An-Najah National University

Faculty of Graduate Studies

ASSOCIATION BETWEEN CLINICAL AND BIOCHEMICAL PARAMETERS OF PATIENTS WITH EPILEPSY: A RETROSPECTIVE STUDY IN THE PALESTINIAN HEALTHCARE SYSTEM

By

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ASSOCIATION BETWEEN CLINICAL AND BIOCHEMICAL PARAMETERS OF PATIENTS WITH EPILEPSY: A CROSS-SECTIONAL CORRELATION STUDY IN THE PALESTINIAN HEALTHCARE SYSTEM

By

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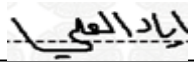
Prof. Iyad Ali	
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Dedication

To my dad, Professor Salameh Bsharat for his unwavering support and love. His belief in me has been my constant source of strength.

To my mum Rola, for her support and encouragement all the time to finish my thesis.

To my beloved husband, Suhail, for his endless love, patience, and support. His faith in me has been my greatest motivation and his constant encouragement has helped me through every challenge.

To my sibling for all the support they gave me while working on my research.

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To Aunt Shifa' for her support while I was collecting data from the hospital system.

And to anyone who dreams of achieving their goals, may this work inspire you to persevere and succeed.

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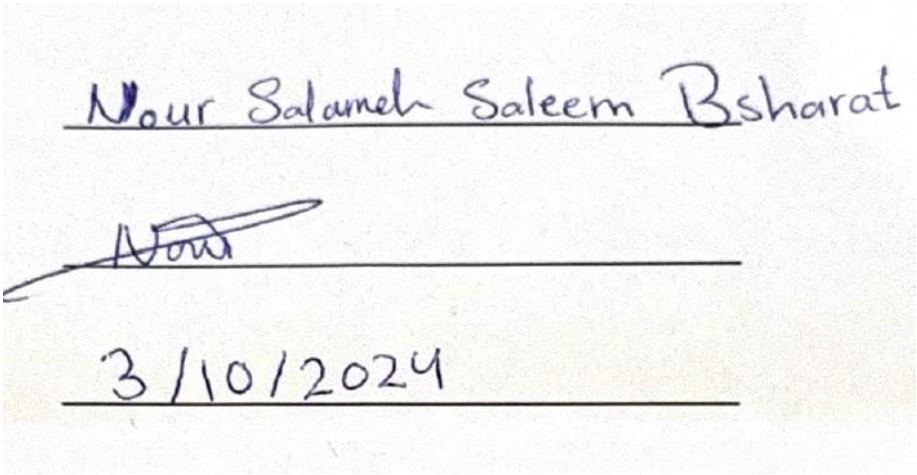
Declaration

I, the undersigned, declare that I submitted the thesis entitled:

ASSOCIATION BETWEEN CLINICAL AND BIOCHEMICAL PARAMETERS OF PATIENTS WITH EPILEPSY: A RETROSPECTIVE STUDY IN THE PALESTINIAN HEALTHCARE SYSTEM

I declare that the work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification.



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ASSOCIATION BETWEEN CLINICAL AND BIOCHEMICAL PARAMETERS OF PATIENTS WITH EPILEPSY: A RETROSPECTIVE STUDY IN THE PALESTINIAN HEALTHCARE SYSTEM

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Abstract

Background: Epilepsy is a neurological disorder characterized by recurrent seizures due to abnormal brain electrical activity. Clinical parameters are crucial for diagnosing, classifying, treating, monitoring, and improving patient outcomes in epilepsy care.

Objective: This study explores correlations between clinical epilepsy characteristics and biochemical parameters in Palestinian patients, aiming to provide population-specific insights that enhance understanding and treatment strategies.

Subjects and Method: The research included epileptic patients admitted to Al-Najah Hospital during or shortly after a seizure. The data gathered between November 2022 and September 2023. Patients with complete medical records were included. Data on demographics, biochemical markers, seizure characteristics, and clinical history were collected and analyzed using IBM-SPSS version 22. Descriptive analyses summarized the data, while Pearson correlation analysis identified relationships between variables. A p-value < 0.05 was considered statistically significant.

Results: The study involved 265 patients, with a higher proportion of males (57.8%) than females (42.2%). Significant associations were identified between age, gender, and blood tests. Younger males showed low hemoglobin levels ($p < 0.001$), while low hematocrit levels were linked to age ($p = 0.005$). Blood test results and seizure history showed correlations, such as high calcium levels being associated with increased seizure frequency ($p = 0.026$). Biochemical imbalances like hypercalcemia, hyperglycemia, and high sodium levels were noted as potential seizure triggers. Associations were also observed between antiepileptic drugs and blood parameters. Diazepam use correlated

with high random blood sugar (p = 0.01), and phenobarbital use was linked to low blood urea nitrogen (p = 0.005) and changes in neutrophil and lymphocyte levels (p = 0.020).

Conclusion: The findings highlight the importance of integrating clinical and biochemical data to enhance epilepsy management and therapeutic outcomes. Monitoring blood levels and addressing imbalances can help manage symptoms and prevent seizures. This research underscores the need for individualized treatment approaches and future studies to uncover potential epilepsy causes and optimize treatment regimens.

Keywords: convulsions, epilepsy, neurological disease, biochemical parameters, Clinical features.

Chapter One

Introduction

1.1 Background

Epilepsy is often described as an enduring central nervous system (CNS) condition that impacts individuals at various stages of life throughout the world, and therefore is a significant threat to humanity everywhere (1). Based on WHO forecasts where it is approximated that Approximately 2.4 million new cases of epilepsy are diagnosed every year while about 50 million people around the world are affected by the condition. Of them, the Eastern Mediterranean Region accounts for 4.7 million, it is characterized by the occurrence of two or more reflexive or unprovoked seizures in a 24-hour period, which makes it a significant neurological condition that affects a significant number of different populations(2). Epilepsy affects all nations, transcending racial or national boundaries, and is increasingly observed in the Arab world, where its incidence is notably high. In the Palestinian region, the incidence rate of epilepsy is reported to be 10.4 per 100,000 people (3)(4). People of all ages and genders can be affected by epilepsy (5). Epilepsy is unique to each gender and requires tailored management and treatment options (6). According to (McHugh & Delanty, 2008) some types of epilepsy affect children but not adults and vice versa; in addition, some types affect women more than men. On the other hand, in 16 of the 29 door-to-door investigations and 11 of the 16 record-review studies for which data were available, the prevalence is higher in men than in women. The absolute variation in gender-specific prevalence is negligible (7). significant knowledge gaps and prevalent negative attitudes toward People with Epilepsy (PWE) were identified among the Palestinian public. This indicates that many people within the population lack a complete understanding of epilepsy and hold unfavorable views or misconceptions about those who live with this condition. The aforementioned results emphasize a fundamental need for enhanced public education and awareness programs to address and reduce the stigma and misinformation surrounding epilepsy in Palestinian society(8).

1.2 Clinical Characteristics and Classification

In 1981, ILAE divided seizures into two main groups: Partial seizures and generalized seizures are the two types of epilepsy that usually occur: Seizures that start in a specific region of the brain are known as partial (focal) epilepsy, and generalized seizures which impacting the entire body (9). Simple partial seizures, in which there is no change in consciousness, and complex partial seizures, in which there is a change in awareness, are further subtypes of this seizure type. When epilepsy manifests as widespread onset seizures, the brain is thought to be affected simultaneously. There are several different forms of generalized seizures, such as absence, myoclonic, tonic-clonic, atonic, tonic, and clonic symptoms (10). According to the International League Against Epilepsy (ILAE), epilepsy classification is based on three primary factors: seizure type, epilepsy type, and epilepsy syndrome (3). These episodes may include brief instances of involuntary movements, loss of consciousness, and occasionally, the inability to control bowel or bladder function. Seizures are divided into three main types focal onset seizures, generalized onset seizures, and seizures with an unknown onset. Focal onset seizures originate in a specific brain area and can present as either maintained or impaired awareness, with further distinctions between motor and non-motor onset, and the potential to develop into focal to bilateral tonic-clonic seizures. Generalized onset seizures begin simultaneously in both brain hemispheres and include motor onset seizures, featuring convulsive activity, and non-motor (absence) onset seizures, characterized by brief awareness lapses. Seizures with an unknown onset are categorized based on observed characteristics, covering both motor and non-motor symptoms, and a separate category is reserved for seizures that cannot be definitively classified. Optional awareness-based classification may be omitted, especially in instances of sudden, brief seizures where determining awareness impairment is challenging (11). Out of the 564 individuals with confirmed epileptic seizures, only 252 (45% [41–49%]) had been registered at the time of their initial seizure. Only 39% (35–43%) of the patients had initial generalized seizures, while 52% (48–56%) of them had partial or subsequent generalized seizures (31).

Figure 1

Seizure Classification

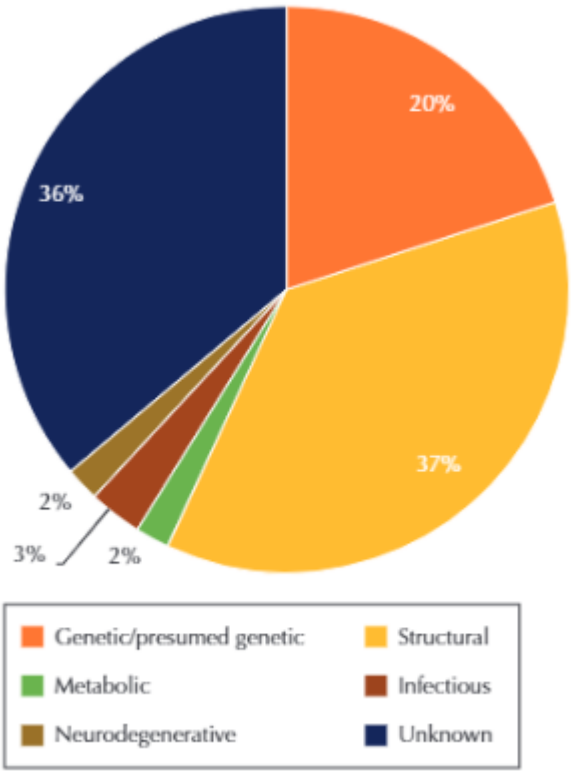
1.3 Etiology of Seizures

The causes of epilepsy are categorized by the International League Against Epilepsy (ILAE) into several etiological groups: structural, genetic, infectious, metabolic, immune, and unknown origins. Additionally, the ILAE curriculum includes a separate category for neurodegenerative causes due to their increasing clinical significance Figure (12). Epilepsy can be a result of metabolic disorders through several mechanisms, including electrolyte disturbances and disorders of intermediary metabolism. The relationship between epilepsy and metabolic factors underscores the importance of thorough biochemical assessments in epilepsy management. Hippocampal damage in patients with epilepsy is believed to be mostly caused by prolonged exposure to unusually high calcium concentrations (13). Inherited features that affect brain function or genetic predispositions defined by mutations are variables that can cause epilepsy. Brain damage such as stroke, trauma, or tumors can interfere with regular brain function and increase the risk of seizures. Epilepsy is frequently linked to structural brain disorders, such as sclerosis or deformities. Seizures are caused by brain inflammation brought on by infections such as meningitis. Epilepsy risk may be increased by developmental problems such as autism spectrum disorder due to complex interactions between genetics and environment. Because metabolic problems can interfere with neurotransmitter balance or cellular energy metabolism, they can impair brain function and cause seizures. Examples of these disorders include mitochondrial diseases and electrolyte abnormalities (14). Genetics and changes in metabolism can both contribute to seizures and epilepsy. Organ failure (liver, kidney,

pancreas, etc.), nutritional deficiencies, autoimmune disorders (type I diabetes, autoimmune cerebral folate insufficiency, etc.), and exposure to exogenous drugs and pollutants are examples of acquired metabolic causes. These causes frequently produce acute seizures, which may be followed by acute encephalopathy, and can culminate in epilepsy if they cause lasting brain damage, such as hypoglycemia or hyperammonemia. Alcohol is a frequent exogenous toxin that causes seizures, particularly during alcohol withdrawal, and it is linked to the development of epilepsy in a dose-dependent manner. This connection could be driven by concomitant illnesses including traumatic brain injury and cerebrovascular disease rather than alcohol use (15).

