A 14-year-old boy with a fever of more than 39°C presented at a local clinic. Before the onset of the fever, he had been healthy. Two days after the initial visit, he noticed redness on the skin and went to another hospital. There, a diagnosis of Japanese spotted fever (JSF) was made and treatment with minocycline (MINO) was prescribed. He was referred to a doctor with good knowledge of the disease. An eschar was detected on his right wrist (Fig. 1A), and erythematous blotches were observed over his whole body (Fig. 1B), especially on the palms and soles (Fig. 1C). He did not complain of itching. Neither lymphadenopathy nor hepatosplenomegaly were noted. Table 1 shows the results of the laboratory tests performed on admission. C-reactive protein (CRP) was slightly elevated. The administration of ciprofloxacin hydrochloride (CPFX) failed to lower his temperature. On day 4 after admission, he complained of dry cough and chest oppression. On day 5, his heart rate was increased to 120 bpm, his blood pressure was 80/40 mmHg, and an electrocardiogram showed a complete right bundle branch block. Chest auscultation revealed cardiac murmur (gallop rhythm). Chest X-ray images showed no pulmonary congestion and the cardiothoracic ratio was found to be 50%. Oxygen saturation was 97% and creatine kinase (CK) was elevated to 1,327 U/l (normal range, 200 - 400) and CK-MB to 98.3 U/l (normal range, 0.0 - 3.8). The levels of aspartate aminotransferase, alanine aminotransferase and lactate dehydrogenase were also elevated (Table 1). Diagnosed with acute myocarditis, the patient was transferred to a hospital in which he could be treated by cardiologists.

Transthoracic echocardiography showed an ejection fraction of 69%, mild mitral regurgitation, and mild pericardial effusion (Fig. 2). Ventricular premature contractions were recognized (5 or 6 per min). Symptoms improved with the administration of MINO and globulin (0.8 g/kg of body weight per day, total 37.5 g within 2 days). On day 17 after admission, the patient was discharged without any complications.

While indirect immunoperoxidase antibody tests for Orientia tsutsugamushi and Rickettsia japonica were negative on admission and on day 3, on day 11 a test for R. japonica showed the IgG value to be 160 times and the IgM value to be 640 times. Antibody tests for O. tsutsugamushi were negative. Serological tests for enterovirus (coxsackie A4, B2, B3 and B4) and adenovirus were both performed on days 5 and 11, and all results were negative.

JSF is a new rickettsial disease discovered in 1984 (1,2). This disease is an infectious disease with acute fever, but most antibiotics are ineffective against it, and JSF may become a fatal illness unless it is carefully treated (3).
Myocarditis can develop as a complication of various infectious diseases. While enterovirus infections are most commonly complicated with myocarditis, they have rarely been associated with rickettsial disease (4). Myocardial disease in Rocky Mountain spotted fever has been reported (5). But acute myocarditis has never been reported as a complication of JSF, and to our knowledge, this is the first case of JSF complicated with acute myocarditis. Systemic manifestations of a viral, bacterial, rickettsial, fungal or parasitic infection may be attended by a novel onset of cardiac dysfunction. When a patient presents with an episode of cardiac failure, myocardial infarction, cardiac arrhythmias, or conduction disturbances, acute myocarditis is a likely condition. After our patient complained of chest discomfort and cough, chest auscultation revealed a gallop rhythm, which is a sign of ventricular dysfunction. Subsequent electrocardiography showed a complete right bundle branch block and premature ventricular beats, while transthoracic echocardiography revealed mitral regurgitation and pericardial effusion, and the ejection fraction was maintained at 69%. A definitive diagnosis of myocarditis can be made only by endomyocardial biopsy, an invasive procedure that, even if it is carried out by an experienced practitioner, carries the risk of lethal complications. Moreover, multiple small samples may be required before an accurate diagnosis can be made. Consequently, we did not request endomyocardial biopsy to confirm the diagnosis. The clinical signs and measurements described above, together with the results of laboratory tests, provided strong evidence, however, of acute myocarditis. Although acute myocarditis was previously unknown as a complication of JSF, we believe that acute myocarditis was present in this case.

The spotted fever group rickettsioses are distributed all over the world (6,7). In Japan, JSF and tsutsugamushi disease have been recognized. JSF was first recognized in 1984 by Maharita et al. (1,2), and *R. japonica* is known to be the cause (8,9). A triad of clinical symptoms is characteristic of JSF: high fever, erythema, and tick-bite eschar. Exanthema on the palms and soles is a specific feature of JSF. Definitive diagnosis is made when indirect immunoperoxidase antibody measurement against *R. japonica* is higher than 40 times (10); besides presenting typical symptoms of JSF, the patient in the present case had IgG values against *R. japonica* that were 160 times and IgM values of 640 times. Serological tests for enterovirus and adenovirus were negative. Therefore we diagnosed this case as JSF.

JSF is associated with central nervous system disorder (11), liver dysfunction, immunodeficiency syndrome, disseminated intravascular coagulation, and shock. If not appropriately treated, it can be fatal (3). While antibiotics, such as penicillins, β-lactams, and aminoglycosides are ineffective, MINO, doxycycline, and new quinolones do act against JSF. A susceptibility study in vitro has demonstrated MINO to be the most potent known antibiotic for JSF (12). The patient received MINO during the early phase of the disease and CPFX later. Seventeen days after admission, he was discharged from the hospital without sequelae. Even though acute myocarditis developed, MINO and CPFX effectively treated the JSF. In severe cases, Iwasaki et al. reported the effectiveness of new quinolones for treating JSF (3).

We experienced JSF complicated with acute myocarditis. It is the first case of acute myocarditis associated with JSF.

### REFERENCES


