CASE REPORT

Refractory ventricular fibrillation managed by coronary revascularisation performed during ongoing manual cardiac resuscitation lasting 1½ h

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SUMMARY

Myocardial infarction is the most common cause of ventricular arrhythmias. Although there have been several improvements and refinements in coronary catheterisation with percutaneous intervention over the years, this intervention is still rarely considered during active ongoing resuscitation of patients, especially in cases of persistent ventricular arrhythmias. We present a case of refractory ventricular fibrillations due to in-stent thrombosis that was managed by emergent coronary angiogram and stent placement during ongoing cardiopulmonary resuscitation in a code that lasted about 1½ h. The patient subsequently made an excellent recovery and was discharged home 13 days later.

BACKGROUND

The role of cardiac catheterisation after ventricular arrhythmias is well established. Given that acute myocardial infarction (MI) is the most common culprit of ventricular arrhythmias and sudden cardiac death,¹ the American Heart Association (AHA) guidelines recommend consideration of coronary angiogram in all cases of ventricular arrhythmias even in the absence of ECG evidence of MI.² Early coronary intervention and therapeutic hypothermia have been shown to improve survival post-cardiac arrest due to ventricular fibrillations.³ However, in cases of persistent and prolonged ventricular arrhythmias, emergent coronary imaging and intervention during simultaneous cardiopulmonary resuscitation (CPR) is still uncommon in contemporary coronary catheterisation laboratories.

CASE PRESENTATION

We present a case of a 47-year-old man who presented to the Emergency Department (ED) with severe substernal chest pain, nausea and diaphoresis. An ECG taken in the ED revealed ST-elevation MI in the inferolateral leads (figure 1). A code STEMI (ST segment elevation MI) was activated but the patient immediately converted to fine ventricular fibrillation (VFib) rhythm on telemetry. CPR, including electrical cardioversion, chest compressions and pharmacological resuscitation, was immediately started. The arrhythmia proved to be refractory despite resuscitation for 30 min and a decision was made to transfer the patient to the catheterisation facility for emergent angiogram. The patient was emergently taken to the catheterisation laboratory where coronary angiogram was performed with ongoing CPR, as VFib intermittently

presented throughout the procedure, revealing an acute coronary occlusion of the right proximal coronary artery. A 3.0×22 mm bare metal stent was placed at the culprit artery with good flow and, soon after, the patient converted to sinus rhythm with pulses. The patient was loaded with ticagrelor 180 mg and then transferred to a nearby tertiary cardiac centre for further complicated care including hypothermia protocol and continuous renal replacement therapy (CRRT).

En route to the facility, the patient again converted to ventricular tachycardia. CPR was reinitiated in the ambulance and continued on arrival to the tertiary hospital. There was a brief interval of spontaneous circulation after arrival to the hospital, during which a repeat ECG was taken (figure 2). This showed marked ST elevation in the inferoposterior leads, raising concern for acute stent thrombosis of the newly placed stents. The patient continued to be in persistent VFib for which he was once again taken for coronary angiogram, again with continued CPR. During the entire procedure, he received electrical cardioversion a total of six times along with ongoing chest compressions and pharmacological resuscitation. The second angiogram revealed acute stent thrombosis of the recently placed bare metal right coronary artery (RCA) stent. Manual thrombus aspiration was performed using a 6 Fr export catheter. Further angiogram revealed significant residual thrombus in the RCA. An AngioJet (mechanical aspiration) device was then used for thrombus removal from the RCA. A balloon angioplasty was performed and two 4.0×30 mm Integrity rapid exchange (RX) bare metal stents (BMS) were deployed to revascularise the RCA, with good results (figure 3). Immediately after revascularisation, the ventricular arrhythmias terminated and the patient returned to spontaneous circulation.

The total duration of the CPR, including time in the catheterisation laboratory, was 81 min. Despite the prolonged duration of CPR and complicated intervention, the patient had a quick recovery with good neurological recovery eliminating the need for hypothermia. His hospital stay was complicated by acute kidney injury for which he initially received CRRT and later intermittent dialysis. Otherwise, he made a swift recovery, with extubation in 4 days, and was discharged on the 13th day of inpatient stay.