Figure 2

Main causes of Epilepsy



1.4 Age-specific considerations

Epilepsy and seizures can be influenced by age, with distinct characteristics and implications observed in different age groups. In infants and young children, seizures are often caused by factors such as birth injuries, congenital abnormalities, metabolic disorders, and infections like meningitis or encephalitis. Childhood epilepsy syndromes,

such as benign rolandic epilepsy and childhood absence epilepsy, typically manifest during this period and have specific age-related features and prognoses. In this age group, early diagnosis and treatment are essential to minimizing developmental delays and cognitive impairments (16,17). Genetics, traumatic brain injuries, and the existence of epilepsy syndromes, such as juvenile myoclonic epilepsy, can all lead to the onset of epilepsy in adolescence and the early stages of adulthood. For this age group, the impacts of seizures on social interactions, psychological well-being, and academic success present difficulties as well. Teenage epilepsy management needs a comprehensive strategy that includes both medical care and assistance with emotional and social growth (18,19). On the other hand, adult and middle-aged individuals may develop epilepsy as a result of stroke, brain tumors, or traumatic brain traumas. The patients are also at a disadvantage because their lifestyle choices like alcohol and stress can cause a lot of seizure activity in the patients too. Also, there is often a need in proper pain control, which is usually balanced with the side effects of drugs in order to manage the epilepsy in adults adequately; and also, there is always a presence of anxiety and depression that often accompany epilepsy all through the adulthood (20,21). This population has increasing susceptibility rates of developing epilepsy mainly due to age related conditions like stroke, dementia, Alzheimer disorder and other related CNS diseases. Mentioned cases of seizures in elderly, seizures might show in a different way it is typical in younger people, causing confusion with any other diseases like transient ischemia strokes or dementia. It is very important to pay much attention to the choice of antiepileptic drugs and their dosages in this category of patients, because they often have multiple diseases and will possibly react adversely to the interactions of a range of medicines (22,23). Realizing the variations in epilepsy with age is essential to maximizing diagnosis, care, and assistance throughout the life course. To enhance results and quality of life for those with epilepsy, customized approaches to manage the condition are crucial. This is because every age group has different problems and considerations (24).

1.5 Gender-Specific Considerations

Women have a slightly lower incidence of epilepsy compared to men (46.2 vs. 50.7 per 100,000). Regarding the types, the most common kind of epilepsy is partial epilepsies, which are more common in men (25). Both men and women's reproductive health can be adversely affected by epilepsy and the usage of antiepileptic medications (AEDs),

requiring specialized treatment choices. Women may experience reproductive health issues and irregular menstrual cycles if she suffers from epilepsy and take AEDs, which may result in Poly cystic ovarian syndrome (PCOS), hyperandrogenism, and changes in luteinizing hormone (LH) and follicle-stimulating hormone (FSH) levels. These disturbances, which are connected to the hypothalamic-pituitary-gonadal axis, can lead to irregular menstruation, decreased fertility, and other endocrine problems that affect reproduction. Also, testosterone levels and general reproductive health in males, can be impacted by disturbances to the hypothalamic-pituitary-gonadal axis caused by epilepsy and AEDs use. The impact of AEDs to the endocrine system, more specifically on AEDs that hasten the activity of enzymes, like carbamazepine, and phenobarbital, are particularly damaging to these issues with further decline in sexual potency and low levels of testosterone (26–28). The research that is so far available indicate that the male gender is more affected than the female gender. On the other hand, Females' susceptibility to seizures does, however, fluctuate more significantly, especially when it comes to hormonal changes that occur during the menstrual cycle. Catamenial seizures can be defined as a situation in which there is an increased peculiarity of seizures throughout phases of a certain menstrual cycle. Sex uncertainty reveals that hormonal changes and the activity of seizures share a complicated connection that underscores the necessity of considering the issue of sex when diagnosing and treating epilepsy. Epilepsy and AEDs use can affect both endocrine function and fertility. It is known that AEDs can disrupt the hypothalamic-pituitary-gonadal axis that may cause hormonal changes in men and women and influence their reproductive system (29). More efficient treatment plans and better effects for those with epilepsy can result from the knowledge of these subtleties (30). More studies to clarify the underlying mechanisms causing these sex-based disparities and to create customized therapies that cater to the requirements of both male and female epileptic patients are necessary to conduct.

First seizures: appear in many individuals who experience a single convulsion at some time or another in their lifetime. It can be primary or secondary, and in other words, it can be either well-sustained or multifactorial, which means that it can happen anytime and does not require any reasons. Thus, most individual fits are rarely again repeated if a person has not received a blow to the head, or if he or she has had no family history of epilepsy, or other neurological disorders. Medical disorders which can provoke a seizure include low or very elevated blood sugar levels, abnormalities in enzymes,

hormones, glucose levels, body temperature and blood pressure, eclampsia postpartum or during post-partum period, kidney or liver disorders or any acute or chronic inflammation. In certain circumstances one would find other sources of risk that would warrant giving drugs after the first seizure with an aim of preventing other seizures. Some studies advise it to initiate antiseizure medication when a person has had the second or the persistent seizure because the risk for future seizures raises substantially. Another significant determinant of seizure risk includes prior brain illness, for instance stroke or traumatic brain injury meaning any given individual with one of these conditions has a higher propensity to have a second kind of seizure. The reasons to begin antiseizure medication depend in general on considerations made by the health care provider regarding the number of conditions that make another seizure more or less likely in that individual (31).

1.6 Clinical Manifestations of Epileptic Seizures

1.6.1 Involuntary Movements

Involuntary movements are frequently seen during epileptic episodes. Frequently resembling shock-like muscle spasms, these myoclonic jerks are characterized by sudden, rapid movements. They can affect the muscles of the chest, arms, legs, or face, among other sets of muscles in the body. They can also arise alone or in clusters(32).

1.6.2 Loss of Consciousness

Another feature that epileptic seizures generally have is which the momentary loss of consciousness is another characteristic that is not unique to simple focal seizures and can come in diverse forms**.** Such as: absence seizures, which are more common in children, result in brief lapses in consciousness lasting a few seconds, which are occasionally mistaken for daydreaming (33). Tonic-clonic seizures, on the other hand, are more dramatic and comprise a clonic phase that is characterized by rhythmic jerking and a tonic phase that is characterized by muscle stiffness. During these periods, the person is completely unaware of their surroundings and unable to respond to stimuli (34).

1.6.3 Autonomic Dysfunction

Seizures can occasionally affect the autonomic nervous system, resulting in symptoms such as loss of control over bowel or bladder function. This can cause incontinence during or after a seizure, which, in addition to the physical discomfort, can also contribute to severe emotional and psychological suffering for the patient (35). This loss of control is especially difficult since it affects the person's feeling of dignity and autonomy, which frequently results in social distancing and retreat (36).

1.6.4 Sensory Symptoms

Sensory phenomena of a sensory nature such as twitching, change in visual acuity or the spectrum, or paresthesias in the mouth or even smell may occur during seizures. These sensory signals are sometimes called auras and often occur immediately before a seizure, but they can provide valuable information regarding the location and nature of the epileptogenic focus in the brain (32). For example, seizures of the occipital lobe can cause visual hallucinations, while seizures of the temporal lobe usually cause déjà vu or odd smells (33).

1.6.5 Cognitive and Emotional Changes

During or after a seizure, some individuals may have problems in their understanding, difficulty in their speech and loss of memory. Also, other people possibly will show signs of emotion, such as exhilaration, dread, or anxiety. This because the epileptic seizures are not only limited to coordination and muscle control, but they also affect the perceptual and emotional activity as well as other cognitive processes. These cognitive and affective characteristics could be different, depending on the type and location of the seizure in the brain (34) (36).

1.6.6 Postictal State

The interval of recovery after a seizure is known as the postictal state. Some people after a seizure may enter a postictal state that include confusion, fatigue, and headache (36). Recovery phase could linger for a few seconds or for hours and may include temporary impairments in cognitive and memory work. The degree and duration of the preceding seizure activity can affect the postictal state's intensity and endurance (37).

1.6.7 Variability of Symptoms

It is important to keep in mind that the clinical manifestations of epileptic seizures can differ significantly across individuals and even within the same person during a single episode. Factors that affect how symptoms manifest include: the underlying cause of epilepsy, the location of the seizure center in the brain, and the general health and well-being of the person (38). As a result, diagnosing the disease accurately and treating it effectively may necessitate precise observation and documentation of seizure symptoms throughout time.

1.6.8 Influence on Daily Life

Epileptic seizures can totally interfere with a person's everyday life due to their unpredictable nature and their impact on cognitive, emotional, and physical functioning. Also, it is considered difficult to pursue employment, further education, and social contacts because epilepsy can strike at anytime and anywhere (39). Fear of having a seizure in public, or of being injured or embarrassed during a seizure, can also lead to feelings of anxiety and social isolation (40).

1.6.9 Other manifestations

A visible and frequently dramatic symptom of seizure activity is the up-rolling of the eyes, revealing aberrant electrical discharges in the brain. This symptom is an important indicator for physicians and caregivers, since it aids in the detection of seizure beginning, especially in persons who do not exhibit other visible indicators. Observing this particular manifestation allows medical experts to quickly intervene and offer appropriate care to reduce the symptoms of the seizure (41). Furthermore, cyanosis, defined by a bluish or purplish coloring of the skin and mucous membranes caused by insufficient blood oxygenation, is frequently seen in the late stages of a seizure, particularly after protracted or severe episodes. Recognizing these symptoms allows for complete seizure management and therapy, resulting in optimal patient results (42). Furthermore, during certain types of seizures, people may experience unexpected and significant emotional shifts, such as fear, worry, happiness, sadness, or wrath. These emotional shifts are ascribed to aberrant electrical activity in the brain, which affects regions important for emotion regulation, such as the limbic system. Recognizing rapid emotional changes as a seizure symptom is critical for correct diagnosis and appropriate

care, helping to distinguish seizures from other psychiatric illnesses with comparable emotional presentations (43).

1.7 Metabolic and Biochemical Changes in Epilepsy

There are two types of metabolic causes of seizures and epilepsy: hereditary (inborn) and acquired. Seizures may arise from acquired metabolic reasons, such as organ failure (liver, kidney, or pancreas), dietary inadequacies, autoimmune disorders (type I diabetes, autoimmune cerebral folate insufficiency), or exposure to exogenous medicines and poisons(15). Status epilepticus is caused by a failure of endogenous mechanisms to stop a seizure, while other molecular and cellular processes may also contribute. Excessive stimulation during seizures or absence of natural inhibitory systems can lead to failure. Maladaptive alterations can cause a single seizure to become status epilepticus, prolonging the disease and making it resistant to medication (44). Abnormalities of intermediate metabolism and electrolyte imbalances are examples of metabolic problems ways which can cause epilepsy (45). Occasionally, loss of consciousness and the inability to control bladder or bowel function may occur simultaneously with these episodes (9).There is an urgent need for diagnosis and therapy. Continued seizure activity has numerous repercussions. There is receptor trafficking, and GABA ergic receptors are endocytosed and have a reduced quantity on the synaptic surface, leading to diminished sensitivity to treatment. Additionally, glutamate receptors are increased in the synapse, resulting in a more proconvulsant state. Homeostatic failure and increases the likelihood of sequelae and mortality can happened due to the alter in gene expression by synaptic plasticity, leads to (46). Biochemical parameters play a crucial role in understanding the pathophysiology of epilepsy, monitoring treatment efficacy, and managing potential side effects of antiepileptic drugs (AEDs) (29). This section provides an overview of key biochemical markers commonly assessed in epilepsy research and clinical practice. Acquired metabolic disorders, including electrolyte imbalances (e.g., sodium, potassium), hypoglycemia (low blood sugar), mitochondrial disorders impacting energy production, liver dysfunction affecting detoxification processes, and toxic metabolic states induced by toxins or drugs, can lead to epilepsy via disruptions in neuronal excitability, energy metabolism, neurotransmitter function, and oxidative stress (14,15). A review conducted in 2017 concluded that epileptic seizures (ES) lead to alterations in the blood laboratory values and reflect changes in different organ systems. The review also found

that lab tests (CK, electrolytes, creatinine, liver, and renal function tests) are important in determination of etiology of seizures with unknown cause and should be measured on at least one occasion (10). Laboratory analyses are used for identifying patients who are at risk for developing rare, risky complications (47). Also, they can be fundamental to determining the cause and guiding management of seizures (48). According to (Sutton et al., 2020) laboratory investigations are important in determining the cause and management of epilepsy (49). The same study showed that some complications like hyponatremia or hypernatremia may be fatal if not discovered and treated. A study done on 112 patients found that serum chemistry abnormalities in epileptic patients are associated with other factors and diseases (49). Most AEDs are eliminated through kidney and liver. Some patients with epilepsy may develop chronic kidney disease which may be a result of AEDs nephrotoxicity (50). Patients with epilepsy on antiepileptic drug therapy must check Liver function tests routinely to prevent the adverse effect of liver dysfunction. Albumin and ALP levels are markers to diagnose liver dysfunction in epileptic patients (51). The clinical and biochemical values for epileptic patients will be determined in this study and will show if there is a relationship between demographic profile, clinical and biochemical parameters with etiology and complications of seizures. A review conducted in 2017 concluded that epileptic seizures (ES) lead to alterations in the blood laboratory values and reflect changes in different organ systems. The review also found that lab tests (CK, electrolytes, creatinine, liver, and renal function tests) are important in determination of etiology of seizures with unknown cause and should be measured on at least one occasion (47). A study conducted in an emergency department revealed that 125 people had hypoglycemia with symptoms. A glucose level of less than 2.0 mm was linked to the case of a generalized seizure; further exacerbating factors, such as drinking and extra metabolic derangement, may also have played a role (52). According to (Sutton et al., 2020) laboratory investigations are important in determining the cause and management of epilepsy (53). The same study showed that some complications like hyponatremia or hypernatremia may be fatal if not discovered and treated. A study done on 112 patients found that serum chemistry abnormalities in epileptic patients are associated with other factors and diseases. Another study done on 115 epileptic outpatients concludes that Clinical factors such as high seizure frequency and long duration of epilepsy had a significant influence on high-rate quality of life. Advanced age, female sex, and a low education level were

