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CASE REPORT

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A case of ultrashort-acting beta-blocker landiolol hydrochloride for takotsubo syndrome with left ventricular outflow tract obstruction

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Abstract

Takotsubo syndrome (TTS) has been known to have a favorable prognosis. Beta-blockers are reported to be effective for TTS patients with cardiogenic heart failure due to left ventricular outflow tract (LVOT) obstruction. However, there is no report on ultrashort-acting beta-blockers being used for treating TTS, and there are no clear guidelines for their dosages or applications. Herein, we describe a 72-year-old woman in whom landiolol hydrochloride was used in the acute phase of TTS with LVOT obstruction. In this case, the dose of landiolol hydrochloride was increased to 10 μg/kg/min, resulting in improvement of LVOT obstruction, which led to hemodynamic stabilization.

KEYWORDS

beta-blocker, landiolol hydrochloride, left ventricular outflow tract obstruction, Takotsubo syndrome

1 | BACKGROUND

Takotsubo syndrome (TTS) has been known to occur because of emotional or physical stress, although its precise cause has not been clarified.[1–3] It has a favorable prognosis. TTS patients with cardiogenic shock due to left ventricular dysfunction, arrhythmia, or left ventricular outflow tract (LVOT) obstruction, and death caused by hemodynamic failure have been reported.[4,5] For patients with TTS accompanied with LVOT obstruction, beta-blockers are reported to be effective.[6,7] However, there is no report about using ultrashort-acting beta-blockers, such as landiolol hydrochloride, for treating TTS. Herein, we describe a patient in whom landiolol hydrochloride was used in the acute phase of TTS with a significant left ventricular pressure gradient caused by LVOT obstruction.

2 | CASE PRESENTATION

A 72-year-old woman presented to our emergency outpatient unit with a chief complaint of chest pain. She had precordial chest pain and shortness of breath about 5 hours before presentation following an episode of emotional stress. She had a history of hypertension. Upon physical examination, she had a fast heartbeat, blood pressure of 96/60 mm Hg, pulse rate of 100 beats/min, and systolic murmurs in the second right sternal border. She had no leg edema. Electrocardiography revealed the following: sinus rhythm and ST elevation in II, III, aVF, and V2-6. The laboratory findings during admission were as follows: white blood cell count, 9570/μL; red blood cell count, 503×10^4/μL; hemoglobin level, 15 g/dL; hematocrit level, 45.6%, platelet count, 17×10^4/μL; albumin level, 4.3 g/dL, blood urea nitrogen level, 13.8 mg/dL, creatinine level, 0.78 mg/dL; total

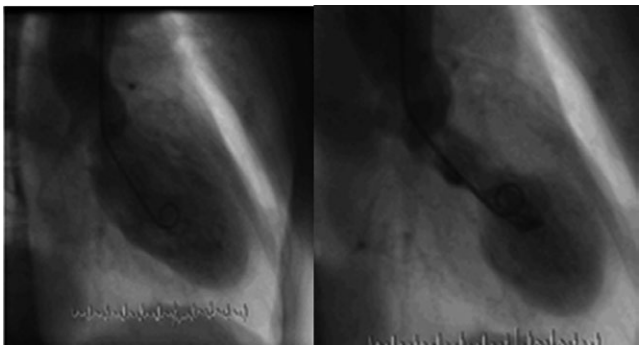

FIGURE 1 The LVG findings in the RAO view. The LVG findings in diastole and systole reveal apical ballooning and hyperdynamic contraction of the basal segments. RAO, right anterior oblique; LVG, left ventriculography

