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Short communication

Semiologic, electroencephalographic and electrocardiographic correlates of seizure-like manifestations caused by cardiac asystole

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ABSTRACT

Purpose: Cardiac asystole is known to cause clinical manifestations mimicking seizures. The recognition of this uncommon phenomenon is important to expedite appropriate clinical intervention and avoid unnecessary morbidity as well as potential mortality.
Methods: We retrospectively reviewed video-electroencephalographic (EEG) records from January 2008 to December 2013 for relevant cases.
Results: We identified four patients who experienced nine events of asystole accompanied by seizure-like activity captured on video-EEG. None had evidence of epilepsy on video-EEG. Semiological features of captured clinical events included aura, automatisms, generalized tonic activity and focal as well as generalized myoclonus. No patient had generalized tonic-clonic seizures. A peculiar rapid breathing pattern was seen preceding the onset of asystole. General pallor was observed during asystole, followed by flushing on recovery. Seizure-like semiology was observed in three stages; pre-asystole, during asystole and after resumption of cardiac rhythm. The EEG demonstrated generalized slowing followed by generalized suppression during asystole and generalized slowing again on resumption of sinus rhythm ("slow-flat-slow" pattern). All patients had dual-chamber pacemakers implanted. On follow-up, they have remained symptom-free without antiepileptic medications.
Conclusions: Cardiac asystole can be associated with features closely mimicking seizures. Recurrent episodes of cardiac asystole can be stereotypical in a given patient. There are some diagnostic clues in semiology.

1. Introduction

Determining the etiology of recurrent episodes of loss of consciousness (LOC) is a common clinical problem faced by neurologists. The differential diagnoses range from cardiac arrhythmias, syncope and psychogenic non-epileptic seizures to epileptic seizures; all of which require prompt and accurate diagnosis and treatment. This assessment becomes complicated as there is considerable semiological similarities and occasional interplay among these diagnoses. For instance, cardiac arrhythmias may be precipitated by seizures [1]. Furthermore, seizure-like activity may occur during syncope [2–10]. This case series highlights the clinical importance of seizure-like activity related to cardiac asystole (SRCA). Additionally, we detail the timeline and interrelationship among electrocardiographic (ECG), EEG and clinical phenomena (Fig. 1, Supplementary Table 1, Video 1, Video 2).

2. Methods

Medical records of all patients admitted for inpatient video-EEG monitoring at Monash Medical Center, Melbourne, Australia between January 2008 and December 2013 were reviewed retrospectively to identify those who had seizure-like events related to asystole. The demographic information, clinical details and investigations were collated from medical records. Video-EEGs were analyzed in detail by the same investigator (US) to ascertain the relationships among semiology, EEG and ECG. This study was approved by the Monash Health Human Research Ethics Committee.

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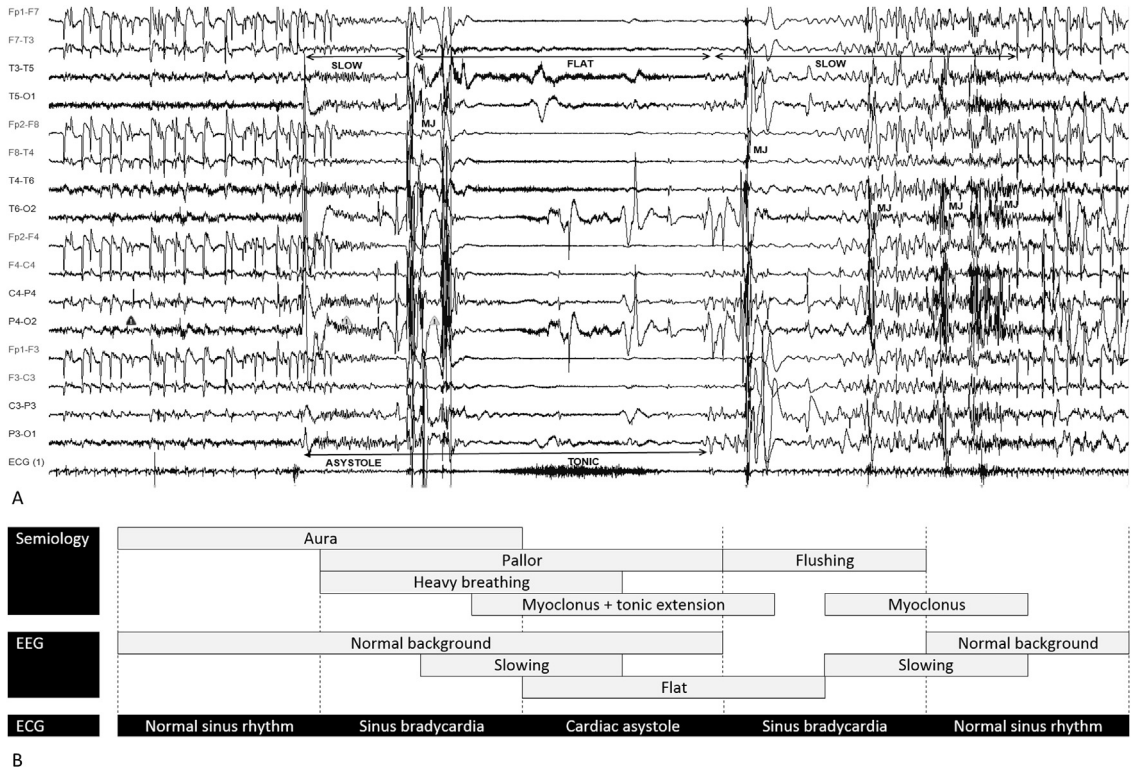

