

CASE REPORT

## Takotsubo cardiomyopathy precipitated by delirium tremens

Chidozie Charles Agu, MD\*, Ahmed Bakhit, MD, Md Basunia, MD, Bikash Bhattarai, MD, Vikram Oke, MD, Divya Salhan, MD and Frances Schmidt, MD

Interfaith Medical Center, Brooklyn, NY, USA

A 57-year-old woman presented with alcohol withdrawal symptoms, which later progressed to delirium tremens. During hospitalization, she developed respiratory distress with acute pulmonary edema. Electrocardiogram (ECG) showed diffuse ST elevation with elevated cardiac enzymes. Echocardiogram showed estimated ejection fraction of 20–25% with characteristic apical ballooning. After several days of supportive care, the patient showed significant clinical improvement with normalization of ECG, cardiac enzymes, and echocardiographic findings. Coronary angiogram revealed no coronary abnormalities. Although Takotsubo cardiomyopathy has been associated with diverse forms of physical or emotional stress, only a few cases have been described with delirium tremens in the medical literature.

Keywords: *Takotsubo; delirium tremens; alcohol*

\*Correspondence to: Chidozie Charles Agu, Interfaith Medical Center, 1545 Atlantic Avenue, Brooklyn, NY 11213, USA, Email: chidoziecharles82@hotmail.com

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**T**akotsubo cardiomyopathy (TCM) also known as stress-induced cardiomyopathy is a clinical syndrome characterized by transient acute apical ventricular dysfunction in the absence of significant obstructive coronary artery disease (1) and is usually triggered by physical or emotional stressors. Clinical manifestations mimic that of an acute coronary syndrome with typical ST-T wave changes on electrocardiogram (ECG) and elevated cardiac enzymes. We herein present a case of TCM precipitated by delirium tremens.

### Case presentation

A 57-year-old African-American female, heavy alcohol drinker (1–2 pints of liquor daily), with no prior history of seizures presented to the emergency room complaining of alcohol withdrawal symptoms (anxiety, tremor, sweats, etc.). She had not been drinking her usual amount of alcohol and her last drink was 2 days prior. Her initial vitals were as follows: temperature 97.2°F, pulse rate 108 beats per minute, respiratory rate 22 breaths per minute, blood pressure 125/85 mmHg, and oxygen saturation 96% on room air. Her physical examination was unremarkable except for tremors and disorientation. Laboratory examination initially revealed electrolyte abnormalities including serum potassium of 3.1 (3.6–5.1 mEq/L), magnesium of 0.9 (1.5–2.4 mg/dL), and phosphorus of 1.6 (2.4–4.1 mg/dL),

all of which were adequately supplemented. Chest X-ray on admission was normal (Fig. 1). ECG revealed sinus tachycardia with non-specific T-wave abnormality (Fig. 2). The following day, the patient became tachycardic, agitated, and confused with auditory and visual hallucinations, delusions, tactile disturbances with a Clinical Institute Withdrawal Assessment of Alcohol Scale, Revised score of 22 indicative of delirium tremens. She was managed with IV

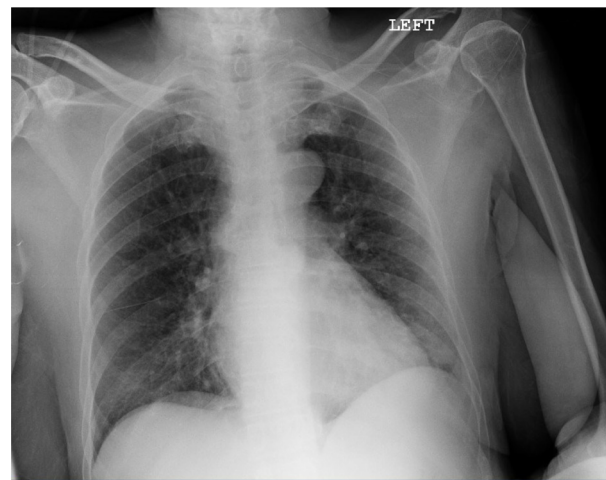
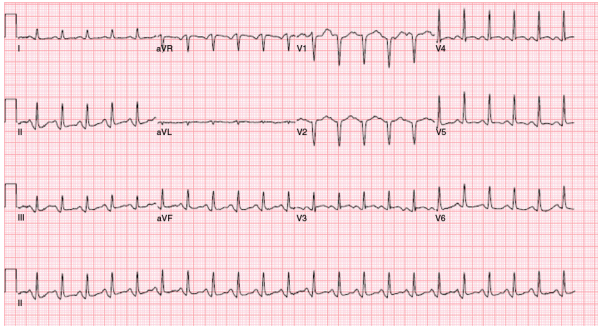
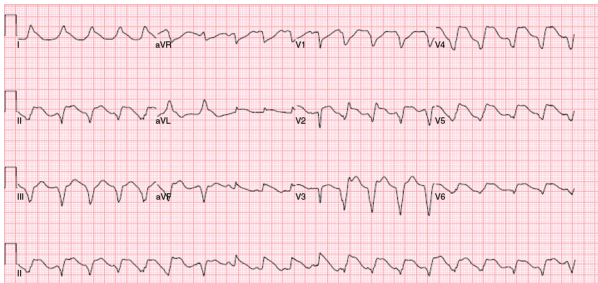


Fig. 1. Chest X-ray showing no active disease.