bilirubin level, 0.73 mg/dL; aspartate transaminase level, 48 IU/L; alanine transaminase level, 20 IU/L; lactate dehydrogenase level, 292 IU/L; sodium level, 138.3 mEq/L; potassium level, 3.98 mEq/L; chloride level, 103.8 mEq/L; C-reactive protein level, 0.11 mg/dL; creatine kinase level, 297 U/L; troponin I level, 8491.2 ng/mL; and brain natriuretic peptide level, 1640 pg/mL. Echocardiography revealed hypercontraction of the base, no contraction of the apex, a mosaic pattern in the left ventricular tract, flow velocity of 4 m/s, and severe mitral regurgitation. On the basis of the patient's physical symptoms and electrocardiographic and echocardiographic findings, we considered the possibility of acute myocardial infarction and immediately performed the cardiac catheterization test using the right radial artery approach. Coronary angiography did not show significant stenosis. However, left ventriculography showed hypercontraction of the base and no contraction of the apex (Figure 1). Additionally, severe mitral regurgitation was noted. Pullback of the pigtail catheter from the apex to the basal tract of the ventricle showed a pressure gradient of 61.9 mm Hg (Figure 2). Thus, a diagnosis of TTS was made. We observed systolic anterior motion (SAM) of the anterior mitral valve leaflet on the echocardiogram and diagnosed outflow tract obstruction as the cause of the left ventricular pressure gradient.

After oxygenation (3 L/min) was initiated, the patient was transferred to an intensive care unit, and we initiated fluid management and treatment for TTS with accompanying LVOT obstruction. Since SAM of the anterior mitral valve leaflet due to hypercontraction of the base caused LVOT obstruction and mitral regurgitation, we initially administered 4 μg/kg/min of landiolol hydrochloride, and 10 minutes later, we examined the pulse rate, blood pressure, and

