CASE REPORT

Wearable cardioverter defibrillator in stress cardiomyopathy and cardiac arrest

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SUMMARY

A 57-year-old woman presented with nausea, vomiting and diarrhoea. She had severe hypokalaemia and hypomagnesaemia with marked QTc (680 ms) prolongation after suspected viral diarrhoea. She then developed progressive dyspnoea with congestion. An echocardiogram was obtained and showed severe hypokinesia with apical ballooning and hyperdynamic cardiac base, suggestive of stress cardiomyopathy. A repeat ECG showed further prolongation of the QTc (883 ms) and she rapidly developed polymorphic ventricular tachycardia. She underwent cardiac arrest and was successfully resuscitated. A coronary angiogram confirmed the diagnosis of stress cardiomyopathy. We had therapeutic dilemma at discharge to implant a permanent automated implantable cardiac defibrillator in view of the high risk for recurrent ventricular tachycardia, or follow-up for resolution of both reversible causes of the prolonged QTc (stress cardiomyopathy and electrolyte abnormalities). We suggested an alternate treatment for sudden death prevention in high risk patients who have reversible cause for QT interval prolongation.

BACKGROUND

Stress cardiomyopathy (Takotsubo) is characterised by reversible left ventricular wall motion abnormalities, extending beyond a single epicardial vascular distribution and in the absence of obstructive coronary artery disease. It usually affects elderly women usually after a stressful event or severe acute illness. The ECG typically shows ST segment elevation or T wave inversions and QT interval prolongation. The treatment is supportive and the prognosis is usually favourable.¹ This patient was unusual with severe electrolyte abnormalities and QTc prolongation which led to cardiac arrest in polymorphic ventricular tachycardia event during hospitalisation requiring secondary prevention for sudden cardiac death (ie, AICD), as the QTc persisted prolonged at the time of discharge. The AICD implantation however, would commit the patient to a permanent device for a potentially reversible (treatable) cause, where an implantable hardware could be avoided. The temporary treatment with wearable cardioverter defibrillator (WCD) and close follow-up was effective and this approach presents as an alternate therapy with no additional risk. By writing this up evidence is provided for a very effective non-invasive treatment.

CASE PRESENTATION

A 57-year-old woman with 2-day history of nausea, vomiting and diarrhoea with unremarkable prior

medical history was diagnosed with severe hypokalaemia (2 mmol/dL) and hypomagnesaemia (1.2 mg/dL), laboratory testing including stool samples testing and review of history were inconclusive for a cause, and viral aetiology for diarrhoea was suspected. The ECG is shown (figure 1). Besides, sinus bradycardia and diffuse T wave inversion, the QTc interval was 680 ms. On day 2 of admission, the patient could not sleep due to anxiety. The diarrhoea has resolved, but the patient started to have dyspnoea and signs of congestion for which an echocardiogram and ECG were obtained. The echocardiogram showed severe hypokinesia with apical ballooning and hyperdynamic cardiac base, whereas the ECG demonstrated markedly prolonged QTc of 883 ms. The electrolytes were back to normal range. Subsequently on the same day the patient developed cardiac arrest due to polymorphic ventricular tachycardia requiring defibrillation. There was no family history of sudden death and she was not on any medication recently to have contributed to prolongation of QT. She underwent emergent cardiac catheterisation which showed no obstructive disease in the coronary arteries. The left ventriculogram showed severe apical ballooning with an ejection fraction of 20%. The findings were consistent with stress cardiomyopathy, although no stressors were identified other than severe malaise due to diarrhoea and vomiting, and anxiety for being in the hospital. The patient was treated supportively, including a temporary transvenous pacer for faster pacing and to shorten the QT interval during the subsequent days of hospitalisation. On day 8, she had diffuse T wave inversion on ECG and a QTc of 521 ms, but was hemodynamically stable and able to be discharged out of the hospital. As she had an episode of unstable Torsades de Pointes (TdP), β -blocker was avoided to prevent eventual recurrence in case of bradycardia.

We believed that the severe prolongation of QT was secondary to stress cardiomyopathy based on the evidence published but we did have a therapeutic dilemma at discharge whether to implant an AICD in view of cardiac arrest and prolonged QTc, or follow-up for resolution in view of associated stress cardiomyopathy and severe electrolyte abnormality. She remained at high risk for recurrent ventricular tachycardia and sudden cardiac death.

