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Case Report

A case of acute purulent pericarditis due to MRSA treated with daily pericardial lavage for one month followed by pericardial fenestration

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ABSTRACT

Acute purulent pericarditis is a rare infection in developed countries. We herein report a case with diabetic nephropathy under maintenance hemodialysis who suffered from acute purulent pericarditis caused by methicillin-resistant *Staphylococcus aureus* (MRSA). The treatment of purulent pericarditis mainly involves rapid administration of appropriate antibiotics and drainage. However, in this case, the patient was unresponsive to vancomycin and performing early surgical intervention was challenging due to highly pathogenic MRSA. Therefore, we performed pericardial fenestration in the chronic phase to suppress the risk of fatal secondary infections after daily irrigation for one month to reduce bacterial load mechanically.

Learning objective: In a case of purulent pericarditis caused by highly pathogenic methicillin-resistant *Staphylococcus aureus* resistant to antibiotics and resulting in constrictive pericarditis, it was possible to perform pericardial fenestration in the chronic phase, while mitigating the risk of fatal secondary infections, by controlling the inflammation through daily irrigation for a long time to reduce the bacterial load mechanically.

Introduction

Acute purulent pericarditis is a rare infection in developed countries, accounting for less than 5 % of cases of acute pericarditis, and the majority of cases are attributed to tuberculosis. Other causes, such as infections caused by *Streptococcus pneumoniae*, *Staphylococcus aureus*, or *Streptococcus pyogenes* that spread after pneumonia, pleurisy, surgery, or trauma, are rare [1]. Treatment for purulent pericarditis typically involves appropriate antibiotic therapy and surgical pericardial drainage.

Here we report a case in which the control of refractory inflammation was achieved through daily pericardial lavage for one month.

Case report

The patient was a 54-year-old male with diabetic nephropathy who was undergoing maintenance dialysis and being treated for hypertension and dyslipidemia. He had undergone five percutaneous coronary interventions (PCIs) due to recurrent stent restenosis after old myocardial infarction. This time, PCI was successfully performed for chronic total occlusion of the left anterior descending artery #7–8, and he was discharged without complications. Thereafter, maintenance hemodialysis was performed in another outpatient clinic. On the 7th day after the PCI, he developed a fever of 40 °C and chest pain, and was admitted to the hospital for examination and treatment purposes. Physical examination of the patient at admission revealed pulse 116 beats/min and blood pressure 94/54 mmHg. A routine blood test revealed a total white blood cell count of 28,900/μL (81.0 % neutrophils), a hemoglobin concentration of 17.0 g/dL, and a blood platelet count of 179,000/μL. Biochemical examination showed normal liver enzyme and electrolytes. The C-reactive protein (CRP) level was 33.87 mg/dL. Procalcitonin level was 32.5 ng/mL. An electrocardiogram showed ST-segment elevation in leads aV_F, V4–6 compared to a previous recording. Echocardiography confirmed the new pericardial effusion behind the left ventricle. Since pericardial effusion related to bacterial infection was observed, suggesting the possibility of bacterial pericarditis, we decided to empirically choose broad-spectrum antibiotics for severe infection of unknown etiology. The patient was given meropenem on the 1st day of hospitalization and vancomycin on the 3rd day of hospitalization. Additionally, we initiated the administration of aspirin while monitoring to achieve a target blood concentration of approximately 100-250 μg/mL on the 5th day of hospitalization. However,

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there was no improvement and on the 7th day of hospitalization, the patient exhibited hypotension and right ventricular collapse due to increased pericardial effusion as seen on echocardiography and chest X-ray (Fig. 1), and was cardiac tamponade was diagnosed. After performing pericardial drainage by 6-French drainage tube, 550 mL of purulent dark brown fluid was discharged. Methicillin-resistant *S. aureus* (MRSA) was detected in this culture, and we diagnosed acute purulent pericarditis caused by MRSA. Although the patient's hemodynamics improved, there was no improvement in fever or inflammatory response despite the MRSA culture showing good susceptibility to vancomycin, and no fluid was obtained from the drain. We consulted with the cardiovascular surgery department about surgical pericardial fenestration. However, there was high likelihood of developing mediastinitis after the surgery because it was a purulent pericarditis caused by highly pathogenic MRSA. Therefore, the patient underwent pericardial lavage through drainage tube to reduce bacterial count. After we changed the 6-French drainage tube to 8-French drainage tube, we conducted pericardial lavage in which 100–150 mL of normal saline was injected into the pericardial cavity, followed by drainage with 500 mL of normal saline per session, once daily. After we conducted it from the 10th day to the 40th day of hospitalization, his fever and inflammatory response improved. It was confirmed that MRSA was no longer detected in the pericardial wash fluid culture, and the drain tube was removed on the 43rd day of hospitalization. At this point, CRP level was 4.1 mg/dL, and the administration of vancomycin was discontinued on the 53rd day of hospitalization. However, as CRP level gradually increased, the administration of vancomycin was resumed on the 60th day of hospitalization. Subsequently, conservative treatment was continued, but laboratory data revealed a mild inflammatory response with CRP levels of approximately 7–10 mg/dL. Chest computed tomography showed a small amount of pericardial effusion and mass remained behind the left ventricle (Fig. 2), and the systolic blood pressure remained at around 90 mmHg, suggesting constrictive pericarditis with chronic inflammation. Therefore, we made decision that pericardiostomy was performed on the 66th day of hospitalization via a left thoracic approach in consultation with the departments of cardiovascular surgery and respiratory surgery. Large numbers of inflammatory cells (mainly neutrophils) were observed in the wash solution during the surgery, and mild inflammatory cells and mucinous fibrosis were observed in the pericardial histological tissue.

