Heart obeys the brain: ictal asystole

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Case report

Heart Obeys the Brain: Seizure Ceases Cardiac Rhythm

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Abstract

Ictal asystole is a rare phenomenon which may contribute to sudden death during epilepsy. Here we describe a case of a 20-year-old woman with ictal asystole and normal findings during electrophysiologic study. This case illustrates that ictal asystole may occur in patients with electrically normal hearts. We provide pathophysiologic considerations and discuss therapeutic options.

Case Report

A 20-year-old woman presented with medically refractory temporal lobe epilepsy associated with syncopal episodes. Magnetic resonance imaging of the brain yielded cortical dysplasia and encephalomalacia, which was attributed to prenatal cerebral ischemia.

During a 24-hour video EEG monitoring for preoperative evaluation of temporal lobe surgery, the patient developed a complex partial seizure with oral and ocular automatisms followed by a syncopal episode, which coincided initially with a sinus pause with two junctional escape beats (Figure 1, panels A and B), and later with a complete cardiac asystole for 18 seconds (panels B and C). The patient fell backwards within 8 seconds, showed right-sided myoclonic convulsive movements followed by extensor spasms for another 11 seconds (panels C and D). Thereafter, cardiac rhythm resumed with a sinus tachycardia (120 beats/min). Ictal EEG activity with theta
activity was initially recorded from the left temporal region spreading to frontal areas. Ten seconds after the onset of syncope, subdelta activity was found followed by generalized high frequency alpha activity. The EEG returned to normal after resumption of regular heart activity (panel E).

The patient had no previously known cardiac abnormalities. The 12-lead surface ECG and the echocardiography were normal. Invasive electrophysiologic study demonstrated normal sinus nodal function, normal intracardiac conduction times and refractory periods, and no inducible supraventricular or ventricular tachyarrhythmia.

**Discussion**

Cardiac arrhythmias are frequently observed during epileptic seizures. The most common arrhythmia is sinus tachycardia. Sinus bradycardia is found in up to 6 percent of patients with partial seizures.\(^1\)

Ictal asystole is a rare phenomenon, which may contribute to sudden death during epilepsy (SUDEP). In larger series, ictal asystole has been demonstrated in 0.27-0.4 percent of patients undergoing video EEG monitoring.\(^2-4\) However, a higher rate of ictal asystole might be detected if the duration of rhythm monitoring is extended. In a long-term ECG study of 20 patients using implantable loop-recorders ictal asystole of at least 5 seconds was observed in three patients (15%), corresponding to an incidence of 16 ictal asystole events per 100 person-years of monitoring.\(^5\) This is consistent with the rate of 21–32 ictal asystole events per 100 person-years of monitoring observed in the two largest video-EEG series, assuming a mean monitoring duration of 10 days in such studies.\(^6\)
Ictal asystole is characterized by a sudden loss of postural tone occurring late during the clinical event, usually preceded by a period of asystole longer than 8 seconds and associated with EEG changes typically seen during cardiac arrest and cerebral hypoperfusion. Ictal asystole is most frequently characterized by loss of sinus nodal function or sinoatrial block without activation of an underlying escape rhythm. However, progressive AV block has also been reported.

Clinical factors predisposing for ictal asystole, including cardiovascular risk factors, baseline ECG abnormalities, or genetic determinants have not been identified.\(^7\) Lethal bradyarrhythmia may be provoked by seizure-induced activation of autonomic centers in the brain through a direct effect on postganglionic discharges on the heart.\(^8\) In animal experiments, the so-called lock-step phenomenon has been demonstrated, which shows a synchronization of the cardiac postganglionic autonomic discharges with epileptogenic activity.\(^9\) However, the cardioinhibitory effect on the heart during epileptic seizures could also reflect activation of the limbic system mediated through medullary reflex centers as seen in patients with vasovagal asystole provoked by fear, emotional stress, or pain.\(^10\) Our case with temporal onset epilepsy causing a remarkable 18-second cardiac asystole documented during a 24-hour video EEG monitoring demonstrates that, on electrophysiologic evaluation, abnormal sinus nodal function or impaired atrioventricular conduction are not prerequisites for the occurrence of ictal asystole.

Pacemaker therapy is frequently used in patients with ictal asystole. However, the benefit of cardiac pacing is not well established. In a double-blind randomized trial, pacing therapy did not reduce the risk of recurrent syncope in patients with vasovagal syncope.\(^11\) Therefore, further investigation on the role of cardiac pacing is warranted in patients with ictal syncope. In conclusion, ictal asystole is a rare phenomenon which is characterized by a secondary seizure
associated with loss of postural tone usually preceded by a period of asystole. It may occur in patients with normal sinus nodal function and with normal AV conduction.

Disclosures: none.
Figure Legend

Figure 1. EEG of a 20-year-old woman demonstrating asystole (ECG, bottom line) during epileptic seizure.


