from the patient in line with COPE guidance.
Conflict of interest: none declared.

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Figure 5 Postoperative contrast-enhanced computed tomography. Contrast-enhanced computed tomography shows that the pseudoaneurysm has not enhanced (yellow arrow) and the perforation site of the mitral valve is closed (red arrow).