



# Transient mid-ventricular obstruction in left ventricle induced by acute pulmonary thromboembolism

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## Case report

A 66-year-old male was admitted to our hospital with acute pulmonary thromboembolism (APTE) and consequent cardiogenic shock. He had a medical history of two incidences of APTE and had been treated with an anticoagulant agent. On admission, his blood pressure was 80/60 mmHg, his heart rate 90 beats/min, his oxygen saturation 90%. A systolic ejection murmur in addition to an accelerated II sound was auscultated. The echocardiogram showed not only high RV systolic pressure but also a mid-ventricular obstruction in the left ventricle (LV), with a 51 mmHg of max pressure gradient (Fig. 1a, b; Movie 1). Because shock progressed rapidly, he was intubated and underwent cardiac catheterization. The simultaneous pressure of the LV-apex and LV-outflow revealed 62 mmHg of pressure gradient in the LV (Fig. 1c). A large amount of thrombus in the pulmonary arteries was identified via pulmonary angiogram. Therefore, an emergent pulmonary arterial thrombectomy was performed, and a very large thrombus was resected from the bilateral pulmonary arteries (Fig. 1d). Thereafter, the LV obstruction disappeared (Fig. 1e; Movie 2) and the patient recovered from shock. A dobutamine-stress cardiac

catheterization performed 18 days after surgery did not induce an LV obstruction. The histology findings of the RV septum obtained by myocardial biopsy also were incompatible with hypertrophic cardiomyopathy such as myocyte disarray with an irregular arrangement of abnormal-shaped myocytes (Fig. 1f). This was the patient's third incidence of APTE, so a permanent filter device was placed in the inferior vena cava.

## Discussion

An LV outflow-tract obstruction (LVOTO) is induced by LV hypertrophy, dehydration, sepsis, vasodilation, excessive sympathetic stimulation, and atrioventricular valve surgery. However, an APTE is a very rare cause of LVOTO. Kruzer and colleagues first reported on LVOTO caused by an APTE [1]. Thereafter, similar cases were reported [2, 3, 4]. An APTE increases RV systolic pressure and shifts the geometry of the interventricular septum toward the LV. Decreased blood return to the LV also causes low preload of the LV, inducing LV obstruction. However, in most APTE patients, LV obstruction is rarely seen. In our case, the hypertrophied papillary muscle of the LV was shown using cardiac magnetic resonance imaging, which was accordant with the obstructed site. Together with underlying LV abnormalities and consequent change of an APTE, the patient developed reversible and dynamic LV mid-ventricular obstruction, thus promoting shock. In a case of an APTE with shock, we should also pay attention to LV morphology and LV obstruction.

