

## Original Article

# Cardiac asystole in frontal lobe epilepsy: a potential cause of sudden unexpected death in epilepsy

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**Abstract:** Background: Mechanisms involved in the causation of sudden unexpected death in epilepsy (SUDEP) are not well-understood. Ictal asystole has been identified as a cause of SUDEP in patients with temporal lobe epilepsy. Herein, we report a patient who developed cardiac asystole during the ictal period of frontal lobe epilepsy. Case Report: A 35-year-old man presented with a history of progressive nocturnal stiffness in the left lower extremity since six years and that of paroxysmal episodes of altered consciousness. In the last two years, he sustained epileptic seizures which presented as closed eyes, wheezy phlegm in the throat, facial pallor, moist cold skin, clenched fists, and limb stiffness; the episodes lasted 3-4 minutes. The seizures did not respond to antiepileptic therapy. Twenty four-hour electrocardiography monitoring showed transient atrial tachycardia, supraventricular premature beats, and cardiac asystole. Conclusion: Frontal lobe epilepsy may be a potential cause of SUDEP. Clinician should be aware of this condition.

**Keywords:** Cardiac asystole, frontal lobe epilepsy, sudden unexpected death in epilepsy

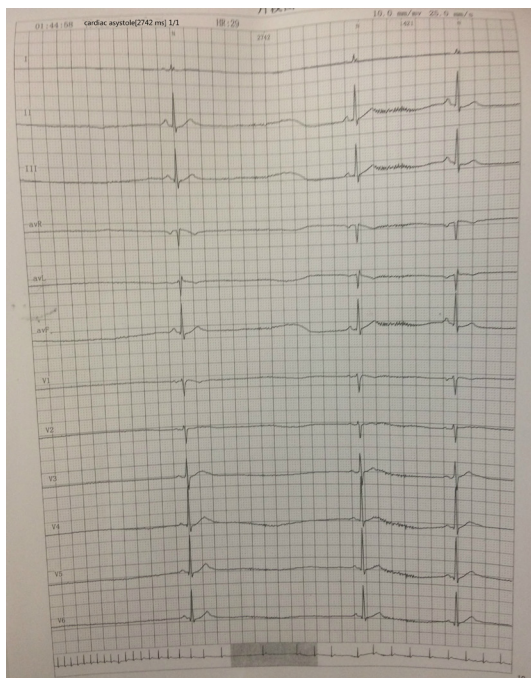
## Introduction

Sudden unexpected death in epilepsy (SUDEP) refers to the sudden unexplained death of a person with epilepsy, in the absence of any obvious traumatic, toxicological or anatomical cause [1]. The exact cause of SUDEP is still unknown. The most common reported causes of SUDEP include seizure-induced hypoventilation and ictal cardiac arrhythmias such as bradycardia and asystole [2]. We report a patient who sustained cardiac asystole during the ictal period of frontal lobe epilepsy.

## Case report

A 35-year-old, previously healthy man presented to us in May 2016 with a history of progressive nocturnal stiffness in the left lower extremity since 6 years and paroxysmal episodes of altered consciousness. The left-leg stiffness occurred in clusters of 2-3 weeks duration at intervals of approximately 3 months. During the episodes, he experienced brief intermittent nocturnal attacks which lasted for 2-3 seconds. During the initial four years, there was no dis-

turbance of consciousness. In November 2014, the patient suffered a seizure during which manifested as eyes closed, wheezy phlegm in the throat, facial pallor, moist cold skin, clenched fists, and limb stiffness; the seizure lasted 3-4 minutes. His relatives volunteered that he opened his eyes and responded to verbal commands during the seizure; however, the patient had no memory of the seizure. In April 2016, two such seizures occurred early in the morning. During the second attack, ambulatory electrocardiography (ECG) indicated cardiac asystole. A diagnosis of epilepsy was made, and oxcarbazepine was prescribed at a dosage of 150 mg twice daily. The patient did not respond to antiepileptic treatment. There was no history of trauma or infection; the family history was unremarkable. Twenty-four-hour ECG monitoring showed transient atrial tachycardia, supraventricular premature beats (34 times with two repetitive beats), and cardiac asystole (3 times) (**Figure 1**). Electroencephalogram (EEG) monitoring, brain magnetic resonance imaging (MRI), and cardiac electrophysiology showed no significant abnormality (**Figure 2**). Ultrasonic cardiogram (UCG) revealed atrial en-