OUTCOME AND FOLLOW-UP

The patient was discharged with a WCD after complete orientation about the device and details regarding medications to avoid in future in view of prolonged QTc were provided. The patient was

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Figure 1 ECGs during disease and recovery.

able to follow the instructions and was able to wear the device as advised but admitted to the fear of possible defibrillation anytime and had limited herself to a certain extent and made sure that a family member was around her most of the time. She was followed up in the clinic 2 weeks later and the echocardiogram showed normal left ventricular ejection fraction. She was in sinus bradycardia at 52 bpm, and a QTc of 416 ms (figure 1). The WCD was then discontinued.

DISCUSSION

We report a case of a relatively young woman with a combination of predisposing factors for prolonged QT: stress cardiomyopathy, hypomagnesaemia and hypokalaemia. The QTc worsened

during her hospitalisation, led her into cardiac arrest due to polymorphic ventricular tachycardia (TdP), which was successfully treated. A WCD was placed before committing the patient to a permanent intracardiac device, given the fully reversible nature of the process. If during the recovery period further events were noted, then an AICD implantation should be considered for long-term management. Further studies are needed to confirm this hypothesis.

LifeVest (figure 2) is the WCD approved for sales in the USA and Europe. Unlike an AICD, the LifeVest is worn outside the body rather than implanted in the chest. Common indications for WCD are patients with early postmyocardial infarction with severe left ventricular dysfunction and left ventricular ejection

Figure 2 LifeVest (Image courtesy Zoll Medical Corp.).

fraction (LVEF) <35, newly diagnosed non-ischemic cardiomyopathy with LVEF <35, as a bridge to heart transplantation or a temporary inability to implant an ICD due to infection. Patients and family are explained to reduce unprotected situations off WCD (like during shower) to a minimum and to be assisted by family. The WCD represents an alternative approach to prevent sudden arrhythmic death until either AICD implantation is clearly indicated or the arrhythmic risk is considered significantly lower or even absent.²

It is proposed that the temporary QT prolongation reflects the transient myocardial insult of stress cardiomyopathy. Although this phenomenon predisposes for ventricular tachycardia, frequency of such event is as low as 1%.³ Recurrence of stress cardiomyopathy can be up to 11.4% but survival rates are no different to age-matched and gender-matched population.⁴ Stress cardiomyopathy has been shown to be associated with life-threatening ventricular arrhythmia in over 8% of cases as noted from a registry of consecutive patients and should be recognised among the causes of acquired long QT syndrome and can be associated with risk of Tdp.⁵

Recently Tdp and sudden death have emerged as complications associated with stress cardiomyopathy; however, described only in few case reports. It was suggested as an association between the prolongation of the presenting and maximal QTc intervals in development of Tdp. A cut-off QTc of 500 ms during the acute phase of stress cardiomyopathy is considered as a predictor for Tdp, with sensitivity and specificity greater than 80%.⁶ Findings from the WEARIT-II registry suggest that in real world management strategies using WCD can be safely used to bridge a decision for appropriate AICD therapy.

WCD can be as effective as AICD. In a US postmarket study of 3569 patients, 80 sustained ventricular tachycardia/ventricular fibrillation (VT/VF) events occurred and a first shock success in terminating VT/VF was 100% among unconscious patients and 99% for all patients.⁷

Learning points

- ▶ Temporary QT prolongation is noted with stress cardiomyopathy and it reflects the transient myocardial insult and it usually resolves to normal in few weeks after recovery.
- ▶ When Torsades de Pointes (TdP) occurs during stress cardiomyopathy, the risk for sudden cardiac death increases.
- ▶ A wearable cardioverter defibrillator is an effective alternative to implanted automated implantable cardiac defibrillator and its associated risks, especially given the fully reversible nature of the process.
- ▶ This case is a learning example for complex presentation of stress cardiomyopathy and its associated complications and management strategies.

Contributors FCN identified the case, was involved in follow-up of the patient, drafted and edited the report. RKK was involved in drafting the report. HH reviewed and edited the report. OS was involved in drafting the article and approved the final version of the manuscript. All four authors were involved in managing the case and are the contributors as being responsible for the overall content as guarantors.

Competing interests None.

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