The administration of vancomycin was continued even after surgery, and gradual improvement in inflammation and systolic blood pressure was observed, with the latter reaching approximately 110 mmHg. The drain was removed on the fifth postoperative day, and vancomycin was discontinued on the 14th postoperative day. Subsequently, respiratory exacerbation due to pneumonia and hemorrhagic shock due to rectal ulcer were observed, but finally, a decrease in inflammation was confirmed with a CRP level of 1.0 mg/dL. The pericardial effusion and mass resolved without re-accumulation, and the patient was transferred to another hospital for rehabilitation on the 125th day after admission.

Discussion

Purulent pericarditis has been associated with various routes of infection, such as open wounds due to thoracic incisions or contaminated surgical fields, infectious endocarditis, pneumonia or spread of infection from subphrenic regions, and hematogenous dissemination from remote sites [2]. As a result, it has become a relatively rare disease in advanced countries where antibiotics are widely available [3–5]. On the other hand, it is known to follow an acute fatal course such as cardiac tamponade, sepsis, and heart failure due to constrictive pericarditis caused by adhesions in the pericardial sac, and the prognosis is poor with an untreated mortality rate of 85 % and a treated mortality rate of 40 % [6]. The causative pathogens include streptococci, pneumococci, and staphylococci, as well as opportunistic infections caused by Gram-negative bacilli in immunocompromised patients [3–5]. In this case, the patient involved had a long history of diabetes and maintenance hemodialysis, and was susceptible to various bloodstream infections due to repeated PCI, shunt puncture, and skin itching caused by uremic symptoms. Although it was difficult to identify the route of infection, purulent pericardial fluid was clearly present, and MRSA was detected in the pericardial fluid, which was accompanied by septic shock and cardiac tamponade. The treatment of purulent pericarditis mainly involves rapid administration of appropriate antibiotics and drainage. However, in this case, the patient was unresponsive to vancomycin, which could be effective against the infection, and significant improvement in inflammation was not observed even after drainage. Although early surgical intervention was considered, it was highly likely that the situation would become life-threatening and difficult to save if highly pathogenic MRSA spread to the mediastinum while in a state of septic shock. Therefore, daily washing of the pericardial cavity with normal saline was performed via a pericardial drain for one month. As a result, the peak of inflammation was overcome, and some degree of infection control was achieved. A method involving continuous perfusion and washing using two drainage tubes has been reported [7]. However, in this case, a simpler approach was adopted. Continuous perfusion was not performed, and a one-time cleansing with 500 mL of normal saline using only one drainage tube was conducted daily. Purulent pericarditis has two aspects; as a chronic inflammatory disease caused by abscesses from the subacute to chronic phase, and as a disease that affects the hemodynamics leading to constrictive pericarditis. Although pericardial window surgery and intrapericardial thrombolysis have been reported to be effective in resolving these aspects [6,8,9], there is no consensus on the treatment. This case was a maintenance dialysis patient taking dual antiplatelet

