Takotsubo cardiomyopathy triggered by status epilepticus: case report and literature review

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SUMMARY

Takotsubo cardiomyopathy (TC) is acute stress-induced cardiomyopathy with characteristic transient wall motion abnormalities. TC has a clinical presentation similar to an acute coronary syndrome, including chest pain or dyspnoea, ECG changes and elevated cardiac enzymes. TC often occurs after emotional stress. There are approximately 50 TC cases reported related to seizure activity, and our review revealed 15 articles which were associated with status epilepticus. This condition can be a serious complication of seizures. We report a case of TC after status epilepticus in a patient who had been seizure-free for 20 years.

BACKGROUND

Takotsubo cardiomyopathy (TC) is a rare complication of status epilepticus and important to identify in patients with haemodynamic compromise.

CASE PRESENTATION

The patient presented in this report is a 71-year-old woman with a medical history of right temporal parietal craniotomy with intracranial aneurysms clippings likely in the setting of previous intracranial haemorrhage (ICH), epilepsy likely secondary to ICH and deep vein thrombosis, not on anticoagulation. Her epilepsy had been well controlled on phenytoin, and the last seizure activity was 20 years ago. She presented in status epilepticus with generalised tonic-clonic seizures lasting 45 min, terminated by clonazepam in the emergency department. Postictal clinical examination revealed left gaze palsy and left hemiparesis. Imaging with CT brain demonstrated subtle right cerebral hemispheric reduced perfusion with evidence of previous aneurysm clip adjacent to the right internal carotid artery terminus and coiling of the left paraophthalmic internal carotid artery aneurysm. These changes were attributed to seizure activity, in the setting of 50% right internal carotid artery stenosis. Neurological examination findings were diagnosed as Todd's paresis which resolved within 12 hours.

INVESTIGATIONS

The patient was admitted to the intensive care unit for asymptomatic hypotension requiring vasopressor support. On further investigation, ECG demonstrated sinus rhythm with lateral ST elevation (I, aVL) and troponin levels were elevated peaking at 14 mcg/L (reference range <0.05).

Figures 1 Normal coronary arteries on angiogram of this patient.

Coronary angiography showed no significant flow-limiting coronary artery disease ([figures 1 and 2](#)), however, left ventriculography was suggestive of severe segmental systolic dysfunction affecting the mid-anterior and mid-inferior walls, consistent with mid-variant TC ([figures 3 and 4](#)). She was diagnosed with TC in the setting of status epilepticus.

DIFFERENTIAL DIAGNOSIS

Other differentials for causes of TC were considered less likely due to the lack of concurrent symptoms,

Figures 2 Normal left sided coronary arteries on angiogram.

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Figures 3 Left ventriculogram of the patient demonstrating mid ventricular ballooning.

especially phaeochromocytoma with no history of hypertension, headache, diaphoresis or palpitations.

TREATMENT

The patient was treated with sodium valproate for seizure control and commenced on perindopril, cardioselective beta-blocker and diuretics once blood pressure improved.

OUTCOME AND FOLLOW-UP

She was discharged with further outpatient neurological investigations planned, including MRI and EEG.

DISCUSSION

TC was first described in 1991 by Dote *et al* in Japanese patients.¹ It is also known as broken heart syndrome, stress

Figures 4 Left ventriculogram demonstrating mid ventricular ballooning and basal and apical sparing.

cardiomyopathy and apical ballooning syndrome. TC is usually triggered by a stressful situation, physical or emotional. The precise underlying pathophysiology has not been elucidated, but the condition is hypothesised to be associated with excessive and acute catecholamine release, with other factors such as vasospasm or microvasculature failure involved² leading to increased cardiac demand and toxicity leading to cardiac dysfunction. Secondary TC occurs in patients already hospitalised for another unrelated condition and usually presents without clear acute cardiac symptoms.^{3–6} There are many triggers associated with TC including psychological or physical stress. Various neurological conditions associated with TC include stroke, transient ischaemic attack, subarachnoid haemorrhages and seizures.^{7,8}

Stroke and stroke mimics such as epilepsy with or without Todd's paresis, migraine, hypoglycaemia and sinus thrombosis can trigger cardiac injury. CT perfusion (CT-P) has a definite role in acute stroke event and to differentiate between stroke mimics. Studies have shown evidence of hyperperfusion in CT-P being consistent with status epilepticus^{9,10} with some evidence of hypoperfusion on CT-P indicating postictal state.¹¹ Our patient's subtle CT changes could indicate postictal state or in the setting of right internal carotid stenosis. In addition to CT, MRI is prudent in patients with status epilepticus to further delineate the underlying aetiology,¹² especially for acute stroke and lesions.

