Atrial Fibrillation Associated With Epileptic Seizures

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**Background:** Epileptic seizures are often associated with changes in cardiac autonomic function. Yet atrial fibrillation (AFib) or atrial flutter (AFlu) following epileptic seizures has only rarely been reported in the past.

**Objectives:** To describe and characterize patients who experienced lone AFib or AFlu as a consequence of epileptic seizures.

**Design:** Case reports.

**Setting:** University teaching hospital.

**Patients:** We describe 4 patients who developed transient AFib following epileptic seizures and 1 patient who developed transient AFlu following epileptic seizures.

**Results:** In all patients, AFib and AFlu followed a generalized tonic-clonic seizure. The arrhythmia usually lasted a few hours and converted spontaneously to a normal sinus rhythm. In 3 patients, AFib or AFlu developed during the first seizure they experienced, and none of the patients developed drug-resistant epilepsy. Moreover, none of the patients had a known cardiac disease, yet, in 2 patients, the cardiological workup demonstrated mild abnormalities on the cardiac stress test.

**Conclusions:** Atrial fibrillation is the most common type of arrhythmia, with an estimated prevalence of 1%. Despite the fact that AFib can cause syncope, it is important to consider the possibility of AFib developing secondarily to an epileptic seizure in cases of AFib and transient loss of consciousness.


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**REPORT OF CASES**

**PATIENT 1**

A 52-year-old man with an unremarkable medical history was admitted to the cardiac intensive care unit in our hospital owing to loss of consciousness. The results of an electrocardiography (ECG) performed on the field before the patient arrived at the hospital showed that he had experienced an AFlu.

The results of a physical examination that occurred during his admission to the hospital were unremarkable. The AFlu persisted for 4 days. During an electrophysiologic study performed 4 days after admission, the patient's rhythm converted spontaneously to a normal sinus rhythm. During the study, no ventricular tachycardia, ventricular fibrillation, or AFlu was elicited.

A transthoracic echocardiography was performed, and the results were normal. The results of a stress test revealed a short

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**EPILEPTIC SEIZURES ARE OFTEN ASSOCIATED WITH CHANGES IN CARDIAC AUTONOMIC FUNCTION.** The most widely described change is tachycardia. Bradyarrhythmia occurs less often but has been the focus of many studies because it may have serious consequences. Cardiac autonomic events, especially bradyarrhythmia, are presumed to be connected with sudden unexplained death in epilepsy. Despite the fact that atrial arrhythmias are the most common types of arrhythmia, atrial fibrillation (AFib) has only rarely been associated with epileptic seizures. Mathew et al were the first to report a case of transient AFib evoked by a general tonic-clonic seizure in a 36-year-old patient with a frontal meningioma. Since then, to our knowledge, only 3 additional cases of ictal AFib and 1 case of ictal atrial flutter (AFlu) were reported. We report a series of 5 patients who developed either transient AFib (4 patients) or transient AFlu (1 patient) as a consequence of epileptic seizures.

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episode of ventricular tachycardia. After neurological consultation and after obtaining a more careful history of the patient, it turned out that he had experienced a generalized tonic-clonic seizure. During a careful and directed interview with the patient about his medical history, he denied any prior events consistent with generalized tonic-clonic seizures, myoclonic jerks, absence seizures, or atrial arrhythmias.

An electroencephalogram (EEG) revealed generalized spike and slow wave discharges. The results of magnetic resonance imaging of the brain were normal. The patient was treated with lamotrigine (100 mg twice a day). Four months later, the patient experienced a second generalized tonic-clonic seizure with no evidence of AFib. Following that seizure, the dose of lamotrigine was increased to 130 mg twice a day, and the patient has remained free of seizures since then (2 years).

**PATIENT 2**

A 41-year-old man with juvenile myoclonic epilepsy since the age of 16 years was admitted to our hospital because of a generalized tonic-clonic seizure. On admission, the results of an ECG revealed AFib that converted spontaneously to a normal sinus rhythm 2 hours later.

Heart isotope mapping and transthoracic echocardiography were performed, and the results were normal. The results of a stress test showed that the patient had a complete left bundle branch block, which normalized at rest. The results of an EEG revealed generalized spike and slow wave discharges. The results of magnetic resonance imaging of the brain were normal. The dose of valproic acid was increased, and, since then, the patient has been free of seizures.

**PATIENT 3**

A 37-year-old obese man with hyperlipidemia and hypertension was admitted to our hospital because of a focal seizure, which was secondarily generalized. Five years prior to his admission, the patient underwent a craniotomy with resection of a right temporal cavernous hemangioma and was rendered seizure-free since surgery, without any medications. The results of an ECG on admission showed AFib; he was treated with a calcium channel blocker, and his AFib converted spontaneously to a normal sinus rhythm 2 hours later.