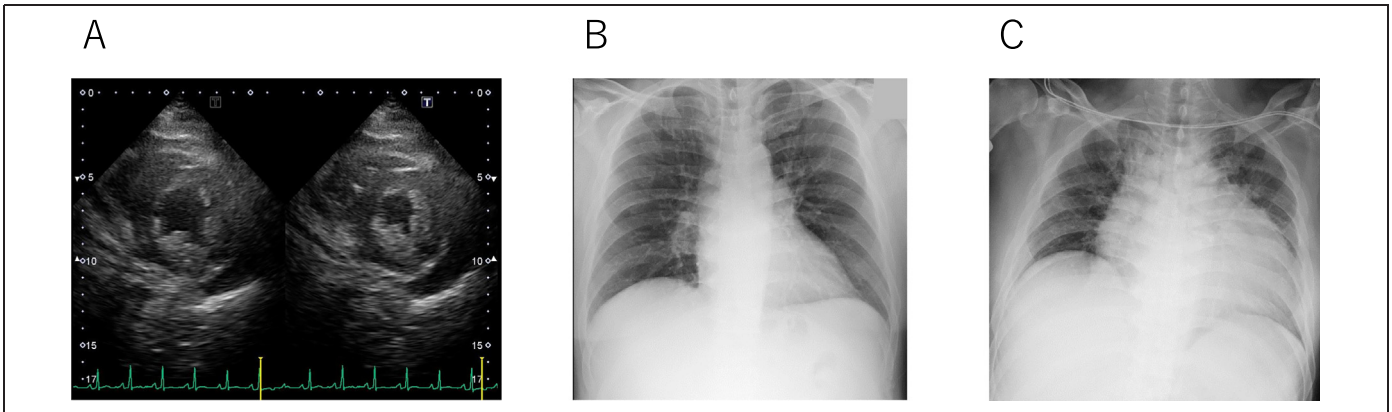

Fig. 1. Echocardiogram (**A**) and chest X-ray (**B**) at admission, and chest X-ray (**C**) at the 7th day. Parasternal short-axis transthoracic echocardiogram displayed new pericardial effusion behind the left ventricle. Chest X-ray showed an enlargement of cardio-thoracic ratio, which suggested an increase in pericardial effusion.

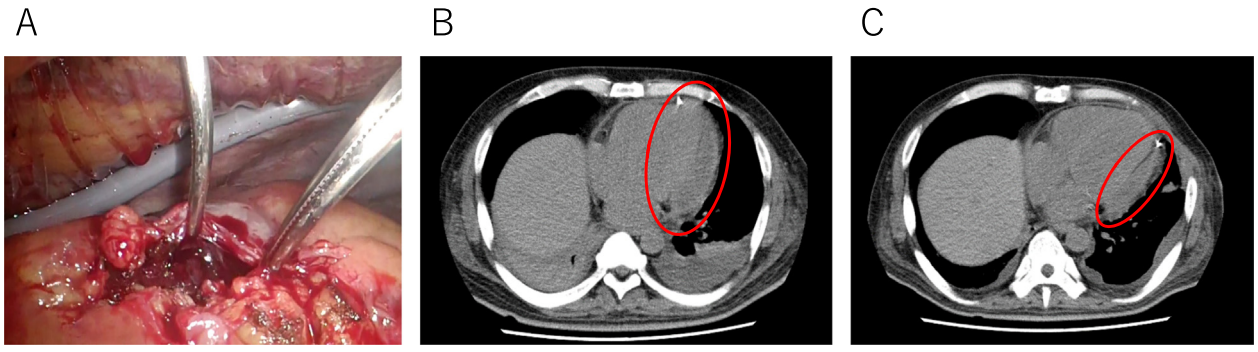

Fig. 2. Surgical pericardial fenestration (**A**), chest computed tomography before (**B**) and after (**C**) surgery. Chest computed tomography showed a small amount of pericardial effusion and mass remained behind the left ventricle. At the surgery, we observed a thickened pericardium and performed an incision up to the anterior edge of the tumor on the posterior wall of the left ventricle via a left thoracic approach. The pericardial effusion and mass resolved without reaccumulation on the 41st day after pericardial fenestration.

therapy and was at high risk of bleeding. Therefore, intrapericardial thrombolysis was not chosen as a method for eradicating chronic inflammation and resolving dilatation failure, and pericardial fenestration was selected instead. Furthermore, since the causative organism was highly pathogenic MRSA, and there was a risk of mediastinitis caused by MRSA, a small incision under the sternum was not chosen, and an approach through the left thoracic cavity was chosen. As a result, the inflammation improved, and the hemodynamics were stabilized.

In a case of refractory purulent pericarditis that was unresponsive to antibiotics and drainage, the patient was saved by controlling the inflammation through daily irrigation for one month to reduce bacterial load mechanically, followed by pericardial fenestration in the chronic phase to suppress the risk of fatal secondary infections.

Consent statement

Written informed consent was obtained from the patient.

Declaration of competing interest

The authors declare that there is no conflict of interest.

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