Abstract

A diabetic patient was admitted to our hospital for infective endocarditis with acute purulent pericarditis and diabetic ketoacidosis. Echocardiography revealed attachment of vegetation to the chordae tendineae in the left ventricle and pericardial effusion. The vegetation was enlarged and pendulated for a few days despite maximal antimicrobial therapy. Surgical resection was desirable to decrease the risk of embolic complications and cardiovascular collapse. We could not open the heart because of accumulation of purulent pericardial fluid, and right renal infarction was complicated. We believe that the immunocompromised and hypercoagulable state due to diabetes caused these conditions.

Key words: immunocompromised state, diabetic ketoacidosis, operation, percutaneous pericardiocentesis

Introduction

Infective endocarditis is a disease with a very varied clinical picture (1). Spread of infection to the pericardium from the infective endocardium is uncommon. Attachment of vegetation to the chordae tendineae is also not common. Here, we present an interesting case that focuses on the clinical aspects of infective endocarditis with acute purulent pericarditis and hyperglycemia.

Case Report

On November 27, 2002, a 43-year-old unconscious man was admitted to our hospital with an elevated fever. Several days prior to admission, he had general fatigue. His past medical history included diabetes mellitus at the age of 30 and symptomatic diabetic neuropathy at the age of 40. He was treated with insulin since the age of 41. Five months before this admission, he discontinued regular outpatient treatment.

His temperature was 39.3°C, pulse was 110 beats/min, and blood pressure was 90/56 mmHg. The physical findings on admission included dilated neck veins and multiple bilateral plantar ulcers that were 2–4 cm in diameter. No heart murmurs, crackles or rubs were audible over his chest. Neurologic examination revealed no abnormalities except for the loss of tendon reflexes. The bilateral dorsalis pedis arteries were slightly palpable. All residual teeth were decayed, and fistulae were found in the oral cavity. Laboratory data showed elevated inflammatory reactions [white blood cell count (WBC), 37,300/μl (neutrophils, 94%); C-reactive protein (CRP), 34.5 mg/dl]. Other laboratory values included the following: serum urea nitrogen (BUN), 41.7 mg/dl; serum creatinine (Cre), 0.96 mg/dl; sodium, 132 mEq/l; potassium, 5.4 mEq/l; chloride, 86 mEq/l; aspartate aminotransferase, 25 IU/l; alanine aminotransferase, 15 IU/l; lactate dehydrogenase (LDH), 375 IU/l; creatine kinase, 100 IU/l; total protein, 5.8 g/dl; albumin, 2.4 g/dl; plasma glucose, 642 mg/dl; glycosylated hemoglobin, 14.6%. His urine showed the following: protein, –; glucose, 4+; ketones, 4+. Arterial blood gas while breathing room air showed the following: pH, 7.21; PCO₂, 29.7 mmHg; PO₂, 102.8 mmHg; base excess, –11.1 mmol/l; HCO₃⁻, 14.1 mmol/l. Chest X-ray disclosed cardiomegaly. Electrocardiogram on admission showed ST elevation in leads I, II, III, V₅, V₆ (Fig. 1). Transthoracic echocardiography revealed attachment of a vegetation (12×10 mm) to the chordae tendineae in the left ventricle, dilated inferior vena cava, and a small amount of pericardial effusion (Fig. 2). No evidence of valvular disease was detected. Transesophageal echocardiography revealed no myocardial...
abscess or periannular abscess, corresponding to the abnormality in transthoracic echocardiography. \( \beta \) hemolytic streptococcus C species and \textit{Staphylococcus aureus} were isolated from two separate blood cultures and multiple plantar ulcers.

