Takotsubo syndrome and complete heart block, which came first? A case report

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Background

In 2018, the European Society of Cardiology published two consensus documents on takotsubo syndrome (TTS), which include the current consensus on nomenclature, diagnosis, management, and complications. However, little is mentioned on the association with complete heart block (CHB), except that ‘AV block [occurs in] 2.9% of cases’. Complete heart block is a recognized rare association of TTS, but causation is often unclear. Does CHB trigger TTS or vice-versa? Here, we present a case of TTS associated with CHB.

Case summary

An 89-year-old woman presented with a transient loss of consciousness, acute chest pain, and dyspnoea. A few days prior to this her daughter died suddenly of a myocardial infarction. On presentation, troponin levels were elevated, the electrocardiogram showed CHB with a broad QRS and an echo showed apical akinesis and ballooning. Angiographic investigation excluded significant coronary artery disease. A dual-chamber pacemaker was implanted after a brief period of temporary pacing. Ventricular function normalized during follow-up and her underlying rhythm remained CHB.

Discussion

Takotsubo syndrome may be triggered by both emotional and physical stressors. Complete heart block is recognized association, but causation is often unclear. In our case, a clear emotional trigger was identified suggesting the TTS may have precipitated CHB not vice versa.

Keywords

Takotsubo syndrome • Complete heart block • Stress-induced cardiomyopathy • Case report

ESC Curriculum

2.2 Echocardiography • 5.9 Pacemakers • 6.5 Cardiomyopathy

Learning points

• Takotsubo syndrome may cause a complete heart block (CHB).
• Takotsubo syndrome associated with CHB is likely to require permanent pacing.

Introduction

Takotsubo syndrome (TTS) was initially described in 1990 as a case series in a Japanese textbook.1

Takotsubo syndrome often mimics an acute myocardial infarction, frequently presenting with chest pain and dyspnoea, electrocardiogram (ECG) changes of ST-elevation and elevation of cardiac enzymes. Takotsubo syndrome is characterized by transient left ventricular dysfunction (classically with apical ballooning) with wall motion abnormalities not typically conforming to coronary territories. Coronary artery disease may co-exist in 10–29% of patients, making diagnosis more challenging in these cases. Takotsubo

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have been reported in the literature as a rarity. Some cases suggest that atrioventricular (AV) block triggered the TTS, others the converse, while most do not ascribe causation. In the most recent reported cases cited above insertion of a permanent pacing system was required. A recent analysis found that of ~56,000 cases of TTS 0.7% had co-existing CHB; of these, the majority required permanent pacing. Here, we describe a case of TTS with CHB.

**Timeline**

| Day 1 | Presented with collapse, chest pain, and shortness of breath. Electrocardiogram demonstrated complete heart block (CHB) with T-wave inversion in V1–6. Hypotensive and bradycardic, administered atropine and subsequently isoprenaline with good haemodynamic effect. Troponin and D-dimer elevated. Computed tomography pulmonary angiogram: no pulmonary embolism. Bedside echo: Left ventricular function mildly reduced overall with akinesis of the apex and all apical segments. Hyperdynamic basal segments. Admitted to High dependency unit (HDU). |
| Day 2 | Transferred to nearby tertiary centre for an angiogram. Intermittent CHB with ventricular tachycardia on arrival into the catheter lab. Isoprenaline stopped, temporary pacing wire inserted. Coronary angiogram and ventriculogram: Unobstructed coronary arteries, apical ballooning present with hypercontractile base. Dual-chamber pacemaker implanted following angiogram and ventriculogram. Moved to intensive care as a precaution. |
| Day 3 | Haemodynamically stable stepped down to the cardiology ward. Secondary prevention medications started. |
| Day 4 | Departmental echo performed: biplane left ventricular ejection fraction: 48%. Regional wall motion abnormalities consistent with takotsubo syndrome. |
| 6 weeks | Outpatient pacing check: underlying CHB. Atrial pacing 17%, ventricular pacing 99% (with lower rate limit of 60 b.p.m.). |
| 6 months | Outpatient pacing check: underlying CHB. Atrial pacing 24%, ventricular pacing 97%. Echocardiogram: normal left ventricular ejection fraction with no regional wall motion abnormalities. |

**Case presentation**

An 89-year-old woman collapsed at the dinner table and was helped to the floor by family members who report that she transiently lost consciousness. On regaining consciousness, she complained of chest pain and dyspnoea. Prior to this episode, the patient had a very stressful few days with the sudden death of a family member.

An ambulance was called, the 12-lead ECGs showed CHB with a broad QRS and T-wave inversion in leads V1–V6 (Figure 1). On arrival to the emergency department, she was bradycardic at 45 b.p.m. and hypotensive 80/60 mmHg. On admission, blood tests revealed a normal full blood count and renal profile, a raised D-dimer at 2200 ng/mL (normal <400 ng/mL), high-sensitivity troponin-I 550 ng/L (normal <11.6 ng/L), and brain natriuretic peptide 1341 ng/L (normal <20 ng/L). C-reactive protein was mildly elevated at 22 mg/L (normal <10 mg/L). She was given a bolus dose of atropine followed by an isoprenaline infusion to good effect with haemodynamic stability achieved.

A computed tomography pulmonary angiogram was performed showing no evidence of pulmonary embolism.

