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Stress-induced Cardiomyopathy during Pulmonary Resection (Takotsubo Syndrome)

— A case report —

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Stress-induced cardiomyopathy is caused by emotional or physical stressors and mimics acute myocardial infarction, though Stress-induced cardiomyopathy is characterized by reversible left ventricular (LV) apical ballooning in the absence of significant coronary artery disease. We describe a 51-year-old male who underwent left upper lobectomy for non-small cell lung cancer, and during which cardiogenic arrest occurred due to stress-induced cardiomyopathy, successfully managed by intra-aortic balloon pumping and extracorporeal membrane oxygenation.

Key words: 1. Cardiomyopathy
2. Extracorporeal membrane oxygenation
3. Lobectomy

CASE REPORT

A 51-year-old male patient had been diagnosed with squamous carcinoma, stage IIIa, two months prior, had twice been treated with cisplatin and gemcitabine combination chemotherapy, and was admitted for left upper lobe resection. Diabetes and hypertension were not detected in the medical history. At the time of admission, the blood pressure was 125/70 mmHg, heart rate was 64 beats/minute, respiration rate was 20 breaths/minute, and body temperature was 36°C. Plain chest radiography and chest computed tomography revealed a 2.9-cm tumor in the left upper lobe. An electrocardiogram was normal, and no abnormal findings were detected in blood tests. The thoracic cavity was approached via left posterolateral thoracotomy. Since adhesion of the pleura was severe, the adhesion was removed. Cardiac arrest occurred while dissecting the adhesion of the left lower lobe, immediately after the increase of the ST segment on electrocardiogram as well as the development of hypotension (60/40 mmHg) and bradycardia (40 beats/minute), after separating the vein and artery branching as well as the bronchus. Inotropics were used, and an intra-aortic balloon pump (Datascope®) was inserted via the left femoral artery while performing cardiac massage by pericardiotomy. After the insertion of an intra-aortic balloon pump, the heart rate recovered to a normal sinus rhythm, the blood pressure was 100/60 mmHg, and the arterial oxygen saturation level was 100%.

After wound closure, surgery was completed, and the patient was transferred to the intensive care unit. After transferring to the intensive care unit, the patient remained stable

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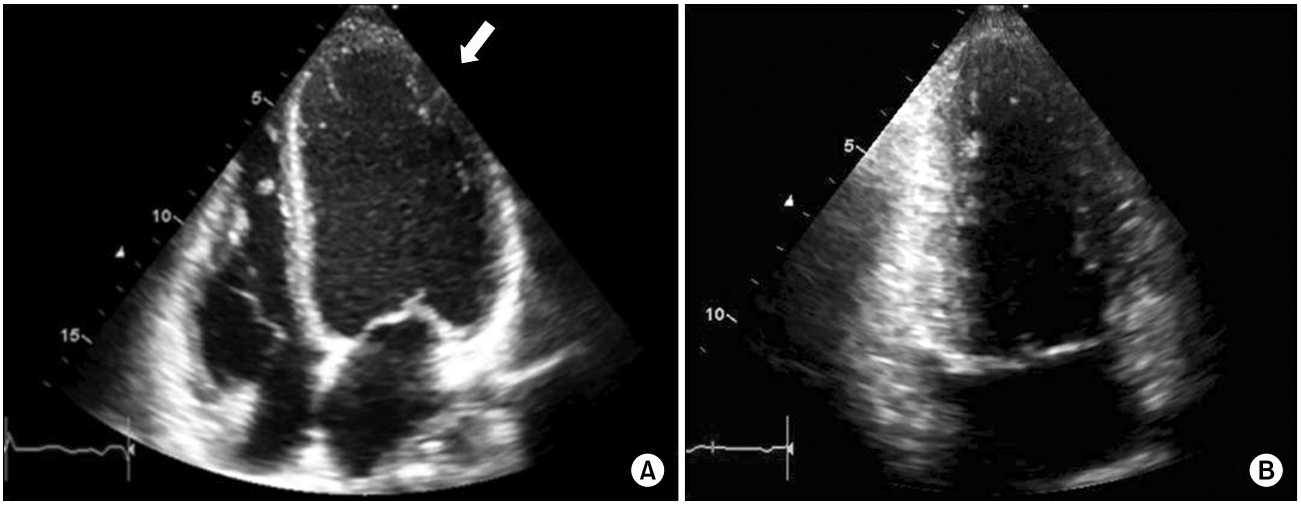

Fig. 2. (A) Postoperative echocardiography shows apical ballooning (arrow). (B) Normalized echocardiography at discharge.

