A Collapsed Sportsman With a Shock Advised in Sinus Rhythm

The Importance of Automated External Defibrillator Rhythm Strip Retrieval Prior to Defibrillator Implantation

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Automated external defibrillators (AEDs) in public spaces have saved countless cardiac arrest victims. They rely on rhythm detection algorithms with high specificity for recognizing ventricular arrhythmia when used appropriately. AED diagnostics can be difficult to retrieve once the patient has arrived in hospital, with patient management decisions often made in their absence. We present a case where retrieval of an AED download was critical to manage.

An 18-year-old Afro-Caribbean semiprofessional basketball player collapsed for the first time while slowing down after a sprint in the middle of a match at a local gymnasium. This was his first collapse episode. He had no past medical history or family history of sudden death. First responders were unable to detect a peripheral pulse, and bystander cardiopulmonary resuscitation (CPR) was commenced by one of his teammates. A Zoll AED Plus was available and applied in under 2 minutes, promptly advising shock delivery. Having received a 120 J shock, consciousness was recovered within 30 seconds, and the patient was transferred to our Cardiology unit by the emergency services for specialist assessment. Baseline 12 lead ECG was unremarkable.

Cardiac magnetic resonance imaging revealed no structural abnormality or myocardial scar. Computed tomographic coronary angiography demonstrated unobstructed coronary vasculature. Exercise testing did not induce any ischemia or arrhythmia. Invasive electrophysiological testing showed normal intracardiac conduction and no tendency to atrial or ventricular arrhythmia, despite aggressive electric stimulation. The patient was scheduled for secondary prevention cardioverter defibrillator implantation.

Before device implantation, we engaged with the gymnasium who advised us that the AED was being serviced by an AED instruction “Do not touch patient,” the CPR waveform trace shows ongoing compressions with associated ECG artifact. Rhythm detection was performed in part during these compressions, resulting in the AED algorithm misinterpreting artifact as a ventricular arrhythmia and advising shock delivery. CPR was eventually stopped before the device charging, revealing spontaneous sinus bradycardia at 45 bpm and R-R variability, but the device algorithm had already committed to delivering therapy. Sinus activity was seen marching through the CPR-induced artifact.

AED rhythm strips with annotation of the verbal prompts and therapy delivery markers are stored in the AED memory. However, these data are not routinely accessible in hospital because of challenges exporting the data, the need to purchase company-specific software to view the data, and as many devices are privately managed. As a result, clinicians have not always recognized the importance of AED data retrieval. A universal means of data retrieval incorporated within all manufactured AEDs with ease of following the patient to hospital via the emergency services would prove invaluable. Failure to review the strips in this case could have had life-changing consequences. Inappropriate AED shocks have also been reported from artifact related to artificial ventilation, a moving ambulance, pacemaker spikes, and intrinsic algorithm errors. This crucial evidence must be reviewed to inform clinical decision-making and avoid unwarranted implanted cardioverter defibrillator implantation.

The cause for syncope in this case remains uncertain. Sinus bradycardia is unusual in the peri-arrest context because of the likelihood of high sympathetic tone. The bradycardia and R-R variation is indicative of high vagal tone, suggesting vasovagal syncope. This inappropriate shock might have been avoided with AED algorithms that filter CPR artifact during rhythm detection and increased public awareness of the stand clear prompts. The patient declined an implantable loop recorder and tilt testing. He remains well with no further collapse episodes.
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References


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