the demographic factors that correlated strongly with low quality of life scores (54). Elevated calcium levels can lead to a cascade of detrimental cellular processes, contributing to neuronal injury and the progression of epilepsy. Excessive calcium influx can activate various enzymes, such as proteases, phospholipases, and endonucleases, which degrade essential cellular components, leading to neuronal death. Moreover, high intracellular calcium can disrupt mitochondrial function, impairing energy production and increasing the generation of reactive oxygen species (ROS), which further exacerbates oxidative stress and neuronal damage (13). A study shows a consistent trend that relatively high calcium reduces excitability and relatively low calcium increases cell firing. This knowledge provides a unifying explanation for the role of hypocalcemia hyperexcitability in seizure activity (55). Additionally, A well-established finding showed that a reduction in calcium levels causes an increase in neuromuscular excitability. In newborns with hypoparathyroidism, rickets, and hypocalcemia, low serum [Ca2+] causes a persistent spasm of the muscles (53). The research revealed a causally negative correlation between genetically determined serum calcium and generalized epilepsy, but it did not establish a causal relationship between serum magnesium and epilepsy (56). Hypokalemia or hyperkalemia, in contrast to other electrolyte imbalances, rarely results in CNS symptoms, such as seizures (57). Recently, hypomagnesemia has been identified as a significant adverse effect of proton pump inhibitors (PPIs), and there have been multiple reports of hypomagnesemia-caused seizures in PPI-using people (56). Seizures can be brought on by hypocalcemia, and less frequently by hypercalcemia. Once this is found, more research into the cause—which is outside the purview of this article—may also be necessary. This is typically done in cooperation with an endocrinologist. Although far less prevalent, hypomagnesaemia can result in seizures in people of any age (53). Hyponatremia is defined as a serum sodium concentration below 136 mEq/L. Hyponatremia was found to be the cause of seizures in 70% of newborns under 6 months, with no other possible causes. Antiepileptic drugs (AEDs) play a crucial role in managing epilepsy, but they are associated with a range of side effects, including electrolyte imbalances. One significant electrolyte disturbance linked to AEDs is hyponatremia, a condition characterized by low sodium levels in the blood. This condition can lead to various clinical symptoms, from mild (such as nausea and headache) to severe (such as confusion, seizures, and coma). Among the AEDs, carbamazepine (CBZ), oxcarbazepine (OXC), and, less frequently, valproate (VPA) is

notable for their potential to induce hyponatremia (58). Hypernatremia, defined as a serum sodium concentration above 145 mEq/L, is less commonly a direct cause of seizures but often a result of seizure activity, such as generalized tonic–clonic seizures, which can lead to significant insensible water loss through hyperventilation and sweating. It can also arise from factors like impaired consciousness post-seizure, reduced oral intake, and certain medications that promote water loss. The primary effects of hypernatremia include cellular dehydration, particularly in the brain, leading to symptoms such as lethargy, irritability, confusion, and severe cases, seizures, coma, or death. Cardiovascular symptoms like orthostatic hypotension and tachycardia, as well as muscle weakness and cramps, are also common. Diagnosis involves measuring serum sodium levels and understanding the patient's clinical history, while treatment focuses on gradual rehydration with hypotonic fluids and addressing underlying causes. Continuous monitoring of serum sodium levels is essential to guide treatment and prevent complications (58). Unlike other electrolyte abnormalities like hyponatremia or hypocalcemia, hypokalemia (low potassium levels) and hyperkalemia (high potassium levels) are not usually linked to central nervous system (CNS) symptoms or seizures. Nevertheless, changes in extracellular potassium levels have a profound impact on cardiovascular and neuromuscular function, and severe potassium abnormalities can be life-threatening (58). Hypoglycemia is a prevalent and acute life-threatening condition that often affects individuals with diabetes. This condition can lead to a variety of severe health complications, one of the most alarming being the onset of seizures. While not all individuals experiencing hypoglycemia will suffer from epileptic seizures, certain populations are more vulnerable. Specifically, neonates and children appear to have an increased susceptibility to seizures induced by hypoglycemia. This heightened vulnerability in younger individuals is likely related to the immaturity of their developing brains, which are more sensitive to fluctuations in blood glucose levels. As a result, hypoglycemia can pose a particularly significant risk to these age groups, necessitating careful monitoring and management to prevent such severe neurological outcomes (59). Verifying that the blood glucose level is within the normal range should be the top priority in patients of any age including neonates for whom it is especially crucial (Gataullina et al., 2015). If left untreated, hypoglycemia can quickly cause irreversible brain damage and even death. For seizures to occur in humans, a glucose level of less than 2 mM/L or more than 25 mM/L is often necessary (53). Simple blood

tests can be a useful tool for rapidly determining the etiology of seizures with unclear origins, especially in cases of certain metabolic and toxic encephalopathies. This is why it is important to measure CK, electrolytes, creatinine, liver, and renal function tests at least once (10). Patients with renal failure frequently experience seizures because of increased urea. Considering non-convulsive status and status epilepticus as potential diagnosis in renal patients is especially crucial since they can resemble uremic encephalopathy (53). Hematological parameters, including complete blood count (CBC) results, are also monitored, as AEDs can impact bone marrow function, leading to conditions like leukopenia, anemia, or thrombocytopenia. For example, research has demonstrated that reduced hemoglobin levels are thought to be a separate risk factor for acute seizures, emphasizing the significance of routine hematological evaluations in the treatment of epilepsy (29). It has been determined that lower hemoglobin levels are a separate risk factor for acute seizures, highlighting the critical connection between brain function and systemic health. Brain oxygenation may be hampered by anemia, which lowers hemoglobin levels and the blood's ability to carry oxygen. This hypoxic condition may worsen neuronal excitability, raising the risk of a seizure. Moreover, the brain is particularly susceptible to reductions in oxygen delivery because of its high metabolic need for oxygen. Therefore, it is essential for epileptic patients to maintain appropriate hemoglobin levels since anemia directly affects seizure thresholds, frequency, and general health. Regular monitoring and management of hemoglobin levels, together with addressing the underlying causes of anemia, are essential to preventing acute seizures and improving patient outcomes (60).

1.8 Problem statement

According to the WHO Epilepsy is a major global health concern which is a neurological disease marked by recurring seizures, affecting an estimated 50 million people worldwide and resulting in around 2.4 million new cases identified each year. Even though epilepsy is quite common, there is still a glaring lack of in-depth research on it, particularly in Palestine. This information gap is concerning given the high number of epileptic patients in the area. Seizures, which are a hallmark of epilepsy, not only immediately put the affected individual at risk but also have long-term implications for their overall health and quality of life. Understanding the intricate relationships that exist between clinical characteristics, demographic profiles, and biochemical data in relation to the causes and outcomes of seizures is crucial. These

discoveries may significantly change the way epilepsy is managed by empowering medical professionals to better customize regimens and treatments to each patient's unique needs. But comprehensive research studies that aim to understand the subtleties of epilepsy in the Palestinian population and elucidate the factors impacting its occurrence, course, and treatment are vitally needed in order to achieve this. Out of an estimated 50 million people worldwide who have epilepsy, the World Health Organization estimates that 2.4 million new cases are discovered each year. Conversely, there are a lot of epileptic patients in Palestine, despite the fact that not much is known about them. Since seizures affect the patient's overall health, it is imperative to comprehend the relationship between the genesis and complications of seizures and the patient's clinical, biochemical, and demographic factors.

1.9 Study hypothesis

Research question:

Is there a relationship between demographic profile, the clinical and biochemical outcomes with etiology and complications of seizures for patients diagnosed with epilepsy who are admitted to Palestinian clinics and hospitals?

Hypothesis:

Alternative non- directional Hypothesis: There is a relationship between at least one of the demographic factors like (sex, gender, place of residence and family history), the clinical and biochemical outcomes with the etiology and complications of seizures in patients diagnosed with epilepsy and admitted to governmental hospitals in Palestine.

Null hypothesis:

There is no relationship between any of the demographic factors like (sex, gender, place of residence and family history), clinical and biochemical outcomes with etiology of seizure in epileptic patients who are admitted to governmental hospitals in Palestine.

1.10 Importance of the study

Knowing the complex association between demographic profile, biochemical markers, and the etiology and complications of seizures in patients diagnosed with epilepsy is of principal importance in healthcare. By comprehending the complexity of these different staking influences, the healthcare workers can gain comprehensive understanding on the

cause of variance in frequency, duration and intensity of Seizure, and in this context, there is possibility to have more customized and better treatment management plans. When used, this information can be used to develop support services, specific programs, and interventions and ways of identifying the issue at an early stage. In addition, patients and their carers will be well informed and able to assume responsibility for their management and make proper lifestyle decisions that would reduce the likelihood of seizure occurrence and that will improve on overall health and wellbeing. In addition, these relationships could be developed to a greater richness that in turn could help to develop new treatment and prevention methodologies which would definitely improve the quality of life of those patients suffering from epilepsy.

1.11 Objectives

This study will be conducted to:

- Determine the clinical and biochemical laboratory values for patients diagnosed with epilepsy.
- Investigate associations between demographic factors, clinical and biochemical biomarkers with epilepsy type, etiology.
- Determine the complications that can occur in epileptic patients which may associate with lab values.

Chapter Two

Methods

2.1 Study context

The participants of this study were patients with different types of epilepsy who are patients in government hospitals in Palestine.

2.2 Study design

A cross-sectional correlation design was utilized for the current study to examine the correlation between neuropsychological functioning of patients with epilepsy admitted in government hospitals in Palestine.

2.3 Population

All admitted epileptic patients were included in the study, regardless of their age, sex, or place of residence.

2.4 Inclusion criteria

Included in the study sample was the following set of patients:

- Patients with all types of seizures (generalized, partial, and partial with secondary generalization).
- Epileptic patients receive at least one anti-convulsion drug.

2.5 Exclusion criteria

The patients in the following category were not included in the study sample:

- Patients were not diagnosed as epileptics.

2.6 Sample size

This study involved 256 patients from various districts of the West Bank. The sample was obtained from the health care system at Rafedia Hospital.

2.7 Sampling method

The study sample collected from Rafedia Hospital's extensive healthcare system and was carefully chosen. Epileptic patients' files were rigorously reviewed, and important data was acquired utilizing a properly developed data collecting form.

2.8 Study tools

A data collection form was carefully designed specifically for the purpose of this research. This large form was created to methodically collect a wide range of relevant information required for detailed examinations. The data collection method included several critical components, including demographic information, for example: age and gender, as well as family medical history, the existence of co-morbidities, and the time since initial diagnosis. Besides, detailed characteristics such as the epilepsy type, frequency of seizures per day, and the duration of the seizure, in addition to the specific anti-epileptic drug regimen used were thoroughly documented. And the most important thing in the data gathering procedure were the laboratory tests findings with precise measurements of electrolyte levels such as calcium, potassium, sodium. Also, kidney function tests, which included parameters such as creatinine, blood urea nitrogen (BUN), in addition to random blood sugar test and complete blood counts (CBC), were thoroughly reported.

2.9 Data Collection

Initially, patient data from all epileptic patients admitted to governmental hospitals in Palestine were collected and uploaded to a data collection form on the Excel program to show the outcomes of laboratory tests when the patient was admitted at the time of seizure or after and results were checked to examine the existence of a relationship between biochemical and demographic factors through the history and laboratory tests.

2.10 Statistical Analysis Methods

Statistical analysis was performed by Excel. Data were presented using tables and figures in Microsoft programs (Word and Excel). Then, the collected data underwent rigorous analysis using the SPSS program, employing statistical tests such as the Pearson correlation test.

2.11 Working Plan

This study was conducted on epileptic patients who were admitted to hospital at the time of seizure or after and has medical record of all the information needed to examine the influence of demographic and biochemical factors on epileptic patients. I went to Rafedia Governmental Hospital in Nablus after obtaining approval from the Institutional Review Board (IRB) of An-Najah National University. I then started collecting data on epilepsy patients from the healthcare records. The information collected included gender, age, medical history, type, and duration of seizures. Additionally, I took two readings of laboratory test results, focusing on biochemical tests: the first reading was taken upon the patient's admission to the hospital and the second reading was taken at the last conducted test. Patients with insufficient information or no history of epilepsy were excluded from the study. After that, the data was entered into an Excel program, where theoretical information was coded as 0 if there were no variables or 1 if the answer was yes to any type of variables. In addition, the outcomes of laboratory tests were recorded as 0, 1, and 2 correspondingly to normal, below normal, and above normal values. Additionally, Excel was used to evaluate data. To better understand the distribution and central tendency of the variables, the program used descriptive analysis to assess the theoretical data. In the meantime, any noteworthy correlations between the variables were found by utilizing Pearson correlation analysis. Since the significance level was set at >0.05, every correlation that had a p-value less than this cutoff was considered as statistically significant. The goal of this thorough approach to data collecting and analysis in summary was to shed light on the clinical and demographic traits of epilepsy patients in the area. Our goal was to find relationships that might guide future improvements in clinical procedures and patient outcomes, through an examination of both demographic, clinical and biochemical data. New research with bigger sample sizes and more factors might produce even more reliable results, regardless of careful attention to detail.