Subsequently, a transthoracic echocardiogram revealed akinesis of all left ventricular apical segments and apical ballooning with hyperdynamic basal segments (Figure 2).

The patient was transferred to a tertiary centre for an angiogram given the presentation of what appeared to be an acute coronary syndrome (ACS). On arrival to the catheter lab, the patient had persistent CHB with intermittent non-sustained ventricular tachycardia, possibly precipitated by isoprenaline. The isoprenaline was stopped and a transvenous temporary pacing wire was inserted.

Coronary angiography revealed minor coronary artery disease with a dominant right coronary artery (Figure 3). A left ventriculogram showed a classic appearance of TTS with extensive apical and mid wall akinesia, with hyperdynamic basal segments and high left ventricular end-systolic pressure of 25 mmHg (Figure 4; Video 1). Given the absence of significant coronary disease and the persistence of haemodynamically compromising CHB, the patient underwent dual-chamber pacemaker implantation.

Her past medical history included carotid artery stenosis (under surveillance), hypercholesterolaemia, gastro-oesophageal reflux disease, and anxiety. She was an ex-smoker of 60 pack-years and had a good baseline functional status, being independently mobile and independent of all activities of daily living. Her regular medications included Bezafibrate MR 400 mg once a day, Citalopram 10 mg once a day, Clopidogrel 75 mg once a day, Lansoprazole 30 mg once a day, and Paracetamol PRN and Ranitidine 150 mg twice a day.

Departmental echocardiography was performed and demonstrated biplane left ventricular ejection fraction of 48% and persisting regional wall motion abnormalities consistent with TTS. Inflammatory markers and troponin levels were reduced on the days following her admission and after a period of observations on the wards, she was discharged home.

Interrogation of her pacemaker at both 6 weeks and 6 months showed underlying CHB, stable lead measurements and >97% pacing in the right ventricular lead. Repeat echocardiography at 6 months...
Figure 1  Electrocardiogram during admission (A, B) both showing complete AV dissociation. There is a relatively narrow QRS escape rate of approximately 48bpm with intermittent ventricular ectopy. There is also widespread T wave inversion in the chest leads.
also demonstrated near normalization of left ventricular function with no apical regional wall motion abnormalities.

**Discussion**

Takotsubo syndrome has multiple synonyms including stress-induced cardiomyopathy, broken heart syndrome, takotsubo cardiomyopathy, and apical ballooning syndrome. The 2018 consensus documents suggest using TTS. Retaining ‘takotsubo’ acknowledges the Japanese physicians that initially described the disorder, with the characteristic ventricular shape resembling a Japanese octopus pot (tako = octopus, tsubo = pot). Furthermore, they argue that using the term ‘cardiomyopathy’ in the description is inaccurate, as TTS shares more with ACS than it does a cardiomyopathy. Finally, with its spectrum of physical and emotional triggers, they assert that the use of ‘syndrome’ is most appropriate.

Takotsubo syndrome was previously considered a relatively benign condition. However, rates of cardiogenic shock and death are comparable to ACS, with rates of death and major adverse cardiac and cerebrovascular events estimated to be 5.6% and 9.9% per-patient year, respectively. A number of severe haemodynamic and electrical complications are recognized including pump failure, sustained ventricular tachycardia or ventricular fibrillation, advanced AV block, ventricular thrombus formation, pulmonary oedema, ventricular septal defect, and free wall rupture.

Estimates of the prevalence of TTS associated with CHB include 0.7% and 2.2%. Both of these analyses found that TTS with CHB was associated with a worse prognosis and found that most patients...
~75% required a permanent pacing system. An important question remains relating to the relationship between TTS and CHB. Several possibilities exist including: CHB is a physiological stressor that triggers TTS, TTS causes CHB or that the association is coincidental and there is no causation.

In our case, there was a very clear emotional trigger to the clinical presentation; the sudden death of a family member. Therefore, the first hypothesis that CHB is the cause of TTS seems unlikely. The final hypothesis suggesting the conditions were coincidental to one another also seems highly unlikely given the nature of the presentation and no preceding history. In this case, we propose the clinical presentation of TTS leading to a CHB is the most likely causal relationship.

Another important clinical question in TTS with CHB is if and when to insert a permanent pacing system. As discussed above, the limited published literature suggests most (but not all\(^\text{10}\)) patients with TTS associated with CHB will require a permanent pacemaker\(^4\text{-}^9\), as did our patient. Complete heart block with haemodynamic instability is indeed a European Society of Cardiology Class I indication for permanent pacing. A further hypothesis generating question relates to the underlying pathophysiology of persistent CHB in TTS?

The transient myocardial oedema that occurs in TTS is thought to play a role in AV conduction abnormalities\(^\text{10}\) and may be one proposed mechanism. However, this has not been clearly demonstrated, nor fully explains the persistence of permanent significant conduction disease.
Conclusion

Our case describes advanced conduction disease presenting in the context of TTS. Early permanent pacemaker implantation is likely necessary in such cases with ongoing haemodynamic instability and no reversible causes are found.

Lead author biography

Dr Mohammad Khurram Nadeem is a clinical fellow in Royal Brompton Hospital, London. His research interests include hypertension and peripheral vascular disease.

Supplementary material

Supplementary material is available at European Heart Journal - Case Reports online.

Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as Supplementary data.

Consent: The authors confirm that written consent for submission and publication of this case report including images and associated text has been obtained from the patient in line with COPE guidance.

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