**Fig. 2.** Admission electrocardiogram showing sinus tachycardia and non-specific T-wave abnormality.

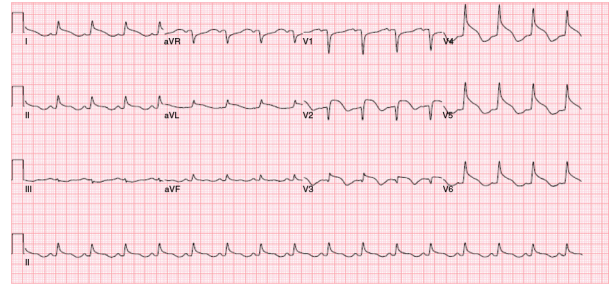
lorazepam as needed (symptom-triggered approach) and other supportive measures. Cardiac monitoring in the intensive care unit and a 12-lead ECG revealed episodes of non-sustained monomorphic ventricular tachycardia (Fig. 3). Serum electrolytes at this time revealed mild hypokalemia and mild hypomagnesemia and these were again supplemented. Troponin I level was elevated at 0.37 ng/mL (normal <0.05 ng/mL) with subsequent values trending downwards. She subsequently developed respiratory distress and hypoxemia. Chest X-ray obtained at this time was suggestive of pulmonary edema (Fig. 4). A trial of non-invasive positive pressure ventilation was unsuccessful



**Fig. 3.** Electrocardiogram showing ventricular tachycardia.



**Fig. 4.** Chest X-ray showing pulmonary vascular congestion.



**Fig. 5.** Electrocardiogram showing diffuse ST-segment elevation.

ful and she was placed on mechanical ventilation. A repeat ECG few hours later showed diffused ST elevation (Fig. 5), and a bedside echocardiogram revealed left ventricular dilatation with apical ballooning on systole with a left ventricular ejection fraction of 20–25% and normal pulmonary artery pressures (Fig. 6). TCM was suspected and supportive therapy was instituted. Significant clinical and radiological improvement (Fig. 7) leading to subsequent extubation was observed over the next few days. Cardiac enzymes returned to normal levels and ST-T wave changes resolved. She subsequently underwent cardiac catheterization, which revealed no significant coronary artery disease (Fig. 8a and b). A repeat transthoracic echocardiogram prior to discharge showed an ejection fraction of 55–60% with no wall-motion abnormalities.

**Discussion**

We highlight a case of TCM triggered by delirium tremens. The diagnosis was confirmed by the presence of cardiogenic



**Fig. 6.** Echocardiogram showing LV dilatation with apical ballooning.



*Fig. 7.* Repeat chest X-ray with improved lung aeration.

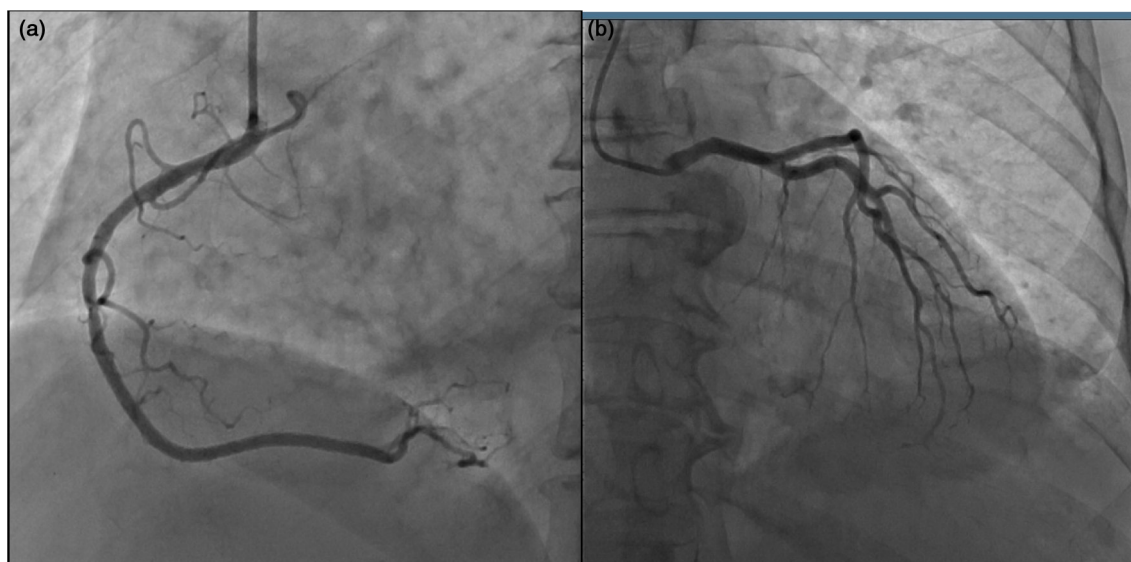
pulmonary edema, ST-segment elevation on ECG, modest elevation of troponin I, classical left ventricular apical ballooning pattern, which resolved after several days, and the absence of significant obstructive coronary artery disease on coronary angiography. We believe that electrolyte abnormalities caused by chronic alcoholism and poor nutrition may have contributed to the development of ventricular tachycardia in our patient.

