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CASE REPORT

Takotsubo syndrome with severe bradycardia initiated by seizure: Is the implantation of a permanent pacemaker necessary?

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Accepted 22 September 2018

SUMMARY

Although arrhythmias are frequent in patients with Takotsubo syndrome (TTS), data on sick sinus syndrome remain elusive. Here, we report a case of TTS initiated by a seizure as a physical trigger that led to sinus arrest. The patient presented with cardiogenic shock and bradycardia which required intensive cardiovascular care. However, in the subacute phase of TTS, the sinus function recovered significantly, and pacemaker implantation was deferred.

BACKGROUND

Takotsubo syndrome (TTS), alternatively called stress-induced cardiomyopathy, is a recently recognised transient and reversible syndrome that typically presents as apical akinesis or dyskinesis of the left ventricle.^{1,2} A number of previous reports described a variety of arrhythmias in patients with

TTS.^{3–6} However, data pertaining to sick sinus syndrome in patients with TTS are limited.

Therefore, we report a case of TTS subsequent to a seizure acting as a physical trigger presenting with sinus arrest where the indication for pacemaker implantation will be discussed.

CASE PRESENTATION

A 77-year-old woman with a history of epilepsy following cerebral infarction was admitted to the hospital for a general tonic–clonic seizure. Intravenous administration of diazepam terminated the seizure, and she regained consciousness. However, 12 hours later, she suddenly developed shock with bradycardia and was transferred to our hospital for intensive cardiac care.

There was no significant emotional or physical stress that could act as the trigger for TTS, except the episode of epilepsy. Her medical history included paroxysmal atrial fibrillation, dyslipidaemia, early-stage dementia and a history of treatment for breast cancer. Her medication included an anticoagulant, statin and lamotrigine, but no antiarrhythmic agent. Her systolic blood pressure was below 60 mm Hg, and heart rate was 47 beats/min (bpm). Chest X-ray showed cardiomegaly with pulmonary oedema. Twelve-lead ECG showed a wide QRS rhythm without a preceding P wave at a heart rate of 47 bpm, suggesting a ventricular escape rhythm. T-wave inversion was confirmed in leads III, aVF and V4–V6 (figure 1).

Transthoracic echocardiography (TTE) revealed akinesis from the middle to the apical portion of the left ventricle. In addition, the akinesis involved the middle to the apical portion of the right ventricle (figure 2). Coronary angiography (CAG) was immediately performed which revealed significant stenosis in the proximal diagonal branch; however, this finding could not explain the left ventricle akinesis from the middle to the apical portion (figure 3). On admission, the serum creatine kinase level was 553 IU, troponin T level was 1.62 ng/mL and peak serum creatine kinase level was elevated to 707 U/L. There were no significant electrolyte abnormalities.

Intensive care with intra-aortic balloon pumping, mechanical ventilation and temporary VVI pacing stabilised the haemodynamic condition and oxygen levels; however, severe liver dysfunction had developed owing to the cardiogenic shock and required

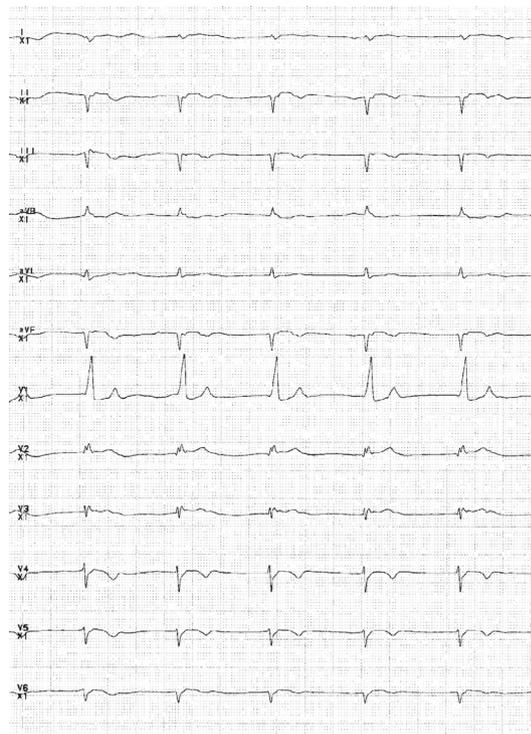


Figure 1 Twelve-lead ECG. Initial ECG showed sinus arrest/sinus block with a wide QRS escape rhythm (R–R=1288ms) and T wave inversion in leads III, aVF and V4–V6.