The arterial blood gas, urinalysis and plasma glucose findings indicated the presence of diabetic ketoacidosis. Isotonic intravenous fluids (7,000 ml) and intravenous regular insulin (110 U) were administered as an initial therapy over a 24-hour period. The glucose level decreased to approximately 200 mg/dl on the second hospital day. Arterial blood gas was pH 7.37, and had a base excess of -0.2 mmol/l. The findings on physical examination, transthoracic echocardiography and electrocardiogram led to a diagnosis of infective endocarditis and acute pericarditis. Intravenous administration of ampicillin (ABPC) 8.0 g/day, panipenem betamipron 2.0 g/day, clindamycin 2.4 g/day and immune globulin 2.5 g/day was initiated. Since enlargement of the vegetation was observed, administration of intravenous heparin 10,000 U/day was initiated on the second hospital day. Although laboratory data showed improvement in inflammatory reactions (WBC, 14,800/\( \mu \)l; CRP, 9.10 mg/dl), echocardiography showed marked progression of the mass size to 38 by 34 mm and pendulation of the vegetation on the third hospital day (Fig. 3). Percutaneous pericardiocentesis was not performed because of inadequate accumulation of pericardial fluid. Although we decided to perform an operation, we could not open the heart due to the accumulation of purulent pericardial fluid on the third hospital day (Fig. 4). After a large volume of pus was removed, improvement of hemodynamics and inflammatory reaction in laboratory data were observed. A pericardial effusion culture yielded \textit{Staphylococcus aureus}. Since angina pectoris had been suspected on a past treadmill test procedure, coronary angiogram was performed before surgery. Coronary arteries were normal.

Transthoracic echocardiography showed obvious diminution in the size of the vegetation on the fifth hospital day. Laboratory data showed the following: LDH, 1,886 IU/l; Cre, 1.65 mg/dl; BUN, 48.0 mg/dl. A computed tomographic scan of the abdomen revealed right renal infarction. There was no evidence of embolism of the other organs. Transthoracic echocardiography revealed no vegetation three weeks after admission. WBC and CRP values improved gradually and returned to the normal range six weeks after admission. The oral antibiotic, amoxicillin (500 mg/day) was substituted for ABPC and panipenem betamipron eight weeks after admission (Fig. 5). His diabetes was treated by human premix (70% neutral protamin Hagedorn/30% regular) insulin 30 U per day. Decayed teeth, fistula in the oral...
cavity and plantar ulcers subsided.

Discussion

The diagnosis of infective endocarditis requires the integration of clinical, laboratory, and echocardiographic findings. In 1994, a group at Duke University proposed standardized criteria for assessing patients with suspected infective endocarditis (2). According to their criteria, a definitive diagnosis of infective endocarditis can be easily made based on the findings in the echocardiogram and blood cultures. In addition, a diagnosis of acute pericarditis can be easily made from echocardiographic evidence of pericardial effusion and electrocardiographic evidence of ST elevation in multiple leads.

Since *Staphylococcus aureus* was isolated from plantar ulcers, arterial blood and pericardial effusion, a chain of infection was suspected to be the pathogenesis. Spread of infection to the pericardium from the infected endocardium could occur by one of the following pathways: hematogeneous spread, septic embolization of the coronary artery, or rupture of myocardial abscess or perianular abscess (3). However, the incidence of acute pericarditis complicated with infective endocarditis is not common. In the present case, echocardiography showed no myocardial abscess or perianular abscess and coronary angiogram revealed no abnormalities. Therefore, it was speculated that septicemia resulting from plantar ulcers or intraoral infection caused the infective endocarditis and acute pericarditis. Acute bacterial pericarditis is commonly observed in patients who are immunologically compromised (4). We suggest that severe hyperglycemia might lead the patient to be immunocompromised, leading to development of infective endocarditis and acute purulent pericarditis.

It is generally known that most cases with native-valve endocarditis are more likely to have cardiac valvular disease or congenital heart disease. The existence of cardiac damage may be important for the binding of bacteria to cardiac endothelial cells (5). Both Staphylococcal endocarditis and β hemolytic streptococci endocarditis sometimes occur in patients without preexisting cardiac damage (6–8). The vegetation attached to the chordae tendineae without cardiac disease observed in the present patient was uncommon. We suggested that specific binding of the vegetation was mediated in part by the hypercoagulable state due to hyperglycemia.