A computed tomographic scan revealed his status after the craniotomy, with right temporal encephalomalacia. The patient was administered phenytoin sodium, which was later switched to carbamazepine. During hospitalization, the patient had a second seizure, and the results of another ECG showed AFib that converted spontaneously to a normal sinus rhythm several hours later. The patient underwent a transthoracic echocardiography, and the results were normal. According to the cardiologist consultant, the patient was treated with amiodarone hydrochloride, which was discontinued by the patient several weeks after hospital discharge. The patient remained seizure free while receiving carbamazepine.

**PATIENT 4**

A 24-year-old man with an unremarkable past medical history who served as an officer in a special forces unit was admitted to our hospital because of a generalized tonic-clonic seizure. He denied any past seizures, including myoclonic jerks and absence or partial complex seizures.

The seizure occurred after severe sleep deprivation. The results of an ECG during admission revealed AFib that converted spontaneously to a normal sinus rhythm a few hours later. The results of a neurological workup, which included transthoracic echocardiography, Holter ECG recording, and a cardiac stress test, were normal.

The results of a neurological workup, which included an EEG and magnetic resonance imaging of the brain, were normal as well. Two years later, the patient had a second generalized tonic-clonic seizure without evidence of AFib. After the second seizure, the patient was treated with lamotrigine and has remained free of seizures for the past 3 years.

**PATIENT 5**

A 21-year-old man who serves as a combat soldier was admitted to another hospital because of a first-ever general tonic-clonic seizure. The results of an ECG during admission revealed AFib that converted spontaneously to a normal sinus rhythm after several hours.

The results of a neurological workup, which included transthoracic echocardiography, a stress test, Holter ECG recording, and an electrophysiologic study, were normal. The results of a neurological workup, which included an EEG and magnetic resonance imaging of the brain, were normal as well. The patient came to our clinic for consultation, and we decided to avoid the administration of antiepileptic medications. As far as we know, for the last 5 years, the patient has remained seizure-free.

The clinical details of all 5 cases are summarized in our Table. Several common features emerged from the 5 cases that we describe. In all patients, AFib and AFU followed a generalized tonic-clonic seizure. All patients were men. Two patients had primary generalized epilepsy, 1 patient had partial symptomatic epilepsy, and the remaining 2 patients had an undetermined type of epilepsy. All patients had drug-responsive epilepsy, and in 3 of the 5 patients, AFib and AFU developed during the first seizures they experienced. The arrhythmia usually lasted a few hours and converted spontaneously to a normal sinus rhythm. None of the patients had a known diagnosis of ischemic or other heart disease, and a careful examination of their medical histories did not reveal prior symptoms consistent with heart disease or cardiac arrhythmia. All patients had a thorough cardiological workup, the results of which implied the presence of concealed cardiac dysfunction in patients 1 and 2; the other 3 patients had normal test results.

**COMMENT**

The main autonomic changes accompanying seizures include sinus tachycardia, which occurs in 80% to 100%
of patients, and sinus bradycardia, which occurs in approximately 5% of patients. In contrast, AFib and AFlu are rare and, to our knowledge, have been previously reported in only 5 cases.

The pathophysiology of AFib in a normal heart (lone AFib) is not well understood. There are several risk factors for lone AFib; these include male sex, family history of AFib, obesity, alcohol consumption, sports activity, history of sleep apnea, and concealed cardiac dysfunction. In our series, all of the patients were men, 2 patients were athletic combat soldiers, and 1 patient was overweight; in 2 patients, there were ECG changes during the stress test that may imply the presence of a concealed cardiac dysfunction.

There are 2 forms of paroxysmal AFib in patients with normal hearts; one is vagally mediated AFib and the other, which occurs much less frequently, is adrenergically mediated AFib. Vagally mediated AFib occurs more often in men, symptoms usually initially appear between the ages of 30 and 50 years, and AFib is usually transient. Because vagal tone is maximal during sleep, most AFib events occur during that period. Augmentation of vagal tone also favors the formation of macroreentrant circuits such as AFib. Augmentation of vagal tone with bradyarrhythmia and asystole is believed to underlie sudden unexplained death in epilepsy. Interestingly, AFib and AFlu may precede sudden unexplained death in epilepsy. Nei et al reported on 21 patients with probable (n = 15) or definite (n = 6) sudden unexplained death in epilepsy who had video EEG monitoring with ECG monitoring prior to death. Three of these patients had recorded ictal AFib and AFlu. All this implies that the possible underlying cause for lone AFib following epileptic seizures is augmentation in vagal tone. Because bradyarrhythmia as a consequence of epileptic seizures is relatively rare, it would be expected that AFib following an epileptic seizure should be rarer.

In conclusion, AFib is the most common type of arrhythmia, with an estimated prevalence of 1%.


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In conclusion, AFib is the most common type of arrhythmia, with an estimated prevalence of 1%. Despite the fact that AFib can cause syncope, it is important to consider the possibility of AFib secondary to an epileptic seizure in cases of AFib and transient loss of consciousness.

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