**Figure 1.** Dynamic electrocardiogram showing cardiac asystole.

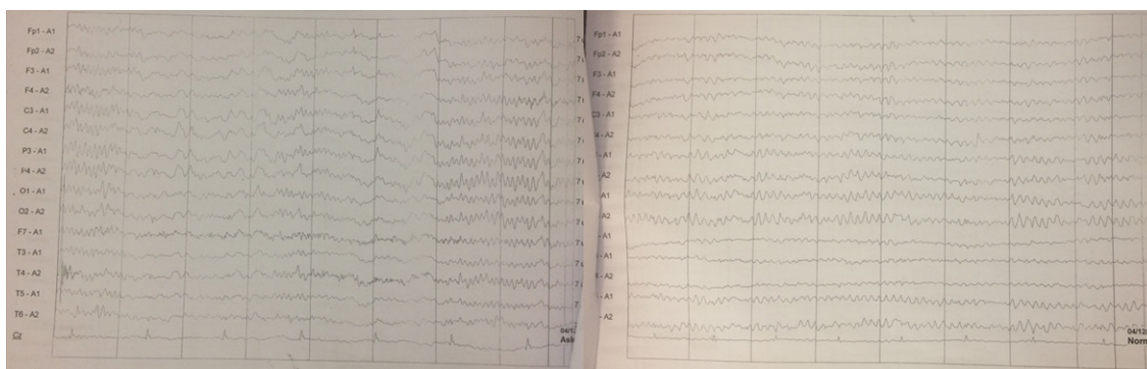
largement, mitral regurgitation, tricuspid regurgitation, and abnormal systolic function of the left ventricle.

## Discussion

Epilepsy is a common clinical syndrome with recurrent neuronal discharges in the cerebral cortex. Patients with epilepsy are known to be at a higher risk of premature death as compared to that in the general population, and SUDEP is the most common cause. SUDEP accounts for approximately 7.5% to 17% of all epilepsy-related deaths and for 50% of all deaths in patients with refractory epilepsy [3]. In recent years, an association between epileptic seizures and cardiac dysfunction has been reported [4]. Ictal cardiac arrhythmias, especially bradycardia and asystole, have been shown to be associated with epileptic seizures. Additionally, ictal cardiovascular abnormalities are also common autonomic manifestations of epilepsy. Epileptic activity originating from amygdala, gyrus cinguli, insular cortex, frontopolar, or frontal-orbital regions was proposed to be a cause of cardiac dysfunction including supraventricular tachycardia, sinus tachycardia, sinus bradycardia, sinus asystole, atrioventricular block, and asystole [5]. Epilepsy-related

tachycardia is more common in patients with temporal lobe epilepsy, especially those that originate from the medial temporal lobe [6]. We speculate that this may be due to proximity of the medial temporal lobe to the cortical and subcortical centers that regulate the autonomic nervous function (such as insular lobe). Therefore, epileptic discharge could involve the autonomic efferent pathways and cause tachycardia. Compared to tachycardia, post-ictal bradycardia and asystole are relatively rare but severe complications [7]. Epilepsy-related ictal asystole refers to the transient cessation of cardiac electrical activity during an epileptic episode; the condition is defined by the absence of ventricular complexes for > 4 seconds during an ongoing seizure episode confirmed on electroencephalography [8]. In a previous systematic review, the prevalence of ictal asystole in patients with refractory epilepsy was reported to be 0.318%; further, in the majority of patients, the seizure onset (91%) was in the temporal lobe. Moreover, nearly all episodes of ictal asystoles were reported to be self-limiting [9]. In a study by Schuele et al., 80% of the patients with ictal asystole had temporal lobe seizures while 20% of these had extratemporal lobe epilepsy [10]. Ictal asystole caused by frontal lobe epilepsy is extremely rare.

In the current case, the patient presented with nocturnal, cluster-onset stiffness in the left lower extremity. Although EEG monitoring showed no peri-ictal seizure activity, the clinical manifestations suggest that the seizure originated from the supplementary motor area (SMA) in the frontal lobe, which is consistent with a diagnosis of frontal lobe epilepsy. The negative EEG findings might be related to the deep location of the neuronal discharge pathway which is liable to be missed by scalp electrodes. In the recent 2 years, we observed three grand mal seizures, and a diagnosis of Adams-stokes syndrome caused by asystole was suspected. The patient had no history of cardiovascular disease, and thus we believe that the asystole might be related to frontal lobe epilepsy. Frontal lobe epilepsy is the second most common type of epilepsy after temporal lobe epilepsy, and both forms are characterized by occurrence of partial seizures. The symptoms and clinical manifestations of frontal lobe epilepsy are variable depending on which specific area of the frontal lobe is affect-



**Figure 2.** Electroencephalogram showing no abnormality.

ed. However, frontal lobe epilepsy manifesting as ictal asystole is rare. As ictal asystole has been identified as a potential cause of SUDEP, we should be aware of the possible link between SUDEP and frontal lobe epilepsy.

However, the optimal preventive and therapeutic strategies for epilepsy-related ictal asystole needs further research in a larger cohort. Early identification of epileptic seizures and potential cardiac dysfunction as well as the risk of SUDEP should be highlighted.

## Conclusion

We presented a patient with frontal lobe epilepsy who developed ictal asystole; our findings suggest a possible linkage between frontal lobe epilepsy and cardiac asystole. Clinicians should be aware of this condition as epilepsy-related cardiac asystole may be associated with SUDEP.

## Disclosure of conflict of interest

None.

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