The American Heart Association has issued a general guideline for medical management of infective endocarditis (9). High doses of antibiotics are needed. Prolonged parenteral administration of a bactericidal antimicrobial agent or a combination of agents is currently recommended (1, 10–12). The initial treatment usually cannot await blood culture results when the symptoms progressively worsen, so the physician must choose drugs to cover the species of organisms most likely to be present. Streptococcus species, coagulase-negative staphylococci, Gram negative bacilli and fungi are common bacteria found in infective endocarditis (1, 5, 13). In a recent series, staphylococci, and in particular *Staphylococcus aureus*, has become the most common cause of infective endocarditis with native-valve endocarditis. *Staphylococcus aureus*, once the most common causative agent of acute purulent pericarditis by far, remains the single most frequent etiologic organism. However, there has been a large increase in pericarditis caused by Gram-negative
aerobic bacilli (3). In addition, facultative bacteria is frequently implicated in pericarditis (14). Therefore, ABPC, panipenem betamipron and clindamycin were chosen in the present patient. Each antibiotic has a high sensitivity to the causative pathogen, Staphylococcus aureus and β-hemolytic streptococcus C species.

Surgical therapy is recommended for patients with infective endocarditis who have congestive heart failure, perivalvular invasive disease, uncontrolled infection despite maximal antimicrobial therapy, or episodes of embolization with residual large vegetation (9, 15, 16). The highest incidence of embolic complication is observed in infective endocarditis due to β-hemolytic streptococcus C species as well as Staphylococcus aureus, resulting in a high mortality rate (17–20). It has been reported that size and mobility of the vegetation are highly sensitive in identifying patients at risk for embolic events (15). In the present patient, the size of the mobile vegetation became progressively enlarged over a few days despite maximal antimicrobial therapy. Therefore, we believed that there was a high risk of embolism due to the vegetation. Furthermore, it was suggested that virulent pathogens, such as Staphylococcus aureus and β-hemolytic streptococcus C species led to destruction of valvular or intracardiac structures and hemodynamic deterioration (17, 18). Surgical resection was considered to be desirable to decrease the possibility of embolic complications and collapse. However, we had to forego removal of the vegetation because of the accumulation of purulent pericardial fluid. In a patient with acute purulent pericarditis, it is very difficult to perform cardiac surgery. There have been no reports of the treatment of patients with infective endocarditis having a large vegetation, complicated with acute purulent pericarditis. The surgical indication for infective endocarditis with purulent effusion has not been assessed. It was fortunate that the present patient was successfully treated despite having a complication of kidney embolism without mortal embolization of the other organs. In patients with acute purulent pericarditis with tamponade, percutaneous pericardiocentesis is recommended to remove pericardial fluid (3). In the present case, removal of pus from the pericardium...
seemed to be useful to improve the hemodynamics and laboratory data. We wondered whether or not there are any alternative treatments other than surgery for patients with similar conditions? In general, anticoagulant therapy has not been shown to prevent embolization (1). Since hyperglycemia, as observed in the present case, is related to a hypercoagulated state, it may be important to assess the usefulness of anticoagulant therapy in patients with hyperglycemia. This calls for further controlled trials.

This case presents several interesting clinical observations. The size of the vegetation was progressively enlarged despite maximal antimicrobial therapy. Infective endocarditis complicated with acute purulent pericarditis that prevents cardiac surgery is uncommon. Attachment of the vegetation to the chordae tendineae is not common, either. We suggest that the immunocompromised and hypercoagulable state due to severe hyperglycemia caused these conditions. It is necessary to keep in mind that infective endocarditis due to Staphylococcus aureus or β hemolytic streptococcus C species with an immunocompromised state such as hyperglycemia may complicate acute purulent pericarditis that prevents cardiac surgery.

References