A previously healthy 40-year-old man was admitted to our hospital complaining of dyspnea at rest and flu-like symptoms. Influenza virus type A was detected in the mucus from his nasal cavity. Chest radiographs showed an infiltrative shadow in the right upper lung field, so influenza pneumonia was diagnosed. An ECG showed newly developed complete right bundle-branch block, and ST-T–segment elevation was observed in all leads except for III, aVR, and aVF (Figure 1A). Because the cardiac enzymes, creatine phosphokinase (1023 U/L; normal value <200 U/L) and creatine phosphokinase myocardial band (38 ng/mL; normal value <7.5 ng/mL), were elevated and the troponin T quick assay was positive, we performed a trans-thoracic echocardiogram. Left ventricular (LV) wall motion was reduced diffusely, and the LV ejection fraction was 17% (Figure 2A). Coronary artery disease was excluded by coronary angiography (Figure 3). An endomyocardial biopsy (EMB) was performed from the LV posterior wall. Light microscopic examination revealed lymphocytic infiltration (Figure 4A). There were no multinucleated giant cells or plasma cells and very few eosinophils. Immunohistochemistry showed macrophages, lymphocytes, and T-cell predominance. Electron microscopy revealed spherical viruses of 20 to 30 nm in an area of myofilament lysis of cardiomyocytes (Figure 4B and 4C).

Two weeks after admission, coxsackievirus B4 and influenza virus type A were elevated >4 times on examination. Both influenza virus and coxsackievirus are RNA viruses that proliferate in cytoplasm. Influenza virus is a bacillary type with a length of 80 to 120 nm. Coxsackievirus is icosahedral shaped with a diameter of 10 to 30 nm. For confirmation, we stained the EMB specimen using both viral antibodies. Cardiomyocytes reacted diffusely to the coxsackievirus B antibody (Figure 4D and 4E).

Only acute-phase mechanical circulatory support by intra-aortic balloon pumping was needed. The patient was discharged 9 weeks after his admission. An ECG performed before the patient left our hospital showed that both right bundle-branch block and ST-T–segment elevation had disappeared (Figure 1B), and the patient’s LV systolic function showed good recovery; his LV ejection fraction was 61% (Figure 2B).

Diagnosis of viral myocarditis is based on the detection of viruses, viral genomes, or viral antibody in serum, excreta, or tissues. Timed examinations for viral infection and molecular biology–based assays of peripheral blood samples do not always show the exact cause of myocarditis. In this case, electron microscopic observation and evaluation by molecular-based immunohistochemistry of an accurately timed EMB specimen enabled the detection of the virus responsible for the myocarditis. Myofilament lysis is recognized in the cardiomyocytes of patients with myocarditis. In this patient, coxsackievirus was found in the area of myofilament lysis. This is also supporting evidence that coxsackievirus was the etiologic cause of myocarditis.

Disclosures
None.

References

From the Department of Cardiovascular Medicine (T.I., T.S., G.T., H.T., M.H., K.A., M.Y., K.M.), Central Electron Microscopic Institute (S.S.), and Department of Intensive and Cardiac Care Unit (Y.H.), Nippon Medical School, Tokyo, Japan.
Correspondence to Tsunenori Saito, MD, PhD, FAHA, Department of Cardiovascular Medicine, Nippon Medical School, 1-1-5 Sendagi, Bunkyo-ku, Tokyo 113-8603, Japan. E-mail unsaitonms@gmail.com (Circulation. 2013;128:2811-2812.)
© 2013 American Heart Association, Inc.
Circulation is available at http://circ.ahajournals.org
DOI: 10.1161/CIRCULATIONAHA.112.000602
Figure 1. Twelve-lead ECG. A, ECG on admission demonstrated complete right bundle-branch block. ST-T–segment elevation was seen in all leads except for III, aVR, and aVF. B, Nine weeks after admission, ECG showed neither right bundle-branch block nor ST-T–segment elevation.

Figure 2. M-mode echocardiography of the LV septum and posterior wall on admission (A) and 9 weeks later (B). LV ejection fraction improved from 17% to 61%.

Figure 3. Coronary angiography demonstrated no stenosis.

Figure 4. Histological, immunohistological, and electron microscopic findings of the endomyocardial biopsy (EMB). A, Light microscopic examination of the EMB shows lymphocytic infiltration in the myocardium (hematoxylin and eosin staining). Arrows show lysis of cardiomyocytes. B, Electron photomicrograph of the EMB. Spherical viruses (*) are recognized in the area of myofilament lysis (ML) of cardiomyocytes. The box-shaped area is enlarged in C. D and E, Immunohistological staining with coxsackievirus B antibody (D) and influenza virus type A (E) antibody. Scale bar, 10 μm in B and 500 nm in C.
Acute Myocarditis Associated With Coxsackievirus B4 Mimicking Influenza Myocarditis: Electron Microscopy Detection of Causal Virus of Myocarditis
Takeshi Ikeda, Tsunenori Saito, Gen Takagi, Shigeru Sato, Hitoshi Takano, Yusuke Hosokawa, Meiso Hayashi, Kuniya Asai, Masahiro Yasutake and Kyoichi Mizuno

Circulation. 2013;128:2811-2812
doi: 10.1161/CIRCULATIONAHA.112.000602
Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2013 American Heart Association, Inc. All rights reserved.
Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circ.ahajournals.org/content/128/25/2811

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Circulation can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Circulation is online at:
http://circ.ahajournals.org//subscriptions/