Chapter Three

Results

3.1 Sample distribution according to demographic data

The present study is a cross-sectional correlation study that included 256 patiants. The key variables among epileptic patients included in the study are age distribution, sponsorship status, and visit sequence to healthcare facilities.

Table 1

Demographics features of the patients (n=256)

Variable	N	%
Gender		
Male	148	57.8
Female	108	42.2
Age		
<=10	91	31.1
11-15	80	27.3
>16	61	20.8
Sponsored		
Yes	245	95.7
No	11	4.2
visit sequence		
<=10	116	39.6
11-15	115	39.2
>15	16	5.5

Table 2

various categories and their corresponding frequencies within a dataset concerning epileptic patients (n=256)

Category	Negative/n	Positive/n	% of negative	% of positive
Died	247	9	96.5	3.5
Infected with Covid 19	253	3	98.8	1.2
Patient History of Falling	248	8	96.9	3.1
Patient History of Head Trauma	244	12	95.3	4.7
Developmental Delay	197	59	76.95	23.05
Family Hx Hyperkalemia	255	1	99.71	0.39
Family Hx Hypernatremia	255	1	99.71	0.39
Family Hx Epilepsy	236	20	92.19	7.81
Parents relativity	239	17	93.36	6.64

The table above reveals significant variations across different demographic and clinical categories among the patients. A total of 3.5% of the patients had died, indicating a survival rate of 96.5%. Only a small fraction, 1.2%, were infected with COVID-19, while the overwhelming majority, 98.8%, were not. When examining the history of falling, 3.1% of patients reported having fallen, in contrast to 96.9% who had no history of falls. Similarly, 4.7% of patients had a history of head trauma, while 95.3% did not. Notably, developmental delays were more common, affecting 23.05% of the patients, with 76.95% showing no such delays. Family histories of hyperkalemia and hypernatremia were both exceedingly rare, each recorded in only 0.39% of the cases, leaving 99.71% without these conditions. Epilepsy in the family history was noted in 7.81% of patients, whereas 92.19% did not have this background. Furthermore, 6.64% of patients had parents who were related, while a significant majority of 93.36% did not have such parental relationships. These findings highlight the diverse medical backgrounds and conditions present within the patient population, emphasizing the importance of considering a wide range of factors in medical assessments and treatment plans. The low percentages of COVID-19 infections, head trauma, and familial electrolyte disorders contrast with the relatively higher incidence of developmental delays and family history of epilepsy, which may suggest areas requiring more focused medical attention and resource allocation.

Table 3

Frequency of the seizure types (n=256)

Type of the seizure	N	%
Absence seizure	2	0.80
Focal	12	4.70
Atonic	6	2.30
partial clonic seizure	1	0.40
generalized tonic-clonic	147	57.40

Table 3 illustrates the types of seizures found out in the dataset with particular concern to their frequency and percentage. It is also important to note the types of seizures encountered, with absence seizures being the rarest, accounting for only 0.80% percent of the cases, atonic seizures are rare, making only 2.30% percent of all the seizures which occur. While focal seizures occur in 4.70% of cases. 0.40% of cases observed had partial clonic seizures. In contrast, it is clearly shown that 57.40% of them, which

represents the highest percentage was generalized tonic-clonic seizures type. It is through such findings that one can be able to identify how different types of seizures are distributed within the identified sample population with a focus on provision of more information regarding Generalized Tonic Clonic seizures than other types.

Table 4

Association between Age, gender, family history and blood tests (n=256)

Blood tests		Age			family hx Epilepsy		Family hx hyperkalemia	
		<=10	Nov-15	16+	No	Yes	No	yes
RBS	Normal	35	31	39	94	11	104	1
	Low	12	4	0	16	0	16	0
	High	44	45	46	126	9	135	0
	p-value	0.008**			0.268		0.486	
Calcium	Normal	40	16	11	57	10	67	0
	Low	19	12	23	51	3	54	0
	High	32	52	51	128	7	134	1
	p-value	<0.001**			0.041*		0.638	
Sodium	Normal	66	54	74	193	1	84	0
	Low	20	18	6	44	0	152	0
	High	5	8	5	18	0	14	1
	p-value	0.023*			0.852		<0.001**	
BUN	Normal	70	64	74	207	1	207	1
	Low	13	7	3	23	0	23	0
	High	8	9	8	25	0	25	0
	p-value	0.163			0.891		0.891	
Creatinine	Normal	16	17	39	72	0	72	0
	Low	65	59	41	164	1	164	1
	High	5	1	1	7	0	7	0
	p-value	<0.001*			0.786		0.786	

The tables above provide a thorough examination of blood test values among epileptic patients, considering factors such as age, gender, and family history of epilepsy, hypernatremia, and hyperkalemia. It elucidates significant correlations between these variables and blood test results. For instance, concerning blood glucose levels (RBS), there's a noteworthy association with age, as older age groups demonstrate higher proportions of abnormal RBS levels compared to younger age groups (p-value = 0.008). Additionally, calcium levels exhibit significant variations with age (p-value < 0.001), with older age groups more prone to abnormal calcium levels. However, no significant correlations were observed between gender or family history of epilepsy,

hypernatremia, or hyperkalemia and blood test values. Interestingly, sodium levels showed a significant association with family history of hypernatremia (p-value < 0.001), suggesting that patients with a positive family history are more predisposed to abnormal sodium levels. This analysis underscores the importance of considering age, gender, and family history when interpreting blood test values in epileptic patients, providing valuable insights for tailored treatment strategies and patient care.

Table 5

Association between Age, gender, family history and blood tests (n=256)

CBC Blood test		Age			Gender	
		<=10	Nov-16	16+	male	female
hematocrit	Normal	24	28	32	7	77
	Low	53	48	51	135	17
	High	12	1	2	1	14
	p-value	0.005**			<0.001**	
MCV	normal	32	25	40	56	41
	Low	47	54	45	87	59
	High	12	1	0	5	8
	p-value	<0.001**			0.335	
MPV	normal	60	48	46	94	60
	Low	12	5	0	10	7
	High	19	27	39	44	41
	p-value	<0.001**			0.379	
MCH	normal	37	47	58	85	57
	Low	30	26	18	41	33
	High	24	7	9	22	18
	p-value	<0.001			0.76	
Hemoglobin	normal	28	33	38	18	81
	Low	49	46	44	127	12
	High	14	1	3	3	15
	p-value	0.002			<0.001**	
Red blood cell distribution coefficient of variation	normal	56	2	74	104	85
	Low	59	1	0	3	0
	High	33	20	11	41	23
	p-value	0.004*			0.148	
RBC	normal	57	62	70	110	79
	Low	22	10	5	24	13
	High	12	8	10	14	16
	p-value	0.01*			0.318	
Neutrophils granules	normal	23	27	19	54	34
	low	48	30	17	52	43
	high	19	23	29	40	31
	p-value	<0.001**			0.646	
Lymphocytes	normal	24	26	33	44	39
	low	14	22	27	36	27
	high	53	32	25	68	42
	p-value	0.003*			0.468	

The table presents a detailed analysis of blood test values among epileptic patients, considering factors such as age, gender, and family history of epilepsy, hypernatremia, and hyperkalemia. For hematocrit levels, a significant difference was observed, with p-values of 0.005 in the age comparison and <0.001 in gender comparison. Normal hematocrit levels were more common in the ≤10 age group, whereas low levels were prevalent among females. Mean corpuscular volume (MCV) showed a significant difference by age ($p < 0.001$), with low MCV levels more frequently seen in younger individuals, but gender differences were not statistically significant ($p = 0.335$). Mean platelet volume (MPV) also varied significantly by age ($p < 0.001$), with normal values mostly seen in the older age group (16+ years) but did not vary significantly by gender ($p = 0.379$). Mean corpuscular hemoglobin (MCH) levels differed significantly by age ($p < 0.001$), but not by gender ($p = 0.76$). Hemoglobin levels also showed significant age and gender differences ($p = 0.002$ and <0.001, respectively), with normal levels most common in females. The red blood cell (RBC) distribution width had a statistically significant variation by age ($p = 0.004$) but not by gender ($p = 0.148$). For RBC counts, significant age differences were observed ($p = 0.01$), with normal levels prevalent in the 16+ group, while no significant gender differences were noted ($p = 0.318$). Neutrophil counts varied significantly by age ($p < 0.001$) but not by gender ($p = 0.646$), with normal levels observed more often in the 16+ group. Lymphocyte counts showed significant age-related differences ($p = 0.003$), with higher levels in younger groups, but no significant gender difference ($p = 0.468$).

Table 6

Association between Blood test results and Duration of one seizure in minutes (n=256)

Blood tests		Duration of Episode/min
RBS	p-value	0.785
Calcium	p-value	0.088
Potassium	p-value	0.443
Sodium	p-value	0.762
BUN	p-value	0.144
Creatinine	p-value	0.977

The table above presents a comprehensive analysis of blood test results alongside the duration of seizure episodes experienced by patients, aiming to explore potential correlations between blood chemistry and seizure characteristics in epilepsy patients. Each blood test, including Random Blood Sugar (RBS), Calcium, Potassium, Sodium, Blood Urea Nitrogen (BUN), and Creatinine, is categorized based on whether the result fell within normal, low, or high ranges. Corresponding frequencies of seizure episode durations are provided for each category, as well as the overall total. Statistical analysis, represented by p-values, assesses the significance of any observed associations between blood test results and seizure episode durations. Notably, there were no statistically significant associations found between blood test results and seizure episode durations for any of the parameters examined.

Table 7

Association between Blood test results and history of seizure (n=256)

Blood tests		Up-rolling eyes		mouth secretion		convulsion of upper limb		convulsion of lower limb		passed urine	
		0	1	0	1	0	1	0	1	0	1
RBS	Normal	65	40	76	29	97	8	100	5	100	5
	Low	11	5	14	2	12	4	15	1	16	0
	High	93	41	102	32	126	9	127	8	130	5
	p-value	0.466		0.405		0.039*		0.916		0.647	
Calcium	Normal	37	30	49	18	58	9	59	8	63	4
	Low	36	18	37	17	51	3	53	1	52	2
	High	96	38	106	27	126	9	130	5	131	4
	p-value	0.067		0.28		0.186		0.022*		0.581	
Potassium	Normal	146	79	169	56	206	20	212	14	216	10
	Low	6	0	4	2	5	1	6	0	6	0
	High	17	7	19	5	24	0	24	0	24	0
	p-value	0.176		0.803		0.242		0.374		0.501	
Sodium	normal	130	63	148	45	177	17	181	13	186	8
	Low	23	21	28	16	40	4	43	1	42	2
	High	16	2	16	2	18	0	18	0	18	0
	p-value	0.018*		0.074		0.42		0.289		0.669	

The table above presents an analysis of blood test results alongside the occurrence of various seizure history among patients with epilepsy. For random blood sugar (RBS), there was a significant difference related to upper limb convulsions (p = 0.039), with normal RBS levels more frequent in patients without this symptom. No other symptoms showed significant differences in RBS levels, with p-values above 0.4 across the board. Calcium levels were significantly associated with lower limb convulsions (p = 0.022), where normal levels were observed more often in patients without these convulsions. Other symptoms showed no significant association with calcium levels. Potassium levels did not show any significant associations with any of the symptoms. Sodium levels were significantly associated with up-rolling eyes (p = 0.018), with normal sodium levels more frequently observed in patients without this symptom. For other symptoms, sodium levels did not exhibit significant differences, with p-values greater than 0.05.

Table 8

Association between Blood test results and history of seizure (n=256)

CBC Blood tests		Up-rolling eyes		
		0	1	total
MPV	normal	103	51	154
	Low	6	10	16
	high	60	25	85
	total	169	86	255
	p-value	0.036*		

The provided table presents an analysis of CBC (Complete Blood Count) blood test results alongside the occurrence of history of episodes among patients with epilepsy. Seizure history such as up-rolling eyes, mouth secretion, convulsions of the upper limb, convulsions of the lower limb, and passing urine are categorized based on their presence or absence during seizure episodes, with '0' indicating the absence and '1' indicating the presence of the symptom. Each CBC parameter, including Hematocrit, Platelet count, MCV, MPV, MCH, Hemoglobin, Red blood cell distribution coefficient of variation, RBC, Neutrophils granules, lymphocytes, and WBC, is further categorized based on whether the result fell within normal, low, or high ranges. Frequencies of symptoms are provided for each category of CBC parameters, alongside the total occurrences. Statistical analysis, represented by p-values, assesses the significance of any

associations between CBC parameters and the presence of seizure symptoms. Notably, significant associations were observed between the occurrence of uprolling eyes and MPV (p = 0.036). These findings suggest potential links between specific CBC parameters and the manifestation of seizure symptoms in epilepsy patients.