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To cite: Imori Y, Iwasaki Y-K, Takano H, et al. *BMJ Case Rep* Published Online First: [please include Day Month Year]. doi:10.1136/bcr-2018-226480



Figure 2 Four-chamber view of the transthoracic echocardiogram (TTE). Left: diastolic phase; right, systolic phase. TTE described akinesis of the mid to apical portions of both the left and right ventricles.

plasmapheresis in the acute phase. Eventually, the patient recovered completely from the cardiogenic shock. Normal left ventricular ejection fraction with recovery of regional wall motion was seen on TTE 2 weeks later, and the patient was diagnosed with TTS. Diagnosis of apical-type TTS was also confirmed using cardiac MRI, wherein the subacute phase of myocardial oedema from the middle to the apical wall was seen on T2-weighted imaging. Once the ventricular systolic function normalised, a P wave was detected on the 12-lead ECG (data not shown), and the temporary pacemaker was no longer needed.

An electrophysiological study was performed because marked bradycardia with cardiogenic shock was confirmed in the intensive care unit, although the ECG showed no bradycardia during her stay on the general ward. Sinus node recovery time estimated with 30 s high right atrial burst pacing at a cycle length of 400 ms was 1.8 s without any symptoms. Atrio-His block was confirmed at 310 ms, estimated with single extrastimulus pacing from a high point in the right atrium at a basic cycle length of 600 ms. These results suggest that sinus and atrioventricular (AV) node functions were almost normal. Moreover, there was no retrograde AV node conduction due to right ventricular pacing. These results indicate that the cause of bradycardia on admission was sinus arrest with escaped wide QRS rhythm associated with TTS.

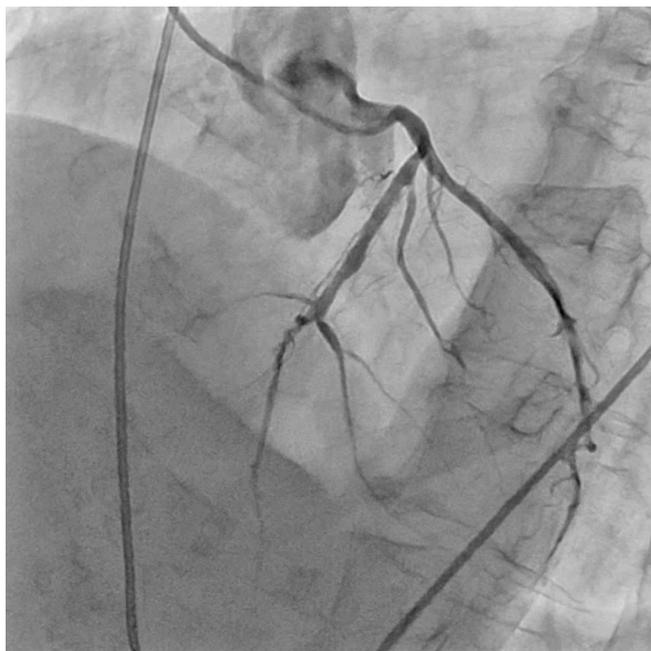


Figure 3 Coronary angiography (CAG). CAG revealed 90% stenosis in the proximal diagonal branch, but this finding could not explain the wall motion abnormalities.

OUTCOME AND FOLLOW-UP

Symptomatic paroxysmal atrial fibrillation was detected, and the average heart rate increased to 72 bpm by the first month of follow-up. Therefore, the oral β -blocker, bisoprolol, was prescribed for atrial fibrillation. Holter ECG at the sixth month of follow-up revealed 103 546 beats per day in the presence of bisoprolol, and there was no significant bradycardia.

DISCUSSION

This was a case of TTS with sinus arrest initiated by a seizure as a physical trigger. Pacemaker implantation was deferred because the patient's sinus function had recovered significantly, and she had favourable outcomes on long-term follow-up.

It is challenging to establish a valid association between TTS and sinus node dysfunction. Microvascular dysfunction or endothelial dysfunction, which have recently been considered TTS aetiologies, are possible explanations for sinus arrest in the present case.⁷ The sinus node is perfused by branches of the right coronary artery or by the left circumflex artery.⁸ Since there was broad biventricular impairment in the present case, the vascular dysfunction was also indicated to be extensive; this could have resulted in sinus arrest.

The present case presented bradycardia. However, the heart rate in the acute phase of TTS was relatively high, in general, where the potential role of catecholamine excess in the pathogenesis of TTS had long been debated.⁹ In a previous report from a multicentre registry from the Tokyo metropolitan area, the median heart rate of patients with TTS on admission was 87 bpm (range 75–108 bpm).¹⁰ The sinus node was innervated by the parasympathetic and sympathetic nervous systems.⁸ Hence, imbalance between the sympathetic and parasympathetic activity may have a key role in the heart rate and sinus dysfunction in the acute phase of TTS; however, evaluation of these systems in the acute phase is difficult.

