ARRHYTHMIC COMPLICATIONS AMONG PEOPLE WITH EPILEPSY: AN EPIDEMIOLOGIC ANALYSIS

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ABSTRACT

Background: Roughly, 1% of the population suffers from epilepsy, and roughly one-third of people have refractory epilepsy. Arrhythmias have been one of the common consequences in epilepsy patients and have also been the reason for death. **Aim of study:** To determine the incidence and associated factors of different subtypes of arrhythmias in epilepsy patients. **Methods:** A cross-sectional study conducted at Ibn Al-Bitar Specialized Center for Cardiac Surgery and a private clinic for a period of one year from March 2024 to March 2025. Eighty adults with a history of epilepsy were included in the study. We looked for arrhythmias in all of our patients, broken down by subtype, and we looked for any correlations between these rhythms and other patient features or kinds of epilepsy. **Results:** Atrial fibrillation was the most prevalent arrhythmia in the 35% of individuals who exhibited it in this and the Holter research. The incidence of arrhythmia was shown to rise sharply with age, and abnormal Echo findings. **Conclusion:** Patients with epilepsy often experience arrhythmia. Age was the most significant non-modifiable risk factor for arrhythmia, but irregular heart rhythms were the most major modifiable risk factor. Reiterate results.

KEYWORDS: Arrhythmia, Epilepsy, Holter, burden, Iraq.

INTRODUCTION

Epilepsy is one of the most common serious brain diseases, affecting 70 million individuals worldwide.[1] On a global scale, it is a leading killer and cause of disability. Epilepsy and syncope are often confused, so a thorough patient history and appropriate tests are required to make the diagnosis.[2] Intractable seizures affect 10–40% of epileptic patients and can cause cardiorespiratory failure and rapid death.[3] Heart disease, which can develop from arrhythmia, is a major health risk that endangers people's lives.[4] This condition disrupts the normal electrical conduction of the heart, leading to irregular heartbeats such as racing, skipping beats, or abnormally slow or fast heartbeats.[5] One of the most prevalent consequences of epilepsy, it has also been the cause of mortality in several cases. An autonomic nerve system coordinates the actions of the brain and the heart, two essential organs for maintaining life. One may affect the other in the event of a pathological disease affecting one of them.[6] Asystole occurred during an epileptic seizure more than a century ago, as recorded in the following way: "He cried out and was observed rubbing his hands together. The doctor checked his pulse

right away, but it wasn't detectable. There have been several reports of ictal cardiac arrhythmias since then, and the fact that seizures can affect cardiovascular regulation has been recognized.[7] Up to 80% of seizures in people with epilepsy can cause sinus tachycardia, making it the most prevalent cardiac consequence of these episodes.[8] Clinical symptoms like syncope are not connected with it, though palpitations might be. Due to its potential to induce syncope and the occurrence of falls, fractures, and traffic accidents, ictal asystole has garnered considerable attention among clinically significant ictal arrhythmias. Among the possible pathomechanisms causing Sudden Unexpected Death in Epilepsy (SUDEP) are ictal arrhythmias and ictal asystole, which are more uncommon.[9] Clinicians give comorbidity of cardiac arrhythmia and epilepsy a cursory consideration, despite its interesting nature. The pathophysiology and electrical background of many disorders are identical, despite the fact that they affect distinct organs. In fact, cardiac arrhythmias originate from disruptions in the heart's electrical activity, whereas seizures are the outcome of abnormally heightened or synchronized neuronal activity in the brain.[10] Other

major studies utilizing administrative databases and population-based cohorts have demonstrated that persons with epilepsy have a consistently greater frequency of nonspecific heart problems compared to those without the disorder.[11] The pathophysiology of SUDEP appears to be more affected by postictal arrhythmias than ictal arrhythmias.[7] However, limited data exist about the burden and outcomes of arrhythmias by subtypes in epilepsy. The purpose of this research was to identify the prevalence and risk factors of various arrhythmia subtypes in individuals with epilepsy.

PATIENTS AND METHODS
Study design, and setting: This was a cross-sectional study conducted at Al-Dowaly Private Hospital and a private clinic for a period of one year from March 2023 to March 2025.