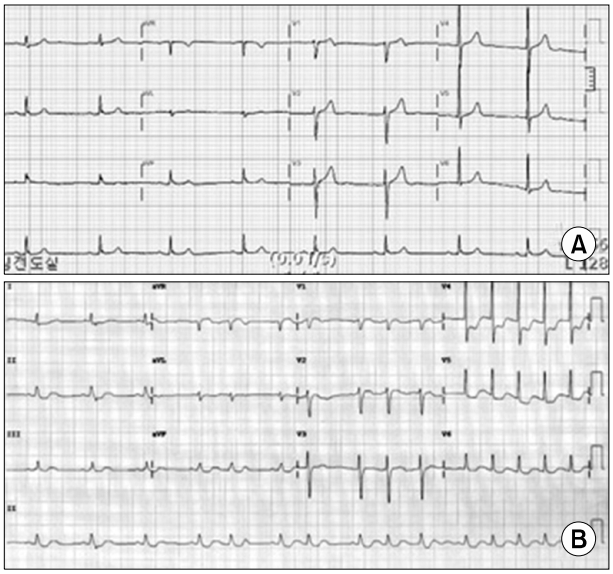

Fig. 1. (A) Preoperative normal electrocardiography. (B) Postoperative electrocardiography shows ST-segment depression in V4, V5, V6, lead II, lead III.

for 10 minutes, cardiac arrest occurred simultaneously with a decrease in the ST segment on the electrocardiogram (Fig. 1). Thus, while performing cardiopulmonary resuscitation, an extracorporeal membrane oxygenator (Medtronic centrifugal Bio-pump®) was inserted into the right femoral artery and the vein by the Seldinger technique using a 17 Fr catheter and a 21 Fr catheter, and vital signs were stabilized. Afterward, echocardiography was performed, revealing apical ballooning and severe dysfunction of the left ventricle (Fig. 2A). An emergency coronary artery angiogram was performed, and it was normal with the exception of 30% stenosis in the left anterior descending coronary artery (Fig. 3A, B). The creatine kinase (CK) level was 2,976 U/L, creatine kinase MB (CK-MB) was 174 ng/mL, and troponin I was elevated to 26 ng/mL. Stress induced cardiomyopathy was diagnosed. Once vital signs were stabilized, catecholamine was terminated. 26 hours after surgery, the extracorporeal membrane oxygenator was removed. 48 hours after surgery, the intra-aortic balloon pump was removed. 3 days after surgery, blebs, edema, and discoloration were detected in the right extremities, and thus a peripheral angiogram was performed (Fig. 3C). Compartment syndrome was diagnosed and a fasciotomy was performed. 4 days after the surgery, CK was 18,000 U/L, CK-MB was 73 ng/mL, and troponin I was reduced to 4.5 ng/mL. The artificial ventilator was removed 6 days after surgery. The patient was transferred to a general ward 11 days after surgery. The fasciotomy wound was sutured and the patient was discharged 20 days after surgery. At the time of discharge, echocardiography showed normal findings (Fig. 2B). Currently, the patient has received follow-up care for one year and six months without significant complications.

