Infective endocarditis complicated by mycotic cerebral aneurysm:
two case reports of women in the peripartum period

Keiji Oohara*, Takenori Yamazaki, Hideki Kanou, Atsukata Kobayashi
Department of Thoracic and Cardiovascular Surgery, Toyohashi Municipal Hospital,
50 Hachiken-nishi, Aotake-cho, Toyohashi 441–8570, Japan

Abstract
Mycotic cerebral aneurysms occur in 2% of all patients with infective endocarditis [1]. Ruptured aneurysms lead to a high mortality rate [2]. Surgical treatment is required, but it also introduces some problems. Early surgery for mycotic cerebral aneurysm may lead to an even higher mortality rate due to heart failure. Early surgery for infective endocarditis may lead to an increased intracerebral bleeding due to heparinization during cardiopulmonary bypass. The management of infective endocarditis during pregnancy is also difficult. The cardiac operation should be performed to save the pregnant woman as well as the fetus.

1. Introduction
Mycotic cerebral aneurysms occur in 2% of all patients with infective endocarditis [1]. Ruptured aneurysms lead to a high mortality rate [2]. Surgical treatment is required, but it also introduces some problems. Early surgery for mycotic cerebral aneurysm may lead to an even higher mortality rate due to heart failure. Early surgery for infective endocarditis may lead to an increased intracerebral bleeding due to heparinization during cardiopulmonary bypass. The management of infective endocarditis during pregnancy is also difficult. The cardiac operation should be performed to save the pregnant woman as well as the fetus.

2. Case reports
2.1. Case 1
A 25-year-old woman was admitted on May 19th, 1995 to our hospital. At the age of 12, she suffered from cerebral embolization and was indicated rheumatic heart valve disease. A vegetation was discovered on the mitral valve in the fifth month of her pregnancy. A Caesarean operation was performed in the thirty sixth week of her pregnancy. From 9 days after delivery, she had a fever and was diagnosed with infective endocarditis with the detection of Streptococcus viridans in a blood culture. On the twenty third day after delivery, she had a headache caused by subarachnoid hemorrhage diagnosed by computed tomography, and a cerebral angiogram revealed a mycotic aneurysm of the posterior cerebral artery (PCA).

On May 24th, due to the uncontrollable infection, mitral valve replacement was performed (using a 31mm St Jude Medical prosthetic valve). On the next day, she left the intensive care unit uneventfully and anticoagulation therapy was started. On the fourteenth day after neurosurgery, a cerebral angiogram revealed that the aneurysm of the PCA had disappeared.

On the nineteenth day after neurosurgery, the patient was...
discharged after infectious signs were under control. She remains very well after 3 years of follow-up.

2.2. Case 2

A 32-year-old woman was admitted to our hospital on November 28th, 1995. On November 5th, she delivered her third child. From 3 days after delivery, she had a fever and cough, and was medicated for bronchitis. After admission, she was diagnosed with infective endocarditis with the detection of a vegetation on the aortic valve and the detection of *Streptococcus milleri* group in a blood culture. After appropriate intravenous antibiotics, her inflammatory signs were improved. Surgery was scheduled for December 20th, due to progressive heart failure caused by aortic and mitral regurgitation. On the early morning of December 20, however, she had a headache caused by subarachnoid hemorrhage. After, cerebral angiography revealed a left posterior cerebral mycotic aneurysm (Fig. 1), emergency craniotomy for clipping was performed. Two days after, a new aneurysm of the right middle cerebral artery ruptured and the patient fell into a coma. She died 5 days after coma.

3. Discussion

This report describes two rare cases of patients with infective endocarditis and mycotic cerebral aneurysm during pregnancy. We have not found any sources in the literature concerned with all three categories. Thus, we reviewed the relationship between mycotic cerebral aneurysm and infective endocarditis and the relationship between infective endocarditis and pregnancy, respectively.

The incidence of associated mycotic cerebral aneurysms in patients with infective endocarditis has been reported to be 2% [1]. Frazee et al. reported that the incidence of mycotic cerebral aneurysms represented 4% of all patients with intracranial aneurysms and 3% of all patients with infective endocarditis [2]. However, the incidence of infective endocarditis in pregnancy has been reported to be 1 in 8000 deliveries (0.0125%) [3]. Cox et al. reported it to be 1 in 16 500 (0.006%) [4].

Among the causes of infective endocarditis, rheumatic and congenital heart disease have been considered. Also it has recently been reported that illicit intravenous drug abuse leads to increasing incidences of infective endocarditis in the West [4,5]. The two patients presented here were not illicit drug abusers.

The mortality rate of patients with myocotic cerebral aneurysm without rupture is 30%, but 80% in cases where rupture does take place [6]. Also, a new aneurysm may appear subsequently. Due to these reasons, prompt and serial angiography should be done on patients with infective endocarditis who develop any neurological signs and symptoms, particularly headache or focal signs. The mortality rate of patients with infective endocarditis during pregnancy is also high. Maternal mortality rate is 23% during pregnancy and 50% during puerperium, and fetal mortality rate is 23% [7]. Although pregnancy itself may not influence the condition of infective endocarditis, delayed diagnosis leads to catastrophic outcomes. The diagnosis of this disease is difficult in a pregnant patient due to the common occurrence of heart murmurs and the use of antibiotics for other infections such as urinary tract infection [8]. Close attention should be given to any pregnant woman who has unexplained fever or cardiac murmur.

It is well-known that the treatment of infective endocarditis is adequate antibiotics therapy against the target organism and cardiac surgery such as valve replacement. However, some serious problems arise when infective endocarditis is combined with mycotic cerebral aneurysm or pregnancy.

In cases where infective endocarditis and mycotic cerebral aneurysm occur together, it must be decided which operation should be undertaken first, heart or brain. If cardiac surgery is performed prior to neurosurgery, systemic heparinization may lead to intracranial bleeding during cardiopulmonary bypass, and postoperative anticoagulant therapy may also lead to intracranial bleeding. If craniotomy is performed prior to cardiac surgery, the risk is high if the patient has heart failure. therefore, craniotomy should be considered before the patient develops severe heart failure. If emergency valve replacement is necessitated, craniotomy should be considered shortly after cardiac surgery. A recent report described an endovascular technique for embolizing a mycotic cerebral aneurysm in a patient with infective endocarditis [9]. This method may be effective for some patients with severe heart failure.

In the case of infective endocarditis during pregnancy, both maternal and fetal life should be rescued. It is suggested that the best time for cardiac surgery is between Fig. 1. Cerebral angiography showing a left posterior cerebral mycotic aneurysm.
the 24th to 28th weeks of gestation [4], because organogenesis is complete at this time. Also, cardiac output increases progressively from the 24th to 36th week of gestation, i.e. hemodynamic load increases through this time. Heparin is used for postoperative anticoagulation because its heavy molecular weight prevents it from crossing the placental barrier. Optimal timing for surgery is not always possible for a critically pregnant patient, and delayed diagnosis may lead to delayed operative timing and complications in a puerperal patient. However, positive surgery should be recommended. In the case of infective endocarditis with mycotic cerebral aneurysm during pregnancy, further jeopardy remains. In Case 1, the cardiac operation was successfully performed prior to neurosurgery in the puerperal period. Outpatient follow-up of 3 years has found the patient to be quite healthy. In case 2, the delayed diagnosis and operative schedule may have led to the death of the patient. Should cerebral angiography have been performed when there were no cerebral symptoms? Regardless, an aggressive strategy should be followed.

References