TCM is a transient cardiomyopathy first described in Japan in 1990. It accounts for about 1% of acute coronary syndromes that present with elevated cardiac biomarkers (2).

In more than 85% of cases, it is provoked by either a physically or emotionally stressful event that precedes the onset of symptoms (3). In western countries, it has been reported more commonly in elderly women (4), unlike in Japan where men are reportedly more affected for

unclear reasons (5). In a recent review of the International Takotsubo Registry of European and American patients by Templin et al. (5), more than 50% of the patients had a history of neurologic and psychiatric disorders and this was significantly higher when compared with patients with an acute coronary syndrome. The pathophysiology of TCM remains unclear. Several mechanisms have been postulated. One hypothesis is that of an exposure to a surge in catecholamine levels causing direct myocyte injury, leading to acute myocardial stunning and transient hypokinesis (1, 6–8). This effect appears to be greatest at the apex, where  $\beta$ -adrenergic receptors are most predominant (1). Also recent studies have demonstrated catecholamine levels up to 34 times higher than normal resting values and significantly higher than levels attainable in acute myocardial infarction or heart failure (1). Another theory is the role of the brain–heart axis (5). The coronary microcirculation is innervated by brainstem neurons, which mediate vasospasm leading to transient myocardial ischemia and dysfunction. This may explain the association of TCM with some neurologic and psychiatric disorders including subarachnoid hemorrhage, status epilepticus, stroke, major depression, or anxiety (5).

Delirium tremens is a state of autonomic hyperactivity characterized by unopposed sympathetic activation with elevated central nervous system (CNS) and plasma catecholamine levels and a loss of inhibitory control of excitatory CNS neurotransmitters resulting in clinical manifestations such as tachycardia, hyperthermia, hypertension, agitation, tremors, and hallucinations with up to 5% mortality reported (9, 10, 11, 12). We believe that the development of TCM in patients with delirium tremens can be explained by either of the two aforementioned theories, that is, direct myocardial toxicity by catecholamines or CNS-mediated transient coronary vasospasm.



*Fig. 8.* (a, b) Coronary angiogram showing no significant coronary artery disease.

**Table 1.** Modified Mayo Clinic criteria for diagnosis of Takotsubo cardiomyopathy (TCM)

1. Transient hypokinesis, dyskinesis, or akinesis of the left ventricular midsegments, with or without apical involvement; the regional wall-motion abnormalities extend beyond a single epicardial vascular distribution, and a stressful trigger is often, but not always, present
2. Absence of obstructive coronary disease or angiographic evidence of acute plaque rupture
3. New electrocardiographic abnormalities (either ST-segment elevation and/or T-wave inversion) or modest elevation in cardiac troponin level
4. Absence of pheochromocytoma or myocarditis

Adapted from Kawai et al. (12). All four of the above-mentioned aspects must be present.

However, we have no substantial evidence to support either as the predominant mechanism in our patient.

TCM clinically mimics an acute coronary syndrome with presenting symptoms such as chest pain, dyspnea, abnormal ECG findings (typically ST elevations or less frequently, T-wave inversions), and modestly elevated cardiac enzymes (11). Echocardiogram typically demonstrates a low left ventricular ejection fraction with wall-motion abnormalities affecting the apical and mid-ventricular myocardium while sparing the basal myocardium (11). Coronary angiography reveals no significant obstructive coronary artery disease. The Modified Mayo Clinic criteria (Table 1) have been proposed for diagnosis (12). Left ventricular function and wall motion typically returns to normal within days to a few weeks, provided no further acute cardiac events occur. Treatment is supportive and the prognosis is excellent with recurrence occurring in <10% of patients (6, 11, 13). No significant benefit has been shown from aspirin,  $\beta$ -blockers, or ACE inhibitors (11).

The paucity of reported cases of TCM triggered by delirium tremens may be due to lack of routine cardiac ischemic evaluation or echocardiogram in the management of acute alcohol withdrawal or delirium tremens (11). TCM should be included in the differential diagnoses when managing patients presenting with acute alcohol withdrawal and signs and symptoms of chest pain or left ventricular dysfunction.

### Conflict of interest and funding

There are no conflicts of interest to declare.

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