Table 9

Association between Antiepileptic drugs and blood test results (n=256)

Blood tests		Phenobarbital		diazepam		clonazepam		Keppra (levetiracetam)	
		0	1	0	1	0	1	0	1
RBS	Normal	76	29	67	38	97	8	97	8
	low	8	8	6	10	16	0	11	5
	high	101	34	62	73	127	8	120	15
	p-value	0.111		0.01*		0.49		0.019	
Calcium	Normal	50	17	36	31	63	4	60	7
	low	43	11	30	24	53	1	49	5
	high	92	43	69	66	124	11	119	16
	p-value	0.248		0.843		0.27		0.866	
Potassium	Normal	167	59	115	111	211	15	201	25
	low	3	3	4	2	6	0	5	1
	high	15	9	16	8	23	1	22	2
	p-value	0.232		0.266		0.728		0.83	
Sodium	normal	145	49	97	97	181	13	175	19
	low	29	15	27	17	43	1	38	6
	high	11	7	11	7	16	2	15	3
	p-value	0.273		0.301		0.371		0.55	
BUN	Normal	157	51	105	103	196	12	187	21
	low	10	13	17	6	20	3	19	4
	high	18	7	13	12	24	1	22	3
	p-value	0.005**		0.102		0.348		0.559	
Creatinine	Normal	51	21	34	38	65	7	66	6
	low	119	46	94	71	158	7	147	18
	high	5	2	1	6	6	1	6	1
	p-value	0.98		0.045*		0.179		0.783	

The provided table presents an analysis of various blood test results alongside the usage of different antiepileptic medications among patients with epilepsy. Each blood test parameter, including RBS, Calcium, Potassium, Sodium, BUN, and Creatinine, is categorized based on whether the result fell within normal, low, or high ranges. The usage of antiepileptic medications, including Carbamazepine, Phenytoin, Valproic acid (Sodium valproate), Phenobarbital, diazepam, clonazepam, and Keppra (levetiracetam),

is categorized based on whether the medication was taken ('1') or not taken ('0'). Frequencies of medication usage are provided for each category of blood test parameters, alongside the total occurrences. Statistical analysis, represented by p-values, assesses the significance of any association between medication usage and blood test parameters. Notably, significant associations were observed between the usage of Phenobarbital and RBS ($p = 0.01$) and between the usage of BUN and Phenobarbital ($p = 0.005$). These findings suggest potential links between specific antiepileptic medications and alterations in blood test parameters among epilepsy patients, emphasizing the need for further investigation into the underlying mechanisms driving these associations.

Table 10

Association between Antiepileptic drugs and blood test results (n=256)

CBC Blood tests		Carbamazepine		Phenytoin		Valproic acid (Sodium valproate)		Phenobarbital		Diazepam	
		0	1	0	1	0	1	0	1	0	1
Hematocrit	Normal	70	14	49	35	74	10	59	25	36	48
	low	128	24	109	43	113	39	115	37	91	61
	high	13	2	5	10	12	3	8	7	4	11
	p-value	0.946		0.004**		0.044*		0.154		0.005**	
MCV	normal	74	23	63	34	80	17	72	25	49	48
	low	130	16	95	51	113	33	108	38	77	69
	high	10	3	7	6	10	3	5	8	9	4
	p-value	0.025*		0.714		0.618		0.020*		0.447	
Hemoglobin	normal	83	16	60	39	87	12	68	31	44	55
	low	115	24	100	39	103	36	106	33	84	55
	high	16	2	5	13	13	5	11	7	7	11
	p-value	0.8		<0.001**		0.026*		0.24		0.025*	
Neutrophils granules	normal	76	12	52	36	72	16	62	26	49	39
	Low	80	15	69	26	73	22	61	34	48	47
	high	56	15	43	28	57	14	60	11	36	35
	p-value	0.436		0.114		0.694		0.014*		0.743	
Lymphocytes	normal	68	15	47	36	68	15	58	25	44	39
	Low	50	13	41	22	50	13	54	9	36	27
	high	96	14	77	33	85	25	73	37	55	55
	p-value	0.354		0.157		0.732		0.020*		0.662	

The table presents an analysis of CBC blood test results categorized by the usage of different antiepileptic medications among patients with epilepsy. Each blood test parameter, such as hematocrit, platelet count, MCV (Mean Corpuscular Volume), MPV (Mean Platelet Volume), MCH (Mean Corpuscular Hemoglobin), hemoglobin, RBC (Red Blood Cell), Neutrophils granules, lymphocytes, and WBC (White Blood Cell), is categorized based on whether the result fell within normal, low, or high ranges. The usage of antiepileptic medications, including Carbamazepine, Phenytoin, Valproic acid (Sodium valproate), Phenobarbital, diazepam, clonazepam, and Keppra (levetiracetam). Notably, significant associations were observed between the usage of Phenytoin, Valproic acid (Sodium valproate), diazepam with hematocrit ($p = 0.004$), ($p= 0.044$), ($p= 0.005$) There was a significant association between MCV levels and carbamazepine

use ($p = 0.025$) as well as phenobarbital use ($p = 0.020$).and hemoglobin ($p < 0.001$). Additionally, Phenytoin and valproic acid showed significant associations with hemoglobin levels, with p-values of <0.001 and 0.026, respectively, as well as diazepam ($p = 0.025$). Phenobarbital also showed a significant association with lymphocyte levels ($p = 0.020$). Phenobarbital had a significant effect on neutrophil levels ($p = 0.014$), with normal neutrophil levels more common among users of this medication.

Also, Notable proportions of patients had MCV (Mean Corpuscular Volume) of 57%, hematocrit (59.4%), and creatinine (64.5%) below normal. On the other hand, higher values were noted for a number of measures, such as the percentage of lymphocytes (43%), neutrophilic granules (26.7%), and mean platelet volume (33.2%). Additionally, a sizable percentage of individuals had calcium levels (52.7%) and RBS (random blood sugar) (52.7%) that were above normal. The frequency of hematological and biochemical abnormalities among epilepsy patients is highlighted by these data, indicating the need to monitor these parameters for proper management and treatment. The results are detailed in Table A1

Blood test results frequency on the first admission (n=256) While Certain markers, such hemoglobin, platelet count, and WBC, primarily display normal values; however, other markers, like lymphocytes%, neutrophil granules%, and RBC, tend to tilt toward aberrant highs or lows. Furthermore, significant departures from the normal range are shown by chemical biomarkers such as creatinine, calcium, potassium, sodium, and random blood sugar, indicating possible physiological imbalances that may require additional testing and medical intervention for patient management. In Table A2

Blood test findings frequency at the time of the last hospitalization (n=256). Among the medications surveyed, diazepam (assival) emerged as the most prescribed, with 121 responses, constituting 28.5% of cases. Following closely behind are phenytoin and phenobarbital, with 91 responses (21.5%) and 71 responses (16.7%) respectively. Valproic acid (sodium valproate) also appears to be a significant medication choice, with 53 responses (12.5%). Other medications such as carbamazepine, Keppra (levetiracetam), and Clonazepam were utilized to a lesser extent, each representing between 3.8% to 9.9% of cases. Interestingly, Vigabatrin was the least commonly prescribed medication, with only 2 responses, accounting for 0.5% of cases. This summary underscores the diverse pharmacological approaches employed in managing epilepsy and provides valuable insights into the medication preferences among healthcare professionals treating epileptic patients. In Table A3

Patients' frequency of usage of antiepileptic medications (n=256). Of the 256 patients who were the subject of the study, the majority (47.3%) reported having no seizure events over the specified period. Additionally, 41% of patients had at least one seizure episode, suggesting that a sizeable segment of the population had a relatively low frequency of seizures. The table also indicates a range in severity, with a lower

proportion of patients having two to forty bouts of multiple seizures per day. 2.7% of patients had three episodes per day, compared to 5.9% of patients who had two episodes per day. Likewise, the presence of extreme cases, such as the 1.2% of patients experiencing five seizures per day, and the isolated instances of patients encountering seven, 15, or even 40 episodes per day In Table A4

Frequency of seizures number happened for the patients per day (n=256). In addition, the majority (51.6%) reported having seizures that lasted for no discernible amount of time, meaning that either very short episodes occurred or there were no seizures at all during the time period that was recorded. However, the distribution of measurable durations varies widely for those patients, with 10.5% experiencing episodes lasting 10 minutes, afterward 7% enduring episodes lasting 3 minutes, and 5.9% enduring episodes lasting 15 minutes. Notably, there is a range of durations reported, including episodes lasting up to 300 minutes, highlighting the diversity in seizure duration experienced within the studied population.

Table A5

Frequency of the duration of one seizure happened for the patient (n=256). Among the symptoms reported, up-rolling eyes were the most prevalent, occurring in 33.60% of cases, followed by mouth secretion, observed in 24.60% of cases. 4.50% of instances show lower limb convulsions and 8.20% of cases report upper limb convulsions. Furthermore, 3.90% of patients said they had passed urine during a seizure. The study's epileptic patients' seizure episode histories and the frequency of symptoms they encountered are broken down in depth in the table. "Up-rolling eyes" was the most common symptom among those recorded, occurring in 33.5% of patients; "mouth secretion" was described in 24.6% of cases. "Convulsion of upper limb" (8.2%), "convulsion of lower limb" (5.47%), and "passed urine" (3.9%) are other symptoms that are frequently mentioned. "Vomiting" (2.3%), "cyanosis" (11.7%), and "staring of his eyes" (3.12%) are fewer common symptoms. Furthermore, researchers noticed very low percentages of strange symptoms were noted, including "facial pallor," "eye blinking," "clenching of teeth," "foul smell in stool," and "lip smacking.". The varying symptoms are highlighted, and the significance of thorough assessment and care techniques catered to the needs of individual patients are emphasized by these findings. They also provide insightful information about the various presentations of seizures among epileptic patients. In Table A5.

Table A6

Frequency of history of seizures episode among patients with epilepsy (n=256) Notably, most past medical history experienced was a brain atrophy in 9 (3. 5%) of them, with cerebral palsy affecting the same number of patients, and with AB MDR + PSED affecting 7 (2. 7%) of patients. Furthermore, abnormal cortical features, specifically Lissencephaly, were evident also in 7 patients (2.7%). In Table A6.

Table A7

Past medical histories of the patients (n=256) Notably, the analysis reveals a significant association between calcium levels and seizure frequency ($p = 0.026$), suggesting a potential link between calcium dysregulation and seizure activity. However, no significant associations were found for the other blood tests examined. These findings contribute valuable insights into the potential role of calcium levels in epilepsy pathophysiology, emphasizing the need for further research to elucidate underlying mechanisms and inform clinical management strategies. In Table A7.

Table A8

Association between frequency of seizure episode per day and results of blood tests (n=256) Significant associations were observed between the frequency of epilepsy episodes per day and platelet count ($p = 0.006$). Detailed results shown on in Table A8, Table A9.

Table A9

Association between frequency of seizure episode per day and results of blood tests (*n=256)* Notably, significant associations are observed between certain blood parameters and the duration of seizure episodes. For instance, hematocrit levels show no significant association with seizure duration, with p-value 0.839. Similarly, platelet count, MCV, hemoglobin, MCH (Mean Corpuscular Hemoglobin), and MPV (Mean Platelet Volume) do not exhibit significant associations with seizure duration, as indicated by their respective p-values (0.97, 0.703, 0.6, 0.348, and 0.124). However, parameters such as neutrophils granules %, RBC (Red Blood Cell), and WBC (White Blood Cell) show no significant associations with seizure duration, despite some variations in abnormal values across different durations of seizure episodes. In Table A10

Association between (CBC) Blood test results and Duration of one seizure in minutes.

Chapter Four

Discussions and Conclusions

4.1 Discussion

This study involved epileptic patients with a subset of these patients being admitted to the hospital during or immediately after the seizure episode. The cases that have been used in this research had detailed records of their medical history, which offered all the data needed to examine the impact of numerous demographic and biochemical aspects to epilepsy. The aim of the study is to find possible correlations between demographic characteristics such as age, gender, and the frequency, severity, and type of seizures experienced. Furthermore, the study investigated biochemical factors, including electrolyte imbalances, blood glucose levels, and metabolic markers, to control their effect on the condition's progression and management. The available data explains the complicated nature of epilepsy by examining patient demographics, seizure kinds, blood test findings, and medication use. Regarding demographic data obtained it is shown that, there are more males (57.8%) than females (42.2%). Also, the age distribution is fairly even across three categories: <=10 (31.1%), 11-15 (27.3%), and >16 (20.8%). Moreover, the vast majority of patients (95.7%) are sponsored, while only a small percentage (4.2%) are not. And most patients (39.6%) have had 10 or fewer visit sequence. A similar number of patients (39.2%) have had 11-100 visits, and a smaller portion (5.5%) have had more than 100 visits. The present results agreed with the previous data of Alyoubi et al. who observed a higher incidence of epilepsy in males compared to females. Additionally, most patients were younger than 10 years old (61). Our findings regarding the prevalence of epilepsy by age group diverge from previous research reported a higher incidence of epilepsy in females; also, they did not observe a significant difference in prevalence across genders (62). Only a small number test positive patients while most are tested negative for COVID-19. Among the categories, most patients survived, with only a few passing away. Furthermore, a significant portion of patients exhibited developmental delay, while the rest did not. Family histories of hyperkalemia, hypernatremia, and epilepsy were very rare. Also, familial history of head trauma and falling, although uncommon, were present in a small number of patients. The results are in accordance with other studies which confirmed that among patients with epilepsy, a small percentage tested positive for COVID-19, with a higher

incidence rate compared to the general population (63). Data obtained from previous research of Asadi-Pooya et al. suggests no significant association between epilepsy and increased susceptibility to COVID-19 infection or severity of illness compared to the general population (64). Analysis of Min et al. revealed a significant association between an epilepsy diagnosis and both extended hospital length of stay and a disposition upon discharge deviating from the standard practice (non-routine discharge), interestingly, no correlation was observed between epilepsy and increased mortality rates (65). It was observed that advanced age, requirement for mechanical ventilation, and a greater burden of co-morbidities were identified as independent risk factors for mortality in patients with co-existing COVID-19 and epilepsy (66).

