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Case Report

# An Adult Patient with Seizure and Supraventricular Tachycardia (SVT) - Occam's Razor or Hickam's Dictum

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## Abstract

This is a case report describing a young lady presenting with both seizure and supraventricular tachycardia (SVT) to the emergency department (ED). She was previously well, asymptomatic with no risk factors for both conditions.

A 33-year-old lady presented to the emergency department (ED) with her first episode of seizure. She was found in the kitchen with up rolling of eyes, jerking of all four limbs which self-aborted after two minutes. Electrocardiogram (ECG) performed showed supraventricular tachycardia, which reverted to sinus rhythm after administration of intravenous adenosine. Post conversion ECG showed normal sinus rhythm, absence of pre-excitation and normal QTc. Laboratory tests and computed tomography of the brain were normal.

This case highlights the complex relationship between seizure and cardiac arrhythmia. SVT and seizure occurring at the same time is unusual. Clinicians need to rule out hypoxic convulsions. Epilepsy and seizures could also have a profound effect on cardiac function. Drug therapy for epilepsy is not without influence on heart rhythm. Both alcohol and illicit drugs could also precipitate concurrent seizure and SVT. Is this a case of Occam's razor or Hickam's dictum?

## Introduction

Seizures and Supraventricular Tachycardias (SVTs) are very common presentations to the Emergency Department (ED). However, both conditions coexisting at the same time in the same patient are uncommon.

The most common symptoms in SVT are palpitations, chest discomfort and lightheadedness. Syncope is less common and may be a warning sign for increased risk of sudden death [1]. SVT symptoms are rarely associated with symptoms or manifestations of the nervous system. Cardiac arrhythmia that is prolonged may lead to hypoxic convulsions and must be carefully excluded in patients with seizures.

Epilepsy and seizures, on the other hand, can have a profound effect on cardiac function [2]. Changes in heart rhythm, conduction and even subtle signs of ischemia have been reported. Ictal tachycardia has been reported in up to 100% of seizures [3]. Nonetheless, the impact of seizure on the heart muscles remains a mystery. These relationships are complex and not fully understood [4,5].

This case report describes a young lady presenting with both seizure and SVT to the ED. She was previously well, asymptomatic with no risk factors for both conditions.

## Case Report

A 33-year-old Filipino lady presented to the Emergency Department (ED) with her first episode of seizure. She was in the kitchen washing dishes when her employer heard a loud thud, found her lying on the floor with up rolling of eyes, jerking of all four limbs, which self-aborted after two minutes. There was no biting of tongue and urinary incontinence. The patient was well prior to her seizure. There was no history of substance or alcohol use. Post seizure, she had mild bitemporal headache. Electrocardiogram (ECG) performed showed supraventricular tachycardia (Figure 1). She failed vagal maneuver. She reverted to sinus rhythm after administration of intravenous adenosine. Post conversion ECG showed normal sinus rhythm, absence of pre-excitation and normal QTc (Figure 2). She did not have any past medical or surgical history. She also did not have any significant family history of cardiac or neurological diseases. In ED, her cardiac and neurological examinations were normal. There was no focal neurological deficit or cardiac murmur. Capillary blood glucose was normal. Bedside point of care ultrasound showed normal cardiac function. Laboratory tests were unremarkable including hematological index, renal panel including extended electrolytes, and thyroid function tests. Her urine pregnancy test was negative. Computed tomography of her brain did not show any intracranial hemorrhage, infarcts, or mass effect. She was admitted for further observation.

She remained well the following day without further episodes of seizure or SVT. She was discharged with appointments to follow up with Cardiology and Neurology. Cardiology performed outpatient Holter; and Neurology performed Electroencephalogram (EEG) and Magnetic Resonance Imaging (MRI) of the brain (epilepsy protocol). All the test results were normal. Both Cardiology and Neurology were unable to explain any overarching syndrome or disease that could attribute to patient's symptoms.

Six months later, she went on to develop a second episode of seizure, without SVT. She was started on lamotrigine and remained seizure free. There were also no further presentations to the ED for SVT after one year.