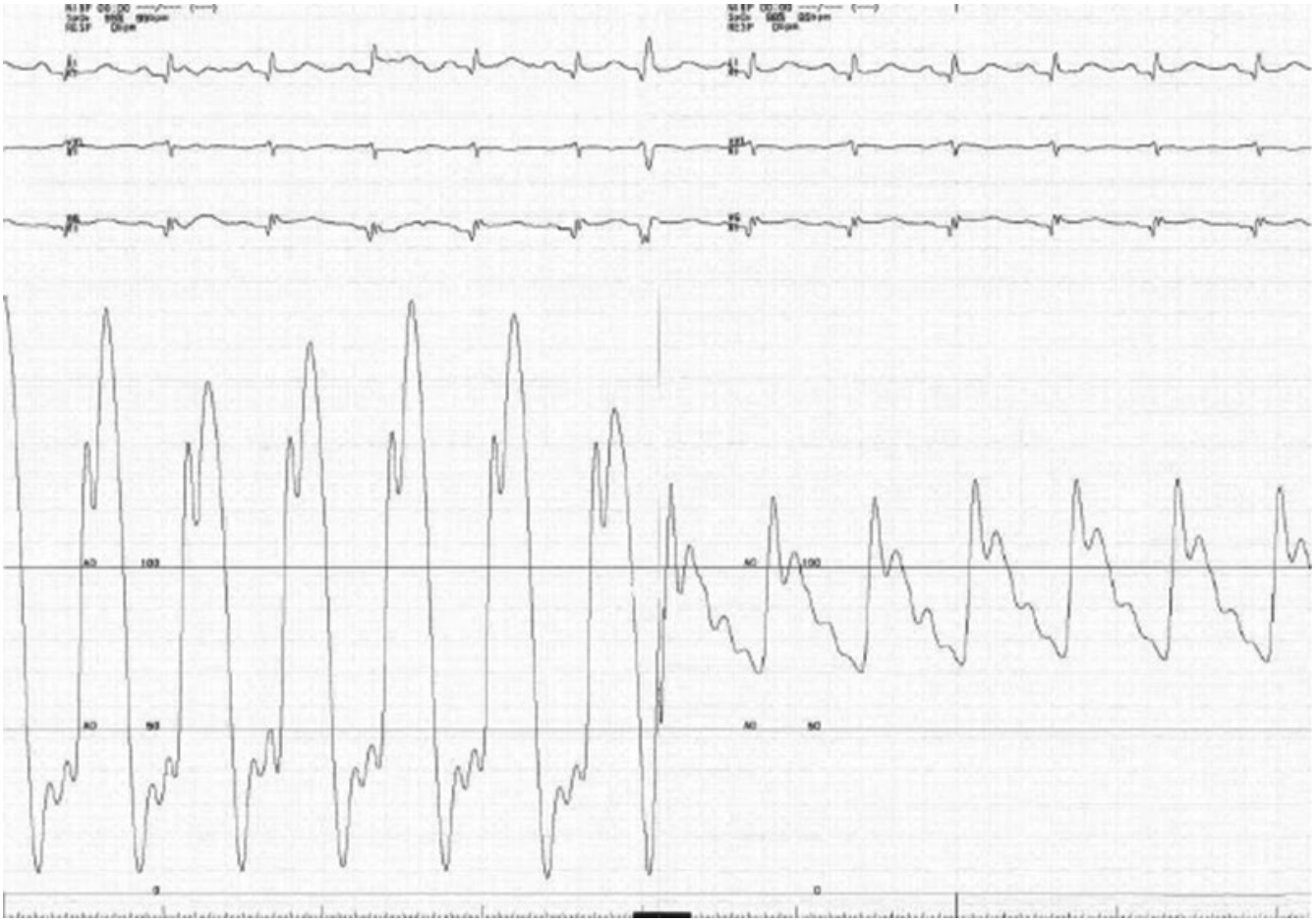

FIGURE 2 Pullback of the pigtail catheter from the apex to the basal tract of the ventricle shows an intraventricular pressure gradient, with a peak-to-peak gradient of 60 mm Hg in the left ventricular outflow tract

echocardiographic findings. At a dosage of 6 μg/kg/min, the pulse was 90-100 beats/min, systolic pressure was 100-110 mm Hg, and no change was noted on the echocardiogram. Then, the dosage of landiolol hydrochloride was increased by 2 μg/kg/min. At a dose of 8 μg/kg/min, the pulse rate was 70-80 beats/min, and systolic pressure was 100-110 mm Hg. Although SAM slightly improved on the echocardiogram, flow velocity remained unchanged. When the dosage was increased to 10 μg/kg/min, the pulse rate decreased to 50-60 beats/min. Echocardiography showed that the flow velocity in the LVOT decreased to 2 m/s, pressure gradient decreased to approximately 20 mm Hg, and mitral valve insufficiency improved to a mild condition. The systolic pressure increased to 120 mm Hg, and hemodynamic parameters stabilized. The dosage of landiolol hydrochloride was decreased to 4 μg/kg/min on day 3; no exacerbation of SAM or a decrease in blood pressure occurred. On day 4, the administration of landiolol hydrochloride was terminated, and the patient was discharged on day 10. She received unfractionated heparin until hospital discharge.

3 | DISCUSSION

Mortality due to cardiogenic shock in TTS is high (17%-30%).[8] As in the present high-risk case (LVOT obstruction >40 mm Hg and systolic blood pressure <110 mm Hg), the use of beta-blockers should reduce the pressure gradient of LVOT obstruction by reducing basal hypercontractility. Therefore, the use of beta-blockers is preferred in the acute phase of TTS.[9,10] After using landiolol hydrochloride, our patient's hemodynamic parameters stabilized. If cardiogenic shock is prolonged, mechanical support, such as temporary left ventricular assist devices and extracorporeal membrane oxygenation, should be considered.

The administration of beta-blockers (2-4 mg of propranolol hydrochloride intravenously[6] and 5-10 mg of metoprolol intravenously[7]) has been reported to be effective in patients with TTS. We administered landiolol hydrochloride, which stabilized the patient's hemodynamics in the same manner as conventional drugs. The half-lives of propranolol hydrochloride, metoprolol, and landiolol hydrochloride are 2.3 hours, 2.8 hours, and 3.4 minutes, respectively. The half-life is the most remarkable feature of landiolol hydrochloride, as it is an ultrashort-acting beta-blocker compared to the other beta-blockers. Negative inotropic effect of beta-blockers might cause further hemodynamic impairment. Ultrashort-acting beta-blockers are preferable because drug action disappears immediately after the discontinuation of the drug, especially in cases of shock. Landiolol hydrochloride is a high beta-1-selective blocker; it reduces the risk of irritation of the bronchial smooth muscle and is safer than propranolol hydrochloride. However, landiolol has a higher price than propranolol (4823 yen/50 mg vs 85 yen/2 mg).

In conclusion, this is the first case report to use ultrashort-acting beta-blockers for higher risk TTS. Further research would be needed for the appropriate use of ultrashort-acting beta-blockers in patients with TTS.

CONFLICT OF INTEREST

The authors have stated explicitly that there are no conflicts of interest in connection with this article.

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