Regarding frequency of the seizure types, it is noted that absence seizures were the least common, followed by focal and atonic seizures. Myoclonic seizures weren't observed in this dataset, and partial clonic seizures were rare. Generalized tonic-clonic seizures were the most common type. This suggests that generalized tonic-clonic seizures are more likely to occur in this group compared to other seizure types. In line with previous research by Li et al. our findings corroborate the notion that generalized tonic-clonic seizures (GTCS) stem from disturbances in bilateral brain function. As reported, patients with GTCS often present with abrupt seizure onsets, necessitating emergency department evaluation and admission (67). This aligns with the observations made by Chen et al. regarding the diverse prevalence rates and risk factors associated with different epilepsy subtypes (68). Another study corroborated this finding, revealing that risk factors for seizure occurrence differed between patients with focal and non-focal epilepsy. Notably, higher seizure frequency emerged as the sole consistent risk factor linked to an increased probability of developing seizure clusters in both patient groups (69). Moreover, the analysis revealed that many patients had abnormal blood values. Some patients had lower-than-normal levels of MCV, hematocrit, and creatinine. In contrast, others had higher-than-normal levels of lymphocytes, neutrophilic granules, MPV, calcium, and RBS. These findings suggest that a substantial number of epilepsy patients have blood abnormalities, highlighting the importance of monitoring these parameters for proper care. Consistent with the current results, the findings of Huang et al. observed alterations in WBC, RBC, lymphocyte count, neutrophil count, platelet count, and neutrophil-to-lymphocyte ratio (NLR) in epileptic patients. Notably, these indices exhibited an increase on the day of seizure,

followed by a decrease on the subsequent day. Additionally, patients with a seizure duration of five minutes or less displayed significantly lower WBC and neutrophil counts compared to those with a seizure duration exceeding five minutes (70). While research investigating routine blood parameter changes in epilepsy patients remains limited, Guneş and Buyukgol. explored the association between MPV and seizures. Their findings, however, suggest a more complex relationship, they identified a correlation between seizures and neutrophil-mediated inflammation, with a one-unit increase in neutrophil count translating to a 1.95-fold rise in seizure risk. This highlights the potential role of inflammatory processes, particularly those involving neutrophils, in seizure development (71). In another review, seizures induced a transient increase in the RBC count, platelet count, and WBC count, possibly due to seizure-induced hemoconcentration. This phenomenon involves a decrease in plasma volume secondary to factors like excessive sweating and vomiting during the seizure event. This may cause dehydration, which can lead to blood concentration, manifesting as increase in RBC count and platelet count (70).

As to the frequency of the Antiepileptic drugs that were employed by patients results depicted that Diazepam (assival) was one of the most often prescription medication by the facilitator, next came phenytoin and phenobarbital. Another commonly used medication was: Prescribed AEDs included phenytoin, valproic acid (Sodium valporate), carbamazepine, levetiracetam (Keppra), and clonazepam less frequently than the first three drugs listed above. However, vigabatrin was the least prescribed medication among them all. This leads to the inference that doctors employ several treatments for epilepsy and some treatments are more common as compared with others. The first of the benzodiazepines used for managing epilepsy, Diazepam is highly lipophilic, thus prompting rapid protraction across the blood-brain barrier. This property makes it infused intravenously, thus providing a rapid response in the therapeutic treatment (72). A significant advantage for diazepam revealed by meta-analysis of three trials that it reduces the likelihood of ongoing seizures compared to alternative medications (73). In addition, A meta-analysis was conducted to assess the efficacy of various drugs in terminating seizure activity. The findings indicated that valproate demonstrated the greatest efficacy, followed by phenobarbital, levetiracetam, and phenytoin, Lacosamide was excluded from the meta-analysis due to insufficient data (74). A recent meta-analysis suggests phenobarbital may be more effective than other medications in

terminating status epilepticus (SE). Conversely, lacosamide and valproate appear to be better tolerated compared to phenobarbital in this context (75). Concerning the frequency of seizures number happened for the patients per day, the study examined 256 patients with epilepsy. A large group reported no seizures, indicating good management or infrequent episodes. Another substantial group experienced one seizure, suggesting relatively low frequency. However, the data also revealed varying severity, with a smaller number of patients having multiple seizures daily (ranging from two to 40 episodes). The study of Fitzgerald et al. agreed with the present study they found that patients with epilepsy experienced varying seizure frequencies per day, ranging from none to up to 40 episodes, indicating diverse levels of severity and management outcomes (76). Also, Dell et al. 2021 results are in accordance with the present results, they found that varying seizure frequencies per day in patients with refractory focal epilepsy, ranging from none to multiple seizures (2 to 40 episodes), indicating diverse seizure severity levels, they also stated that longer sleep duration reduces seizure risk by 27%. Seizures disrupt sleep patterns, reducing quality and elongating sleep (77). Data obtained from several previous studies also showed a range in seizure frequency among young people with epilepsy, from none to multiple daily episodes, indicating varying levels of severity and management with some experiencing no seizures, others having one, and a smaller group facing multiple daily episodes (4) (76) (78) (79) (28). Regarding duration of seizure happened for the patient, the results of the current study showed that most patients reported episodes lasting too short a time to measure, indicating either very brief seizures or none at all during the recording. For those with measurable durations, the length varied widely. Some patients had episodes lasting 10 minutes, while others had episodes lasting 3 or 15 minutes. Seizure durations varied with the maximum recorded seizure duration amounting to 300 minutes; this depicts the variation in the duration of seizures being experienced by the group. As the differences in duration of seizures relating to epilepsy patients clearly indicate, the duration changes randomly in epilepsy patients (80) (81). Studies have shown that seizure durations can range widely, from very brief episodes to as long as 300 minutes, emphasizing the diverse nature of seizure durations observed in this population (82). For instance, focal status epilepticus episodes displayed a median seizure duration of 107 seconds, with some lasting over 10 minutes (83). Similarly, in patients with West syndrome, the time needed to capture the first epileptic spasm on EEG averaged around 188.36 minutes,

indicating the potential for prolonged seizure activity (84). This wide range of seizure durations underscores the complexity and heterogeneity of epileptic episodes, highlighting the need for individualized monitoring and treatment strategies. Regarding symptoms reported during seizures. Rolling eyes was the most common symptom, followed by mouth secretion. Less frequent symptoms included convulsions of the upper limbs and lower limbs. Some patients also reported passing urine during seizures. Kanemoto et al. revealed that during epileptic seizures, the most common symptom reported was rolling of the eyes, as observed in a study analyzing focal-onset seizures (85). This usually happens with oral discharge, which is one of the symptoms that appear during seizures. Furthermore, several patients who had seizures described upper and lower limb convulsions though they are less common. In some cases, patients usually pass urine showing an extensive spectrum of symptoms during epileptic episodes. It occurs most commonly with oral frothing, which is one of the signs that manifest during seizures. In addition, the following: Some patients stated some of them had convulsions in the upper and lower limbs though they are few in the patients with seizure. Sometimes during the episodes of seizures, patients usually produce urine typical of the full range of manifestations. It often accompanies oral discharge, which often occurs in seizures. Moreover, while upper and lower limb convulsions were rare, some participants with seizures or epilepsy reported them to us. Urine output during seizures has also been reported as a sign in some places because epilepsy may manifest in so many different ways (85) (86). The current study found that the medical history data for the analyzed participants revealed a wide range of previous ailments. Some patients suffered from epilepsy, such as temporal lobe epilepsy and partial complex epilepsy. Others suffered neurological disorders such as cerebral palsy, cerebral atrophy, and white matter disease. There were other cases of hypothyroidism, thalassemia trait, Fragile X syndrome, leukemia, autism, and macrocephaly. A few patients have previously undergone neurological surgeries, such as vp shunt insertion. In addition, some individuals developed infectious disorders such as Acinetobacter baumannii, meningitis, ESBL infection, and aspiration pneumonia. There have also been complaints of head injuries. This data reveals these patients' complex medical histories, indicating the necessity for individualized treatment strategies that take into account their unique needs. Epilepsy diagnosis relies heavily on an accurate medical history. Inadequate history-taking can result in misdiagnosis of epileptic seizures,

exposing patients to improper therapies and problems. Historical information aids in the selection of patients who require complete tests such as EEG monitoring and neuroimaging, allowing for the determination of seizure subtypes and lowering the need for extensive testing, resulting in cost savings. The progression of epilepsy knowledge from mystical beliefs in ancient cultures to present scientific approaches emphasizes the significance of a thorough medical history in accurately diagnosing and managing epilepsy. Ratana et al.'s study underlines that thorough history taking, particularly when paired with EEG, greatly enhances the accuracy of epilepsy diagnosis(87). Medical history data in certain research indicated different illnesses such as epilepsy, cerebral palsy, hypothyroidism, Fragile X syndrome, and infectious infections, stressing the need for tailored treatment regimens (61,88). Patients with both types of epilepsy temporal lobe and partial complex appear in the investigations, and they showed a group of characteristics, including aberrant MRI findings such as mesial temporal sclerosis, encephalomalacia, brain atrophy, and localized cortical dysplasia. Furthermore, psychopathology was common in children with refractory epilepsy. This affects their academic performance and their quality of life. Additionally, patients with tuberous sclerosis complex (TSC proved to have TSC-associated epilepsy, with a few cases showing separate temporal lobe epilepsy. Moreover, research on chronic epilepsy patients found an elevated burden of cerebral small vessel disease (cSVD), showing a probable relationship between epilepsy and cerebrovascular illness (87) (89). Patients revealed different forms of epilepsy such as temporal lobe epilepsy and partial complex epilepsy, beside neurological disorders like cerebral palsy, cerebral atrophy, and white matter disease. Comorbidities included hypothyroidism, thalassemia trait, fragile X syndrome, leukemia, autism, and macrocephaly. Neurological surgeries that occurred previously, such as vp-shunt implantation, were documented, as well as cases of infectious diseases such Acinetobacter baumanni, meningoencephalitis, ESBL infection, and aspiration pneumonia. Reports of head trauma were also available (90). This detailed medical information highlights the need for specific treatment options adapted to the particular needs of these individuals. With regard to the connection between age, gender, family history, and blood tests, the results showed interesting links between these factors and test results. For example, RBS levels appear to be associated with age. Patients who are older are more likely to have aberrant outcomes than those who are younger. Similarly, calcium levels change with age, with older people more prone to

have inappropriate levels. Gender appears to influence creatinine levels, with men being more susceptible to anomalies than women. However, gender and family history of some illnesses, such as epilepsy or high potassium levels, had no clear relationship with blood sugar, calcium, potassium, or BUN levels. Interestingly, sodium levels were associated with a family history of high sodium levels, implying a higher likelihood of abnormal readings in patients with such a history. This research highlights the importance of age, gender, and family history when explaining blood tests for patients with epilepsy. This can help a lot in developing a better treatment for patients. Research conducted previously emphasized that age, gender, and family history all have a considerable effect on blood test findings in epilepsy patients. Patients who are relatively old are more liable to have aberrant blood sugar and calcium levels, and epileptic youngsters are at risk for hormonal and metabolic changes. Additionally, epileptic females are at a higher risk of plenty of disorders (91) Creatinine levels are different according to gender, with men having a higher predisposition for abnormalities (3). A family history of high sodium levels has been connected to aberrant sodium levels in patients, demonstrating that this parameter is influenced by family history. However, no apparent link was discovered between gender or family history of epilepsy/high potassium levels and blood sugar, calcium, potassium, or BUN levels. Understanding these relationships is critical for creating individualized treatment approaches and improving patient care in epilepsy management (92). The current study also found intriguing links between characteristics such as age, gender, and family history of epilepsy, hypernatremia, hyperkalemia, and CBC blood tests. And the results of the tests. For example, hematocrit levels appear to be age-related, with older patients having a larger risk of aberrant outcomes than younger ones. Furthermore, the family history of some illnesses, such as high sodium or potassium levels, appears to be associated with hematocrit levels. The same connections appeared between platelet count, hemoglobin levels, and red blood cell dispersion. Interestingly, red blood cell dispersion was linked to gender. Lymphocyte levels appear to be affected by age and a family history of epilepsy, but neutrophil levels and white blood cell count are more closely associated to age. Generally, this analysis highlights the need for considering a patient's age, gender, and family history when interpreting blood tests for epilepsy. This can contribute to finding better treatment for patients. The relation between characteristics such as age, gender, family history of epilepsy, hypernatremia, and