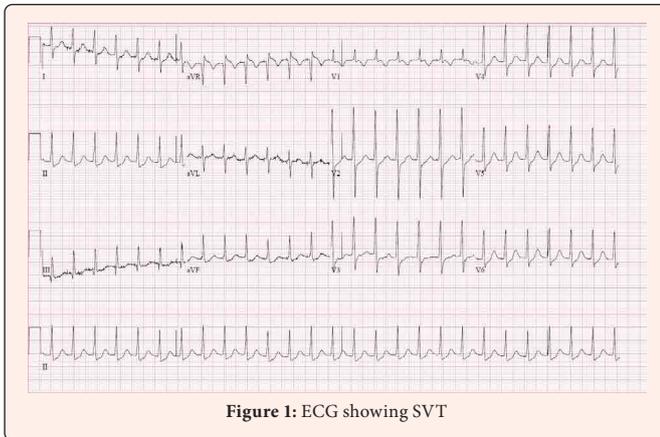


Figure 1: ECG showing SVT

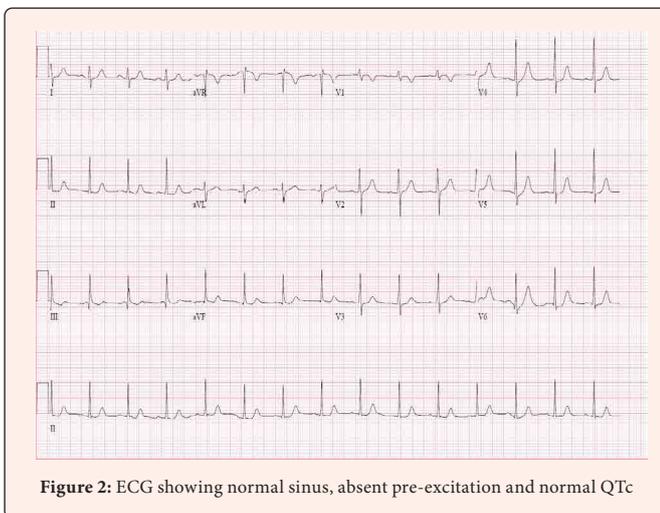


Figure 2: ECG showing normal sinus, absent pre-excitation and normal QTc

## Discussion

Some cardiovascular disorders can cause blackouts that are complicated by seizure like movements. This could be attributed to cerebral hypoperfusion. In infants, protracted arrhythmias can lead to hypoxic convulsion, but this is uncommon in older children and adults due to increase cardiac reserves in structurally normal hearts. Supraventricular Tachycardia (SVT) when prolonged, can also present with shock and occasionally, seizure in infants and young children. However, in older children and adults with structurally normal hearts and cardiac reserves, cerebral hypoxia is uncommon, and seizures are rare.

Arrhythmia often coincides with or may precede epileptic seizures [6]. The occurrence of epileptic seizures preceding the incidence of cardiac arrhythmia such as sinus tachycardia, ventricular fibrillation, bradycardia, asystole, are also frequently reported [7]. To date, the pathophysiology of cardiac arrhythmia in epilepsy has not yet been established [8]. There are several hypotheses explaining this dysfunction. Activation or inhibition of cortical autonomic centers, inflammation (IL-6), activation or inhibition of cortical autonomic centers, increase in vagus nerve tension by activation of brainstem reflex centers, respiratory failure, altered ion channel in drug-resistant epilepsy are considered [9]. Ion channel mutations found in the heart and brain may indicate more susceptibility to both epilepsy and arrhythmia. Some ion channel mutations that have been found in both organs may indicate increased susceptibility to both epilepsy and arrhythmia [10,11]. Therefore, cardiac arrhythmia in epilepsy may result not only from seizure activity, but also from a common genetic susceptibility [12]. Inherited defect in the potassium-dependent cellular repolarization accounts for some familial cases of cardiac arrhythmia with seizures, example is congenital long QT syndrome, but the patient gave no such family history. Daverio et al also described a pediatric patient with Dravet Syndrome presenting with SVT during status epilepticus [13]. They postulated the mutation of SCN1A as the underlying mechanism. Ozturk et al also highlighted that both epileptic seizures and SVT may

have the same underlying etiology and cardiac arrhythmia should be kept in mind when patients presenting with neurological symptoms are resistant to treatment [14].

In adults and children, most complex partial and generalized tonic-clonic seizures cause an increase in heart rate [15]. Seizures also may cause rhythm and conduction abnormalities [16]. These abnormalities include atrial fibrillation, supraventricular tachycardia, bundle branch block, atrial premature depolarizations, ventricular premature depolarizations, ST-segment elevation, and asystole. A longer duration of seizure and generalized tonic-clonic seizure types are associated with an increased occurrence of ECG irregularities. Drug therapy among patients with epilepsy is not without influence on heart rhythm. The negative effects on cardiac rhythm in epilepsy have been documented for drugs such as carbamazepine, levetiracetam and lacosamide [17-19].

Arrhythmias are commonly noted in patients with Alcohol Withdrawal Syndrome (AWS), and the most common arrhythmia is Atrial Fibrillation (AF) [20]. It is well known that alcohol consumption increases the risk of arrhythmias [21]. Cuculi and colleagues reported several tachyarrhythmias, including SVT, AF, sustained VT, and torsades de pointes in AWS patients [22]. Smile DH reported a case of alcohol withdrawal complicated by seizure and SVT [23]. Substances of abuse could also trigger seizures and SVTs. These include illicit drugs such as cocaine, Ecstasy or methamphetamines [24, 25]. These stimulants could produce damaging cardiovascular effects, and initiate and perpetuate various arrhythmias. In the central nervous system, stimulants interact with monoamine neurons, including dopamine, serotonin, and norepinephrine. The patient did not consume alcohol or illicit substances.

## Conclusions

This case highlights the complex relationship between seizure and cardiac arrhythmia. SVT and seizure occurring at the same time is unusual. Clinicians need to rule out hypoxic convulsions. Epilepsy and seizures could also have a profound effect on cardiac function. Drug therapy for epilepsy is not without influence on heart rhythm. Both alcohol and illicit drugs could also precipitate concurrent seizure and SVT. Is this a case of Occam's razor or Hickam's dictum [26]? It appears SVT and seizure were not related to each other for this patient.

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**Conflicts of Interest:** Nil

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