The diagnosis of TC is based on seven diagnostic criteria, which include anatomical features, ECG changes, cardiac biomarkers and reversibility of the myocardial dysfunction.¹³ This condition occurs predominantly in postmenopausal women.

We retrieved data for review based on the search of Medline, PubMed and references from relevant articles using terms 'Takotsubo cardiomyopathy', 'stress cardiomyopathy', 'broken heart syndrome' with 'status epilepticus'. We found 13 case reports and 2 articles related to status epilepticus in adults with findings as shown in table 1.

This mini-review highlights the importance of considering the diagnosis of TC in patients with status epilepticus, non-convulsive or convulsive. Diagnostic tools such as ECG are prudent to assess myocardial injury quickly especially in the setting of haemodynamic compromise. TTE and cardiac catheterisation are used to assess extent of myocardial involvement and to exclude regional wall motion abnormality correlating to the specific vascular territory. In our review, age at occurrence was 47–83 years, with a female preponderance. Oestrogen is hypothesised to have desensitising properties on myocardial response to catecholamines, so postmenopausal women may have rebound hypersensitisation.¹⁴ Despite, moderate to severe dysfunction, most patients made near normal recovery of cardiac function within weeks to months. Vasopressor support, beta-blockers and ACE inhibitors have a role in the management of TC. There were no deaths attributed to TC.

Interestingly, most patients remain asymptomatic despite significant ECG, biochemical or echocardiographic changes. There were significant ECG and echocardiographic findings in most cases and although apical hypokinesis/akinesis was the most common finding (occurring in 11 of 13 case reports), other variants, similar to our case, were also reported.

TC predisposes patients to cardioembolic events, cardiogenic shock, heart failure, arrhythmia, ventricular wall rupture and sudden death. The acute mortality of this condition is up to 8%. TC after seizures has been suspected as a cause of sudden unexplained death in epilepsy (SUDEP) in some observational studies,^{5,15} which is a serious complication of seizures. Cardiac abnormalities are found in up to 33% patients at the time of

Table 1 Cases with status epilepticus associated takotsubo cardiomyopathy

Authors	Year	Age, Gender	ECG changes	Type of status epilepticus	Echocardiography findings
Sakuragi <i>et al</i> ¹⁷	2007	59, F	Anterolateral STE	Non-convulsive	Anteroseptal and apical hypokinesis
Shimizu <i>et al</i> ¹⁸	2007	82, F	Anterior and inferior STE	Convulsive	
Seow <i>et al</i> ¹⁹	2008	62, M	Anterior STE	Convulsive	Mid-ventricular hypokinesis
Legriel <i>et al</i> ²⁰	2008	54, F		Convulsive	Apical hypokinesis
Bosca <i>et al</i> ²¹	2008	61, F	TWI V4- V6	Convulsive	Lateral–apical hypokinesis
Fugate <i>et al</i> ²²	2009	82, F	Anterior STE	Convulsive	Apical akinesis
Traulle <i>et al</i> ²³	2011	50, M	Lateral STE	Convulsive	Apical akinesis
Wakabayashi <i>et al</i> ²⁴	2011	68, F	Anterior and inferior TWI	Convulsive	Mid to apical segmental akinesis
Benyounes <i>et al</i> ²⁵	2011	79, F	Anterior and lateral TWI	Non-convulsive	Apical hypokinesis
Finsterer <i>et al</i> ²⁶	2013	47, F		Convulsive	Apical and mid ventricular akinesis
Hocker <i>et al</i> ²⁷	2013	3/35 patients, 2/3 F	ST and T wave changes	Convulsive and Non-convulsive	RV and LV dysfunction
Belcour <i>et al</i> ²⁸	2015	15/31 patients, 61% Male	Variable ST and T wave changes	Convulsive	Mean LVEF 45%
Koo <i>et al</i> ²⁹	2015	83, F	Anterior STE	Convulsive	Mid to apical LV akinesia and RV apical hypokinesis
Uemura <i>et al</i> ³⁰	2016	61, F	TWI I, II, aVf, V2-6	Non-convulsive	Apical akinesis
Miller <i>et al</i> ³¹	2017	49, F	TWI	Convulsive	Mid to apical akinesis

STE, ST elevation; TWI, T wave inversion.

autopsy of SUDEP with histopathological findings being similar to catecholamine-induced myocardial disease.¹⁶

Learning points

- This case highlights the importance of suspecting takotsubo cardiomyopathy (TC) in postseizure patients, especially in older patients with haemodynamic compromise.
- The prevalence of TC in patients with status epilepticus is unknown.
- Low threshold for investigations such as ECG and transthoracic echocardiogram in high-risk patients following prolonged seizure activity may be recommended.

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