hyperkalemia in epileptic patients has been thoroughly investigated. Based on research, a family history of epilepsy has a significant effect on the disease's prognosis and age of start (93). Moreover, serum potassium levels have been noticed to be greater in children with febrile seizures, signifying a possible connection between hyperkalemia and seizure disorders (94). Furthermore, a study on repeated testing for hyperkalemia in pediatric emergency department patients revealed that age and race were factors impacting aberrant potassium levels in epileptic children, stressing the need for addressing demographic variables in test interpretation (95). Besides, research shows a link between high extracellular potassium concentrations and the growth of epilepsy (96). Numerous studies have recommended variations in extracellular potassium content as a contributing factor to the progress of epileptic disorders. Fröhlich et al. argued that the duration, magnitude, and rate of change of potassium concentrations are influential in this transition (97). Similarly, Curtis et al. showed evidence that substantial elevations in extracellular potassium above normal levels might elicit a depolarization block, leading to persistent seizures (98). This study's findings diverge from those reported by Shajari et al. They observed no statistically significant differences in ferritin and calcium serum levels between the case and control groups. Additionally, no significant associations were found between age, sex, past medical history, or family history of seizures and the occurrence of febrile seizures (99). The current study identified lower ferritin levels in the case group compared to the control group. However, this association lacked statistical significance, potentially due to unequal sample sizes between the groups. Notably, prior research on the link between anemia and febrile seizures presents conflicting findings. Some studies have reported anemia as a risk factor, while others have suggested it might be protective or have found no association at all (100). Conversely, other investigations have identified anemia as a potential risk factor for febrile seizures. In line with this notion, Naseer et al. documented significantly lower serum iron and hemoglobin concentrations within their febrile seizure group (101). Building upon the observation of lower ferritin levels in our case group, Koksal et al. also identified low plasma ferritin and iron as potential risk factors for febrile seizures. This finding lends further credence to the possibility that iron deficiency may be associated with an increased susceptibility to febrile seizures (102). Therefore, there are conflicting findings of the association between ferritin level and the occurrence of febrile seizure. Epilepsy is frequently associated with elevated

hippocampal leukocytes, particularly neutrophils. The extent of this infiltration correlates with neuronal degeneration. Blood-brain barrier (BBB) dysfunction and leukocyte-endothelial interactions are hypothesized to underlie this infiltration. This finding suggests that inhibiting vascular-leukocyte interactions may be a potential therapeutic strategy for epilepsy, based on experimental evidence (103). in contrast to the present results regarding sex and age, there was no significant difference between epilepsy patients and healthy controls regarding lymphocyte levels, neutrophil levels, and white blood cell count (104) (105) (106). The analysis of blood test results (CBC) for epileptic patients looked at how long their seizures lasted. While there were some changes in certain blood values depending on seizure duration, the overall analysis didn't reveal a clear connection between the two. For example, levels of hematocrit, platelets, and red blood cell volume (MCV) didn't seem to be linked to seizure duration. Even though some other values, like neutrophil levels and WBC, varied depending on seizure length, there wasn't a consistent pattern. These findings suggest that while some blood tests might fluctuate in epileptic patients during seizures, there's no clear link between the specific results and how long a seizure lasts. More research is needed to understand why this happens and what it might mean for treatment. There is a certain link between the rise in WBC count and the length of seizures. Prior research of Huang et al. exploring blood parameters in epilepsy proposes that seizures can activate a temporary rise in RBC count, WBC count, and platelet count. This rise is most noticeable for neutrophils. These studies typically observed a important decline in these parameters by the second day after a seizure. Additionally, they reported that patients experiencing seizures lasting less than five minutes exhibited significantly lower WBC and neutrophil counts compared to those with seizures exceeding five minutes (70). In addition, in the context of febrile seizures, the period of fever before the onset of seizure revealed a negative association with total leukocyte count, showing that a longer fever duration was correlated with lower leukocyte counts. These results shows that the duration of the seizure event itself, and the fever duration before, can affect the WBC count response emphasizing the complicated relationship between seizure characteristics and changes in WBC count (70). Regarding the relations between blood tests and seizure symptoms in patients with epilepsy, seizure symptoms like up-rolling eyes, mouth foaming, and limb convulsions were recorded as absent or present during seizures. Blood tests for sugar, calcium, potassium, sodium, BUN, and creatinine were

categorized as normal, low, or high. The research revealed that there was a connection found between upper limb convulsions and calcium levels, and between sodium levels and up-rolling eyes. Studies have shown a significant association between calcium levels and convulsions in epileptic patients. Low serum calcium levels were found in a considerable percentage of epileptics experiencing seizures, emphasizing the importance of monitoring electrolyte imbalances to prevent seizures and potential brain damage (107). However, regarding sodium levels and specific seizure manifestations, such as up-rolling eyes during convulsions, existing research does not indicate a direct correlation. Investigations focusing on febrile convulsions did not find serum sodium and calcium levels to be predictive factors for the recurrence of seizures, suggesting that sodium levels may not be directly linked to distinct seizure symptoms like up-rolling eyes (108). The present research studied the connections between routine blood tests (CBC) and seizure symptoms in people with epilepsy. The analysis reveals that there was a connection found between drooling and a specific platelet measurement (MPV) and between upper limb convulsions and hematocrit levels. These findings suggest that certain blood test results might be related to how seizures manifest in epileptic patients. On the other hand, Huang stated that epileptic patients may experience excessive sweating and vomiting during a seizure episode. This may cause dehydration, which can lead to blood concentration, manifesting as an increase in RBC count and platelet count. Further studies should investigate the relation of clinical symptoms with RBC count and platelet count (70). The current research explored connections between different blood tests like RBS, calcium, and electrolytes (potassium, sodium, BUN, creatinine) and the medications used to treat epilepsy. Medication used for epilepsy, including Carbamazepine, Phenytoin, Valproic acid, Phenobarbital, and others, was recorded. The analysis shows how often each medication was used alongside different blood test results, along with total medication use. Interestingly, a connection was found between taking Phenobarbital and RBS levels and BUN. The present findings suggest potential interactions between certain epilepsy medications and blood test results, warranting further investigation into the underlying mechanisms. The complex interplay between epilepsy and diabetes, particularly the elevated RBS (Random Blood Sugar) observed in diabetic patients, has been extensively documented in the literature, emphasizing its clinical significance. A critical aspect of this relationship is its bidirectionality: hyperglycemia, through its effect on neuronal excitability, can decrease seizure

thresholds in epilepsy patients; conversely, diabetes can itself influence brain function, thereby complicating epilepsy treatment (109). Preclinical and clinical evidence suggests that valproate exposure triggers oxidative stress, mitochondrial dysfunction, carnitine depletion, and inflammatory and fibrotic processes in kidney tissue. Based on these findings, researchers recommend monitoring kidney function in epilepsy patients susceptible to kidney injury during valproate therapy (110). Regarding the connections between routine blood tests (CBC) measures red blood cells, platelets, and other factors and epilepsy medications including Carbamazepine, Phenytoin, and others. The analysis showed that there was a connection between taking Phenytoin and several blood cell measurements (hematocrit, MCV, MCH, hemoglobin). Additionally, a link was found between taking Phenobarbital and hematocrit levels, and between medications affecting neutrophils and lymphocytes. These findings suggest that certain epilepsy medications might influence some CBC test results, highlighting the need for further research to understand the reasons behind these connections. Weber et al. reported no alterations in hematological parameters (Hb, MCH, MCV, and red blood cell counts) or signs of anemia in their study, this suggests that long-term phenytoin therapy does not induce clinically relevant folate deficiency in the absence of additional contributing factors (111). Bengleil et al. contrasted these findings, reporting no significant changes in most hematological parameters for patients taking carbamazepine, with the exception of a decrease in platelet count. Their study also highlighted a substantial effect of antiepileptic drugs, particularly sodium valproate, on children's hematological profiles. However, it is important to note that these changes, while present, remained within the normal physiological range and were not considered critical (112). The present study revealed that there was a link between blood tests like sugar (RBS), calcium, electrolytes (potassium, sodium), and kidney function (BUN, creatinine) and how often epileptic patients experience seizures in a day. The analysis showed that there was a connection found between calcium levels and how often seizures happened. This suggests that calcium levels might be related to seizure activity in epileptic patients. However, no link was found for the other blood tests examined. These findings provide valuable clues about the possible role of calcium in epilepsy, and further research is needed to understand the mechanisms at play and how this knowledge can be used to improve treatment. Studies stated that serum calcium levels are low in patients with or without treatment so these factors could trigger seizures, The baselines of the two

groups are not significantly different from each other, including the serum calcium. Therefore, the statement that the seizure control outcome does not have statistical or clinical significance is reasonable (113). Lower serum calcium levels have been associated with epileptic seizures (114) (115). Studies have shown that nearly half of previously diagnosed epileptics with status epilepticus had low calcium levels (116). Additionally, patients with idiopathic generalized tonic-clonic seizures exhibited reduced serum calcium levels. However, the frequency, duration, or control of seizures did not correlate with serum calcium levels. Interestingly, serum calcium concentrations showed an inverse association with the risk of generalized epilepsy and genetics. Such findings indicate that despite the fact that epileptic patients are characterized by hypocalcemia the dependency of the frequencies of seizures on such a factor as calcium levels is not only quite complex and, certainly, might be affected by numerous other factors (13). It is thought that hypocalcemia could be clear enough in some patients to cause a seizure, electrolyte balance should be carefully observed. More research is needed to better discover the connection between electrolyte and seizures (117). The current study studied the associations between the frequency of seizures in patients with epilepsy during one day and the CBC blood tests that measure red blood cells, platelets, and other variables. The findings of the study revealed a connection between the platelet count and the frequency of seizures. However, the researcher found no connection between the number of seizures and the other observed blood tests, such as counts of red blood cells or white blood cells. These findings suggest that platelet counts may be associated to seizure activity in patients with epilepsy; anyway, more research is needed to make this association clearer. The Complete Blood Count, an ordinary blood test, is important for explaining seizure symptoms in epileptic cases. Studies have confirmed that generalized tonic clonic seizures (GTCS) individuals exhibit abnormalities in numerous blood parameters (70) Normal blood testing in GTCS patients showed temporary rises in RBC, WBC, platelets, lymphocytes, and neutrophils during seizures, with WBC and neutrophils associated with seizure duration (49)Several research have looked into the relationship between the number of seizures per day and the platelet count in epileptic patients. Research indicates that platelet volume indices (PVIs) may play a role in seizure characteristics while, no significant correlation found between other variables in epileptic patients (118). Nikkhah et al. results confirmed that Platelet count was higher in complex febrile seizures group compared to simple febrile seizures

group, but the difference was not statistically significant (119). On the other hand, Haung et al. found a Transient increase in RBC, platelet, and lymphocyte counts observed during epileptic seizures. Significant increase in WBC and neutrophil counts during seizures (70). Another study illustrated that there was no significant difference in iron deficiency anemia between seizure groups, MCV and serum iron levels were significantly lower in seizure group (120).

4.2 Conclusion

All in all, the current research brings valuable new knowledge toward the multiple relations between abnormalities in blood tests elevated seizure rates in epilepsy persons and the usage of AEDs. It seemed that there were important relations between the AEDs therapy and alterations in blood test data that can reflect hematological and metabolic side effects. For instance, phenytoin and phenobarbital are strongly associated with a significant number of blood markers, noting the importance of considering patient's health state before administering these drugs. For instance, these AEDs were linked to modifications in the liver enzyme and blood cell profiles hence signifying that they caused liver damage and reduced bone marrow activity. Remarkably, calcium imbalance seems to indicate the occurrence of epileptic seizure activity. So, the incidence of seizures and calcium concentrations were well correlated. This result is consistent with other studies showing that calcium is essential for neuronal excitability and synaptic function, and that an excess of it may increase the risk of seizures. However, there are irregular interconnections between blood chemistry and seizure, collectively, because some blood tests were not closely related to the severity of seizures. For instance, although there are irregular interconnections between blood chemistry and seizures, collectively, because some blood tests were not closely related to the severity of seizures. For instance, although there are increased incidents of electrolyte imbalances, all persons with abnormal electrolyte imbalances, all persons with abnormal electrolyte levels didn't report frequent seizures, it can therefore be argued that seizures are personal dependent metabolic derangements.

The study also underlines that checking biochemical factors routinely is very important in patients with epilepsy, to have appropriate management for the adverse effects of AEDs. Optimizing patient outcomes requires individualized treatment approaches that take these biochemical markers into account. Furthermore, these programs involve

routine evaluations of liver and kidney function, complete blood counts, and electrolyte levels, to identify and treat any negative consequences as soon as possible. The difficulties in treating epilepsy and the need for individualized treatment plans that take into account each patient's particular requirements are highlighted by these findings taken together. To further understand the underlying causes of these biochemical alterations and create more potent treatment strategies, more research is required. Therefore, people with epilepsy will eventually fulfill their lives, enjoy a long-life expectancy and experience safer and more effective care of their condition.