DISCUSSION

Stress-induced cardiomyopathy was first reported by Dote

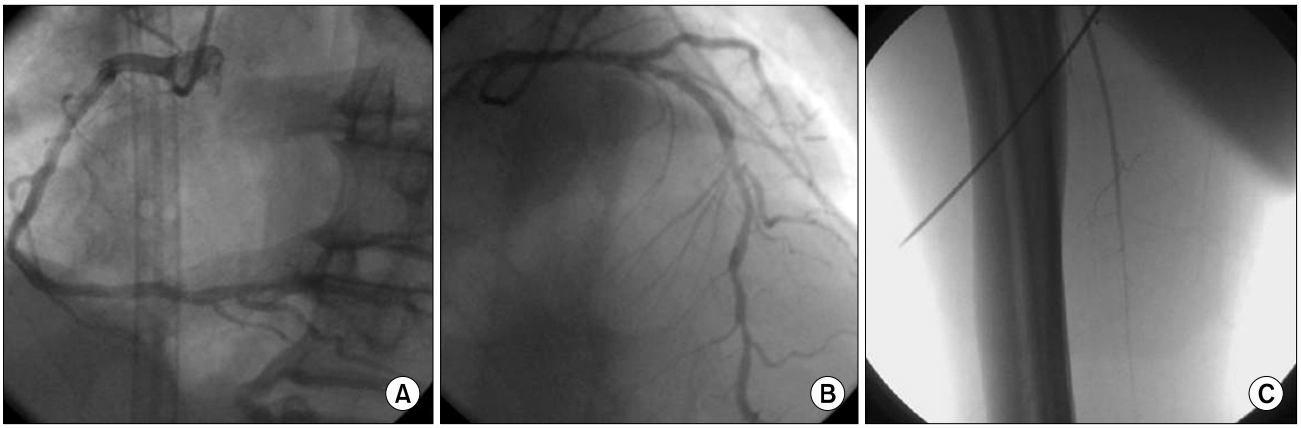

Fig. 3. (A) Coronary angiography shows the normal right coronary artery. (B) Coronary angiography shows minimal stenosis of the left anterior descending artery. (C) Peripheral angiography shows the patent's posterior tibial artery and peroneal artery.

et al. in Japan in 1990. It is an idiopathic disease which develops symptoms similar to acute coronary artery syndrome, such as chest pain, dyspnea, hypotension, and abnormal electrocardiogram, and is a reversible disease without significant stenosis on coronary artery angiogram [1].

Since the apical area of the left ventricle is characteristically balloon-shaped and similar to the Takotsubo, a jar used for catching octopus in Japan, it is also referred to as Takotsubo cardiomyopathy. It is also referred to by other terms such as neurogenic myocardial stunning, stress cardiomyopathy, stress-induced cardiomyopathy, transient left ventricular apical ballooning, ampulla cardiomyopathy, and broken heart syndrome.

Although its causes have not been elucidated, considering that in cases in which catecholamine is elevated due to severe psychological or physical stress or pheochromocytoma, deterioration of myocardial function may be associated, and an association with the elevation of catecholamine has been suspected [2,3].

Takotsubo cardiopathy is diagnosed by echocardiography and coronary artery angiography. It may be diagnosed if the deterioration of left ventricular function such as severe hypokinesia, akinesia, dyskinesia, apical ballooning in the middle ventricle and the apex of the heart is detected by echocardiography, and the coronary artery angiogram is normal [2]. The cardiac enzymes CK and CK-MB are temporarily elevated, the CK-MB/total CK ratio is not higher than 10%, and cardiac enzyme levels return to normal within 1 week. There may be an associated elevation of troponin I. In our case, cardiac enzymes were elevated, and 2 weeks after surgery, the value of CK-MB and troponin I became normal [4].

Takotsubo cardiopathy can be completely cured by conservative treatment. Our patient was a severe case associated with cardiac arrest, and thus an extracorporeal membrane oxygenator as well as an intra-aortic balloon pump were required. In addition, in patients with left ventricular outflow track obstruction, elevation of catecholamine, an insufficient volume of body fluid, and vascular relaxation may cause conditions to deteriorate, and thus the maintenance of the appropriate volume of body fluid and the proper use of pure alpha agents should be considered [4,5].

It has been reported that most patients show good prognosis, the recurrence rate is 3.1%, and the in-hospital mortality rate is 1.7% [1]. Left ventricular function returns to normal within 1 to 4 weeks, and the risk for sudden death has not been identified [4,5].

We reported a case of stress-induced cardiomyopathy developed during pulmonary resection in a lung cancer patient who showed severe clinical features and developed cardiac arrest. The patient was treated with an extracorporeal membrane oxygenator and an intra-aortic pump in the early period.

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