A standard therapeutic strategy for a patient TTS presenting with sinus arrest has not been established. In this case, we decided not to perform pacemaker implantation for three reasons. First, sinus arrest was considered to occur secondary to TTS, and was not a primary cause of TTS. Usually, it is difficult to distinguish TTS as a secondary occurrence due to bradycardia from TTS as a primary occurrence followed by bradycardia. However, in the present case, there was obvious evidence that TTS followed the seizure which is known to be a typical physical trigger of TTS. Second, in the subacute phase of TTS in this patient, sinus arrest recovered when ventricular systolic function normalised. In fact, while patients who have critical bradycardia caused by a reversible disease, such as myocardial infarction, often require temporary pacemaker support, in most circumstances permanent pacing is not commonly recommended by the guidelines. Third, there was no history of syncope suggesting the presence of bradycardia. Various arrhythmias, such as ventricular tachycardia, ventricular fibrillation, asystole and complete AV block, were complications seen in 8%–14% of patients with TTS in previous studies.^{3–6} However, data regarding the prevalence and outcome of sick sinus syndrome in TTS remain elusive. In a recent study of 286 consecutive patients, 4 cases of sick sinus syndrome were reported. Of these, only one patient underwent permanent pacemaker implantation during the acute stage of TTS and death from an unknown cause was reported a year after the initial event.⁴

Thus, we conclude that observation with a temporary pacemaker is important for recovery from sinus node dysfunction in cases of TTS with sick sinus syndrome, especially when TTS is not caused by bradycardia.

Learning points

- ▶ Management of sick sinus syndrome after Takotsubo syndrome (TTS) has not been elucidated.
- ▶ Sinus node recovery can occur in the setting of TTS with sick sinus syndrome, particularly when TTS is not caused by bradycardia.
- ▶ This case report suggests that continued observation following placement of a temporary pacemaker is important.

Contributors YI, YI and HT contributed to the concept, design, data analysis, writing, editing, formatting of the main manuscript. WS reviewed and approved the final manuscript. All authors, YI, YI, HT and WS, certify that they have participated sufficiently in the work to take public responsibility for the content, including participation in the planning, design, conduct and writing.

Funding This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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REFERENCES

- 1 Templin C, Ghadri JR, Diekmann J, *et al*. Clinical Features and Outcomes of Takotsubo (Stress) Cardiomyopathy. *N Engl J Med* 2015;373:929–38.
- 2 Dote K, Sato H, Tateishi H, *et al*. [Myocardial stunning due to simultaneous multivessel coronary spasms: a review of 5 cases]. *J Cardiol* 1991;21:203–14. (in Japanese).
- 3 El-Battrawy I, Lang S, Ansari U, *et al*. Prevalence of malignant arrhythmia and sudden cardiac death in Takotsubo syndrome and its management. *Europace* 2017; <https://doi.org/>.
- 4 Stiermaier T, Rommel KP, Eitel C, *et al*. Management of arrhythmias in patients with Takotsubo cardiomyopathy: Is the implantation of permanent devices necessary? *Heart Rhythm* 2016;13:1979–86.
- 5 Stiermaier T, Eitel C, Deneß S, *et al*. Prevalence and Clinical Significance of Life-Threatening Arrhythmias in Takotsubo Cardiomyopathy. *J Am Coll Cardiol* 2015;65:2148–50.
- 6 Migliore F, Zorzi A, Peruzza F, *et al*. Incidence and management of life-threatening arrhythmias in Takotsubo syndrome. *Int J Cardiol* 2013;166:261–3.
- 7 Naegele M, Flammer AJ, Enseleit F, *et al*. Endothelial function and sympathetic nervous system activity in patients with Takotsubo syndrome. *Int J Cardiol* 2016;224:226–30.
- 8 James TN. The sinus node. *Am J Cardiol* 1977;40:965–86.
- 9 Wittstein IS, Thiemann DR, Lima JA, *et al*. Neurohumoral features of myocardial stunning due to sudden emotional stress. *N Engl J Med* 2005;352:539–48.
- 10 Murakami T, Yoshikawa T, Maekawa Y, *et al*. Gender Differences in Patients with Takotsubo Cardiomyopathy: Multi-Center Registry from Tokyo CCU Network. *PLoS One* 2015;10:e0136655.

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