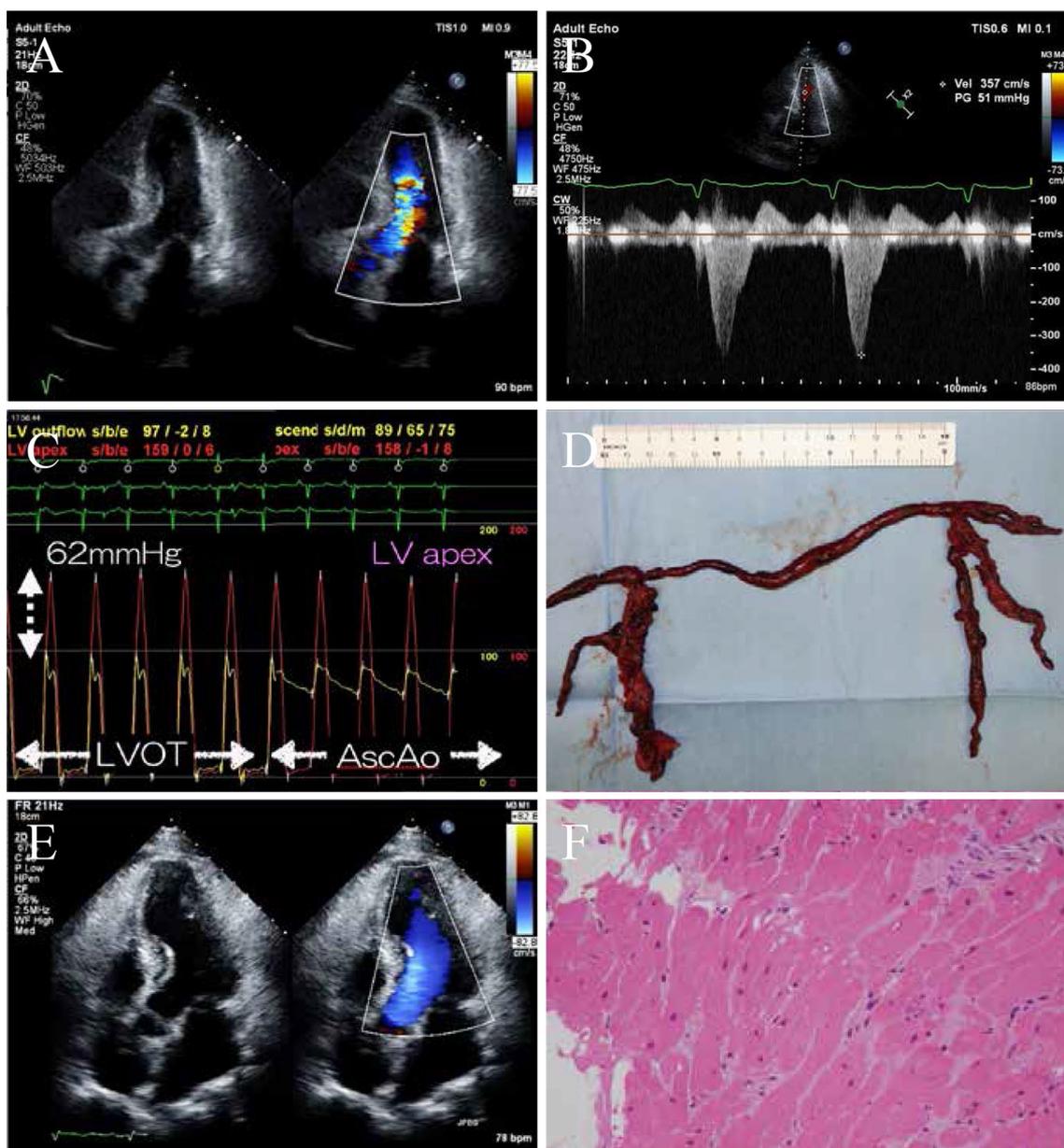
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**Fig. 1** **a** The echocardiogram upon admission revealed acceleration of flow in the LV mid-ventricle, suggesting LV mid-ventricular obstruction. **b** Continuous-wave Doppler of the LV mid-ventricle showed 51 mmHg of peak pressure gradient. **c** The simultaneous pressure wave of the LV-apex and LV-outflow revealed 62 mmHg of pressure gradient in the LV. A catheter placed in the LV-outflow was pulled back to the ascending aorta. **d** A huge thrombus was resected

from the bilateral pulmonary arteries. **e** After surgery, the LV mid-ventricular obstruction disappeared. **f** The histology findings of the right ventricular septum obtained by biopsy were incompatible with hypertrophic cardiomyopathy, such as a myocyte disarray with an irregular arrangement of abnormal-shaped myocytes. Hematoxylin-eosin staining, original magnification  $\times 100$

## Compliance with ethical standards

**Conflict of interest** Manabu Nitta, Teruyasu Sugano, Atsuihiro Shigenaga, Hikari Noda, Daisuke Machida, Makoto Mo, and Munetaka Masuda declare that they have no conflict of interest.

**Human rights statements and informed consent** All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and

with the Helsinki Declaration of 1964 and later revisions. Informed consent was obtained from all patients for being included in the study.

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