OUTCOME AND FOLLOW-UP

The patient followed up as an outpatient with cardiology and nephrology. He had excellent

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Figure 1 First ECG taken on arrival of patient showing ST elevation in the inferolateral leads. As evident, there is significant motion artefact in the ECG due to extreme diaphoresis and agitation.

recuperation from a cardiovascular standpoint with minimal fatigue and no dyspnoea on exertion or anginal chest pain. He underwent cardiac rehabilitation and had a good functional recovery. Echocardiography as an outpatient revealed inferolateral akinesis but a normal ejection fraction of 55–60%.

DISCUSSION

With the ever increasing incidence of MI, the recognition of STEMI and prompt treatment is increasingly important. The present case highlights several important issues in the management of persistent ventricular arrhythmias: most importantly, reiterating the importance of considering coronary angiogram in ventricular arrhythmias. MIs associated with cardiac arrhythmias have a very high mortality rate if definite treatment of underlying coronary artery disease is not urgently undertaken.⁴ There have been reported cases of successful coronary catheterisation during CPR, but in most cases the patients had a coronary

catheterisation planned beforehand and went into arrhythmias peri-procedurally followed by angiogram during the code.^{5 6} In this case, the decision for coronary angiography during cardiac resuscitation was taken after the patient had gone into arrhythmia for two different episodes of persistent ventricular dysrhythmias, on the same day; the procedure was successfully accomplished and resulted in excellent cardiac outcome for the patient.

The initial cardiac rhythm before the onset of an arrhythmia is an important indicator of underlying pathology and is therefore indispensable for further decision-making in cardiac resuscitation. In this case, the initial and subsequent ECGs both showed ST elevation, which supported the decision for emergent angiography.⁷

In-stent thrombosis, as seen in this case, is a rare but dreaded complication of coronary artery stenting. Stent thrombosis should be considered in any patient who presents with acute

Figure 2 ECG again showed ST elevation myocardial infarction in the inferoposterior leads.

Figure 3 First coronary angiogram: (A) right coronary artery (RCA) obstruction at the proximal to mid-portion. (B) Post-percutaneous coronary intervention after placement of 2.0x2.2 mm BMS. Second coronary angiogram: (C) in stent thrombosis in recently placed RCA stent. (D) Two bare metal stents and balloon angioplasty were deployed to the area of in-stent thrombosis with good results.

coronary syndrome after percutaneous coronary intervention (PCI) with stenting. Our patient received adequate antiplatelet therapy with aspirin and ticagrelor load peri-procedure. Also, on review of the angiogram, there was no sign of inadequate stent deployment or poor flow in either inflow or outflow tract. There were no signs of edge dissection near the stent edges. As such, there were no clear implicated reasons for the development of acute stent thrombosis in our case.

Survival after cardiac arrest has poor overall rates and the probability of good neurological and functional recovery after resuscitation generally declines rapidly as the duration of resuscitation increases. Reynolds *et al*⁸ noted a steep fall in the probability of good functional recovery after mechanical resuscitation with increasing duration of CPR. More importantly, they reported that repeating the same therapies that did not work in the first 10–15 min, did not result in an increased survival benefit. However, as in this case, early recognition of cardiac arrest, immediate initiation of effective resuscitation with chest compressions, electrical cardioversion attempts and pharmacological support, along with definitive management of underlying disease in a patient with no other major

comorbidities and good postresuscitative management, may have improved the outcomes. In this case, adequate cerebral perfusion was most likely maintained despite the prolonged code, which resulted in quick neurological recovery. But none of the above interventions would have influenced the final consequence without immediate perfusion of the culprit artery.

Conventional resuscitation in patients who fail to adequately respond to it may need to be supplemented with novel alternative techniques to help with the resuscitative efforts. However, with limitations of resources, costs, training and expertise, these techniques should be rationally applied and individualised to obtain the maximal benefit for a patient in the appropriate setting.

Contributors UBB was involved in the conceptualisation, design, acquisition of images, and manuscript writing and editing. AB was involved in manuscript writing and editing. AS was involved in review of the angiograms and referencing. PB was involved in the literature review, angiogram review for the case and manuscript editing and reviewing.

Competing interests None declared.

Patient consent Obtained.

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Learning points

- It is important to keep a high index of suspicion for in-stent thrombosis in patients with recent percutaneous coronary intervention who present with chest pain and ventricular arrhythmias.
- Urgent coronary angiogram should be considered for most cases of ventricular arrhythmias.
- Coronary angiogram and revascularisation with simultaneous cardiopulmonary resuscitation may be necessary and efficacious in cases of persistent ventricular arrhythmias.

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