Study patients and sample size: The study involved 80 adult patients who were diagnosed with epilepsy. Patients with known coronary artery disease or heart failure, structural heart disease, electrolyte abnormalities, renal failure, malabsorption syndrome, or active liver disease were excluded from this study.

Ethical consideration: This study was conducted according to the declaration of Helsinki on Biomedical Research Involving Human Subjects with an informed consent of the participants and also was approved by the local ethical committee.

Data Collection: The researcher interviewed each patient one-on-one and distributed a questionnaire to gather necessary data. It was utilized to collect vital information such as gender, age, place of employment, kind and length of epilepsy, and more. The interviewer determined the respondent's Body Mass Index (BMI) by

dividing their weight (in kilograms) by the square of their height (in meters). This calculation was part of the questionnaire. All of the participants use the same scale to measure their height and weight. There were three categories used to categorize patients: normal ($\leq$ 24.99 kg/m²), overweighed (25 - 29.99 kg/m²), and obese ($\geq$ 30 kg/m²).[12]

The presence and kind of arrhythmias were identified by the use of electrocardiograms (ECGs) and Holter studies. To check for structural abnormalities or heart failure, an echocardiography was done.

We looked for arrhythmia in all of the patients, breaking them down into their specific subtypes using ICD-9-CM codes. We also looked for any correlations between these subtypes and patient features or kinds of epilepsy.

Statistical analysis: We used SPSS (Statistical Package for the Social Sciences) 28 to analyses the data. Mean, standard deviation, and range are the data presented. Statistics show as percentages and frequencies for categories. The correlation between arrhythmia prevalence and specific variables was examined using a chi-square test. For statistical significance, a P-value of less than 0.05 was used.

RESULTS
In this study, mean age was 41.3 ± 14.3 years; 61.3% were males; 46.2% were overweighed, 32.5% were employee, epilepsy was generalized type in 60% of them and 52.5% of them had epilepsy for less than five years. ECG, Echo and holter study findings were normal in 77.5%, 76.3% and 65% of study patients respectively; atrial fibrillation was noticed in 16.3% of them as shown in table (1).

Table 1: Distribution of study patients by general and clinical information.

Variable	No. (n= 80)	Percentage (%)
Age (Years)		
< 40	33	41.3
40 – 59	26	32.5
$\geq$ 60	21	26.2
Gender		
Male	49	61.3
Female	31	38.7
BMI Level		
Normal	23	28.8
Overweight	37	46.2
Obese	20	25.0
Occupation		
Housewife	21	26.3
Retired	16	20.0
Private work	17	21.2
Employee	26	32.5
Type of epilepsy		
Generalized	48	60.0
Focal	32	40.0

Duration of epilepsy (Year)		
< 5	42	52.5
5 – 9	17	21.2
≥ 10	21	26.3
Echo study finding		
Normal	62	77.5
Dilated left ventricle	8	10.0
Hypertension heart disease	6	7.5
Vulvular heart disease	4	5.0
ECG study finding		
Normal	61	76.3
Atrial fibrillation	12	15.0
SVT	7	8.7
Holter study finding		
Normal	52	65.0
Atrial fibrillation	13	16.3
SVT	7	8.7
VT	4	5.0
LBBB	4	5.0

We noticed that the prevalence of arrhythmia was significantly (P= 0.024) increasing with aging to reach a level of 57.1% of patients aged ≥ 60 years complained from arrhythmia.

In this study, 73.7% of patients who had abnormal Echo findings had significantly complained from arrhythmia with significant associations between Echo findings and (P= 0.001) prevalence of arrhythmia in epileptic patients. No statistically significant associations (P ≥ 0.05) between prevalence of arrhythmia in epileptic patients and all other characteristics. (Table 2)

Table 2: Association between presence of arrhythmia and certain characteristics of epileptic patients.