Fig. 1. Interrelationship among ECG, EEG and semiology. (a) Electroencephalography and electrocardiography changes during asystole. This figure represents a single page of the video-electroencephalogram (EEG) recording of case 3, incorporating a single-channel electrocardiogram (ECG), corresponding to 120 s (time-base compressed to 120 s/page). The EEG demonstrates 'slow' and 'flat' phases during cardiac asystole, followed by the second 'slow' phase after resumption of cardiac sinus rhythm. Myoclonic jerks (MJ) occur during asystole and after resumption of sinus rhythm. Tonic posturing (TONIC) occurs during asystole and note the tonic muscle artifact captured on the ECG channel. Reproduced with permission from the publisher (Xu et al. [8]). (b) Relationship among electrocardiogram, electroencephalogram and semiology of seizure-like activity related to cardiac asystole. This figure illustrates the evolution of semiology and EEG before, during and after asystole. Note the three phases of seizure-like activity (aura-myoclonus/tonic-myoclonus), EEG (slow-flat-slow) and ECG (pre-asystole, asystole, post-asystole).

3. Results

From a total of 252 patients, four were identified who had nine typical clinical events captured on video-EEG. Two cases (cases 3 and 4) have been previously published [8].

3.1. Case 1

A 69-year-old woman presented with four LOC episodes over 6 months. She described feeling light-headed before losing consciousness. During these episodes, she looked dazed and pale with her head slumped. She was unresponsive for a minute or two before complete recovery with no postictal symptoms. Whilst unconscious, though usually flaccid, she occasionally experienced right hand twitching. Her examination and cardiac investigations were normal (Table 1). The video-EEG captured facial grimacing, rapid breathing and pallor with generalized EEG slowing during the second half of the 29 second bradycardia phase. During asystole, the EEG illustrated generalized suppression accompanied by myoclonic activity of the right upper limb. With circulatory recovery, the EEG transitioned from a 'flat' waveform to generalized slowing and finally normal alpha rhythm (Table 1 and Supplementary Table 1). A dual-chamber permanent pacemaker (PPM) was implanted with no further events at 2-year follow-up.

3.2. Case 2

A 47-year-old man presented with LOC episodes since childhood. These episodes were preceded by light-headedness and lasted seconds before recovery with a mild headache. His wife described him looking pale during unresponsive periods accompanied by jerky movements of his arms at the end. These episodes were diagnosed as epileptic seizures and treated with sodium valproate. His clinical examination and cardiac investigations were normal (Table 1). During video-EEG monitoring, he experienced an aura of light-headedness during sinus bradycardia. The transition to asystole coincided with generalized EEG slowing, followed by flattening. Semiologically, the asystole phase was characterized by rapid breathing and generalized tonic posturing. Upon sinus rhythm resumption, upper body myoclonus was observed. A dual-chamber PPM was implanted and sodium valproate was ceased. He has not experienced any episodes of LOC for 2 years on follow-up.

3.3. Case 3

A 26-year-old female presented with eight LOC events over 7 years. She described a 'butterfly sensation in her chest,' heart 'skipping a beat' and occasional epigastric sensation (auras) that marked the onset of her LOC. This lasted a few seconds before transforming into generalized stiffening and some jerking of limbs associated with lateral tongue biting and urinary incontinence. These episodes were diagnosed as epileptic seizures and treated with lamotrigine. Her clinical examinations and cardiac investigations were normal (Table 1). During video-EEG, whilst her ECG and EEG were normal, the patient experienced an aura. The following bradycardia and asystole phases were associated with rapid breathing and eyes rolling back. Generalized EEG slowing occurred at the commencement of asystole. EEG flattening appeared at the conclusion of asystole and coincided with tonic posturing and myoclonic jerks. Myoclonic jerks were again witnessed with