Variable	Arrhythmia		Total (%) n= 80	P - Value
	Yes (%) n= 28	No (%) n= 52		
Age (Year)				
< 40	6 (18.2)	27 (81.8)	33 (41.3)	
40 – 59	10 (38.5)	16 (61.5)	26 (32.5)	**0.024**
≥ 60	12 (57.1)	9 (42.9)	21 (26.3)	
Gender				
Male	18 (36.7)	31 (63.3)	49 (61.3)	**0.682**
Female	10 (32.3)	21 (67.7)	31 (38.8)	
BMI Level				
Normal	7 (30.4)	16 (69.6)	23 (28.8)	
Overweight	11 (29.7)	26 (70.3)	37 (46.3)	**0.267**
Obese	10 (50.0)	10 (50.0)	20 (25.0)	
Type of epilepsy				
Generalized	20 (41.7)	28 (58.3)	48 (60.0)	**0.125**
Focal	8 (25.0)	24 (75.0)	32 (40.0)	
Duration of epilepsy (Year)				
< 5	14 (33.3)	28 (66.7)	42 (52.5)	
5 - 9	5 (29.4)	12 (70.6)	17 (21.3)	**0.652**
≥ 10	9 (42.9)	12 (57.1)	21 (26.3)	
Echo finding				
Abnormal	14 (73.7)	5 (26.3)	19 (23.8)	**0.001**
Normal	14 (23.0)	47 (77.0)	61 (76.3)	

DISCUSSION
Since it was discovered that most patients with witnessed SUDEP had a previous seizure, indicating a link between the seizure and death, there has been a significant increase in research about seizure-related cardiac abnormalities.[13] One possible explanation is that the central autonomic network (such as the cingulated gyrus, amygdala, or insular cortex) is directly stimulated.

Another theory is that vasovagal reactions are caused by catecholamines released during seizures.[14] Patients with epilepsy who do not have any preexisting heart conditions have been reported to experience both fibrillation and peri-ictal ventricular tachycardia. Patients with tachyarrhythmias may also be experiencing pathologic cardiac repolarization, which can manifest as increased dispersion, QT prolonging, or QT shortening.[15]

This study showed that the incidence of arrhythmia in epileptic patients was 35% and most common type was atrial fibrillation, while ECG findings were abnormal in 23.7% of them. Scarce literatures are present about the subtypes of arrhythmia, but most of the authors agreed that it is a very common cause of sudden death in epilepsy.[16] Lower results were observed in Desai et al study in 2017, as found incidence of about 20% (9.7% was atrial fibrillation) and in Wong et al study in 2008.[17] in which 13% of epileptic patients had an abnormal ECG findings. The discrepancies in the results between the studies could be explained by a variety of factors, including the sample sizes used, the ages of the patients, the types of medications they were taking, and metabolic abnormalities (such as idiopathic hypocalcemia) that may be present in older populations. Understanding the so-called "central autonomic network" and how it functions may be possible with more research into cardiac rhythm abnormalities associated with seizures. The heart may be affected by epileptic discharges if certain areas of the brain responsible for controlling autonomic systems are involved.[18]

Prevalence of arrhythmia significantly increased with aging and Echo study abnormality. This is similar to Desai et al study in 2017.[19] when observed that percentages of arrhythmias were the highest in the age group of 65-84 years. This is expected as when the age progresses; the comorbidities also increase.

In this study, no statistically significant associations between prevalence of arrhythmia in epileptic patients and all of gender, type and duration of epilepsy. This is in contrary to number of studies done by Standridge et al in 2010[15] and Desai et al in 2017.[19] when they noticed that ictal arrhythmias were significantly more common in male patients.

In conclusion, patients with epilepsy often experience arrhythmia. The most important modifiable risk factor for arrhythmia was irregular heart rhythm, whereas ageing was the most important non-modifiable risk factor. Reiterate results.

Study limitations
This study faced number of limitations: First, problems with temporal sequencing, such as determining if arrhythmia occurs before epilepsy or vice versa, can be challenging in the absence of longitudinal data collected at exact intervals. Second, this study lacks longitudinal data, which would enhance the inference, and it is only able to estimate incidence or directionality because it is cross-sectional. Third, Small sample sizes for specific types of arrhythmias resulted in less statistical precision and wider confidence intervals. Fourth, limitations in generalizability to broader epilepsy populations may exist due to the study cohort being collected from a single center.

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