4.3 Recommendations

Epilepsy is a very dangerous disease that is getting more and more widespread among families all over the world and in Palestine in particular. It is a permanent threat for the family who has an epileptic case as they will be worried all the time especially if the case is a female; she can't travel alone because during the seizures, the situation will be very embarrassing and dangerous at the same time, she can't be left alone at home as she might hurt herself if she is using any sharp tools. It is also a threat for the epileptic person himself as his/her future career choices will be very limited, he/she almost can't do any job that demands attention and concentration. He/ she can't drive to work as driving needs concentration and any possibility of fainting during seizures will be an unavoidable accident. Culturally speaking either males or females with epilepsy can't be a good choice for a future partner as people want kids free of any diseases or drawbacks. These threats facing epileptic people, though out of their hands, label them as unfit for playing important roles in the future. Considering the threats above, decision makers, epilepsy associations, researchers are asked to give more attention to this disease and take serious steps towards finding solutions and better treatment approaches. Several recommendations may be made to improve the management and care of people with epilepsy based on the research's findings:

1. Health care providers should also contemplate about possible hematologic and metabolic complications of drugs. Also, the awareness of multiple ways that AEDs affect the blood chemical composition should inform a change in the management plan.

2. In defining the adequate therapy strategy for Epilepsy patients, it would also be necessary to identify the multiple ways, through which AEDs influence blood chemistry, and modify them, respectively.

3. Dependent upon the type of epilepsy and treatment taken routinely by the patient, the values of some blood tests should be kept under observation and constantly controlled, especially in those individuals who regularly consume antiepileptic medications that are known to affect biochemical parameters of patients. Thus, identifying the oddities in medication at early stages can do away with any harm affecting the patients or any inefficiency in treatment procedures.

4. The probable situation is to enroll the networks of interdisciplinary cooperation to deliver patients with epilepsy the entire management and comprehensive attentive care which include neurological and medical aspects of the disease. The next action plan that should be put into practice in epilepsy management is to establish a multimodal framework involving pharmacists, primary care physicians, neurologists, and other specialists.

5. Inform people with epilepsy on the value of routine blood testing as well as the possible adverse effects of antiepileptic drugs. Giving patients information about their regimen and monitoring procedures can improve drug compliance and encourage proactive engagement in their medical journey.

6. Enhance other studies to examine the main processes guiding the relationships shown between biochemistry test results, AEDs used, and seizures frequency and duration. Knowing these relationships can lead to helping to plan more specialized treatment strategies and better understanding of the pathophysiology of epilepsy disease.

List of Abbreviations

Abbreviation	Meaning
ILAE	International League Against Epilepsy
WHO	World health organization
EEG	Electroencephalogram
SE	Status Epilepticus
AED	Antiepileptic Medication
ES	Epileptic Seizures
CNS	Central Nervous System
MCV	Mean Corpuscular Volume
MPV	Mean Platelet Volume
RBS	Random Blood Sugar
WBC	White Blood Cell Count
RBC	Red Blood Cell Count
BUN	Blood Urea Nitrogen
MCH	Mean Corpuscular Hemoglobin
CBC	Complete Blood Count
PCOS	polycystic ovary syndrome
NLR	Neutrophil-To-Lymphocyte Ratio
GTCS	Generalized Tonic-Clonic Seizures
TSC	Tuberous Sclerosis Complex
Csvd	Cerebral Small Vessel Disease
BBB	Blood-brain barrier
TIAs	Transient ischemic attacks
OXC	Oxcarbazepine
PPIs	Proton pump inhibitors
ROS	Reactive oxygen species

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Appendices

Appendix A

Tables of Study

Table A1

Blood test results frequency on the first admission (n=256)

Test	N/Below normal	%	N/ Above normal	%
WBC	21	8.2	44	17.2
Lymphocytes%	63	24.6	110	43
Neutrophilic granules %	95	37.1	71	27.7
RBC	37	14.5	30	11.7
Red blood cell distribution width coefficient of variation %	3	1.2	64	25
Hemoglobin	139	54.3	18	7
MCH	74	28.9	40	18.6
MPV	17	6.6	85	33.2
MCV	146	57	13	5.1
Platelet Count	10	3.9	57	22.3
Hematocrit	152	59.4	15	5.9
Creatinine	165	64.5	7	2.7
BUN	23	9	25	9.8
Sodium	44	17.2	18	7
Potassium	6	2.3	24	9.4
Calcium	54	21.1	135	52.7
RBS	16	6.3	135	52.7

Table A2

Blood test findings frequency at the time of the last hospitalization (n=256)

Last lab values	Below normal N	%	Above normal N	%
WBC	14	7.7	23	12.6
Neutrophils granules	38	15.7	0	0
lymphocytes	65	20.5	100	41.2
RBC	25	13.8	36	19.8
Red blood cell distribution width	1	0.6	35	20.3
hemoglobin	18	10	2	1.11
MPV	10	3.9	55	21.4
MCV	98	49.4	4	2.2
MCH	67	37	25	13.8
platelet count	13	6.9	44	23.4
random blood sugar	7	2.7	193	76.8
Calcium	20	17	52	44.4
Potassium	11	4.4	122	48.8
Sodium	33	13.1	116	46.2
BUN	26	2.4	121	48.4
Creatinine	98	69.5	3	2.1
Hematocrit	95	40	1	0.4

Table A3

Patients' frequency of usage of antiepileptic medications (n=256)

Medication Type	N	%
Carbamazepine	42	9.9
Phenytoin	91	21.5
Valproic acid (Sodium valproate)	53	12.5
Phenobarbital	71	16.7
diazepam (assival)	121	28.5
Vigabatrin	2	0.5
Clonazepam	16	3.8
keppra (levetiracetam)	28	6.6

Table A4

Frequency of seizures number happened for the patients per day (n=256)

Frequency of episode/day	N	%
0	121	47.3
1	105	41.0
2	15	5.9
3	7	2.7
4	1	0.4
5	3	1.2
7	2	0.8
15	1	0.4
40	1	0.4

Table A5

Frequency of the duration of one seizure happened for the patient (n=256)

duration of episode/min		
	N	%
0	132	51.6
1	9	3.5
2	7	2.7
3	18	7
4	5	2
5	13	5.1
7	1	0.4
10	27	10.5
15	15	5.9
20	6	2.3
25	2	0.8
30	11	4.3
40	1	0.4
45	2	0.8
60	2	0.8
70	1	0.4
90	1	0.4
120	2	0.8
300	1	0.4

Table A6

Frequency of history of seizures episode among patients with epilepsy (n=256)

History	Yes	%
Up-rolling eyes	86	33.5
mouth secretion	63	24.6
convulsion of upper limb	21	8.2
convulsion of lower limb	14	5.47
passed urine	10	3.9
facial pallor	2	0.8
eye blinking	2	0.8
clenching of teeth	1	0.4
foul smell stool	1	0.4
lip smacking	2	0.8
twitching of lips and eyes	3	1.17
twitching of right-side face	1	0.4
fasciculate of the tongue	1	0.4
twitching facial muscles	1	0.4
bowl incontinence	1	0.4
bitting tongue	3	1.17
mid brain edema	1	0.4
Acrocyanosis	1	0.4
stool passing	1	0.4
Drowsy	2	0.8
Vomiting	6	2.3
harsh sounds	1	0.4
Cyanosis	30	11.7
staring of his eyes	8	3.12
Flaccid	1	0.4
Cessation of breathing	2	0.8

Table A7

Past medical histories of the patients (n=256)

Past medical history	Yes	%
temporal lobe epilepsy	3	1.17
partial complex epilepsy	1	0.4
vp-shunt	2	0.78
Hypothyroidism	1	0.4
car accident	1	0.4
Cerebral palsy	7	2.7
cerebral atrophy	1	0.4
thalassemia trait	1	0.4
Acinetobacter baumanni MDR+PSED	7	2.7
DM-type 1	1	0.4
sever aortic stenosis	1	0.4
white matter disease	1	0.4
Falling	2	0.78
Meningioencephalitis	1	0.4
Leukodystrophy	1	0.4
Headache	2	0.78
niemann-pick-syndrom	3	1.17
ESBL	1	0.4
Acinetobacter	1	0.4
Fragile X syndrome	1	0.4
escherichia coil isolated in blood	1	0.4
Focal with orofacial seizures	1	0.4
Leukemia	1	0.4
hydrocephalus with vp shunt	1	0.4
Developmental delay	1	0.4
Lissencephaly	1	0.4
congenital hydrocephalus	2	0.7
Hypotonia	1	0.4
multiple head trauma	1	0.4
aspiration pneumonia	1	0.4
Autism	3	1.17
Brain atrophy	9	3.5
Macrocephaly	4	1.5
Lissencephaly	7	2.7
Generalized tonic clonic seizures	4	1.5
Generalized myoclonus seizures	2	0.7

Table A8

Association between frequency of seizure episode per day and results of blood tests (n=256)

Blood tests		Frequency of episodes/day
RBS	p-value	0.825
Calcium	p-value	0.026*
Potassium	p-value	0.996
Sodium	p-value	0.439
BUN	p-value	0.691
Creatinine	p-value	0.618

Table A9

Association between frequency of seizure episode per day and results of blood tests (n=256)

CBC Blood tests		frequency of episodes/day
hematocrit	p-value	0.42
Platelet count	p-value	0.006**
MCV	p-value	0.188
MPV	p-value	0.332
MCH	p-value	0.559
Hemoglobin	p-value	0.558
Red blood cell distribution coefficient of variation	p-value	0.975
RBC	p-value	0.389
Neutrophils granules	p-value	0.679
Lymphocytes	p-value	0.432
WBC	p-value	0.83

Table A10

Association between (CBC) Blood test results and Duration of one seizure in minutes

CBC Blood test		Duration of Episode/min
hematocrit	p-value	0.839
Platlate count	p-value	0.97
MCV	p-value	0.703
MPV	p-value	0.124
MCH	p-value	0.348
Hemoglobin	p-value	0.6
Red blood cell distribution coefficient of variation	p-value	0.962
RBC	p-value	0.605
Neutrophils granules	p-value	0.878
Lymphocytes	p-value	0.378
WBC	p-value	0.187

جـامعـــة النجاح الوطنية

كليـــة الدراســـات العليـــا

العلاقة الارتباطية بين المعايير السريرية والكيميائية الحيوية لمرضى الصرع: دراسة استرجاعية في نظام الرعاية الصحي الفلسطيني

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إشراف

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قدمت هذه الرسالة استكمالا لمتطلبات الحصول على درجة الماجستير في الكيمياء الحيوية السريرية، من كلية الدراسات العليا، في جامعة النجاح الوطنية، نابلس– فلسطين.

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الملخص

الخلفية: الصرع هو اضطراب عصبي يتميز بنوبات متكررة تعزى الى نشاط كهربائي غير طبيعي في الدماغ. تعتبر المعايير السريرية من الضرورة بمكان لتشخيص وتصنيف وعلاج ومراقبة وتحسين النتائج أثناء رعاية مرضى الصرع.

هدف الدراسة: تبحث هذه الدراسة في العلاقة بين الخصائص السريرية للصرع والمعايير البيوكيميائية لدى المرضى الفلسطينيين بهدف تقديم رؤى محددة للسكان من شأنها تعزيز الفهم وإستراتيجيات العلاج.

أفراد العينة وطريقة البحث: تضمنت الدراسة مرضى الصرع الذين تم إدخالهم الى مستشفى النجاح خلال أو بعد نوبة الصرع. حيث تم جمع البيانات ما بين تشرين الثاني 2022 وأيلول 2023. واقتصرت العينة على المرضى الذين لديهم سجلات طبية كاملة. ثم تم جمع البيانات المتعلقة بالتركيبة السكانية والمؤشرات البيوكيميائية وخصائص النوبات والتاريخ الطبي وتحليلها باستخدام برنامج التحليل الإحصائي IBM-SPSS الإصدار 22 حيث لخصت التحليلات الوصفية البيانات بينما حدد تحليل ارتباط بيرسون العلاقات بين المتغيرات واعتبرت قيمة $p\text{-value} < 0.05$ دالة إحصائيا.

النتائج: اشتملت الدراسة على 265 مريضا تضمنت نسبة أعلى من الذكور 57.8% مقارنة بالإناث 42.2%. لقد أظهرت النتائج أن هناك ارتباطات هامة بين العمر والجنس والفحوصات الدموية حيث أظهر الذكور الأصغر سنا مستويات منخفضة من الهيموغلوبين ($p < 0.001$) بينما ارتبطت مستويات

الهيماتوكريت بالعمر ($p = 0.005$) كما أظهرت نتائج اختبارات الدم والنوبات ارتباطات واضحة، على سبيل المثال ارتبط ارتفاع مستويات الكالسيوم بزيادة تكرار النوبات ($p = 0.026$) كما تم ملاحظة اختلالات كيميائية حيوية مثل فرط كالسيوم الدم وزيادة سكر الدم وارتفاع مستويات الصوديوم كعوامل محفزة لنوبات الصرع. كما تم ملاحظة ارتباطات بين الأدوية المضادة للصرع ومعايير الدم حيث ارتبط الديازيبام بارتفاع مستوى السكر العشوائي في الدم ($p = 0.01$) كما ارتبط استخدام الفينوباربيتال بانخفاض مستوى نيتروجين اليوريا في الدم ($p = 0.005$) وتغيرات في مستويات النيوتروفيل والخلايا اللمفاوية ($p = 0.020$).

الخاتمة: تسلط نتائج الدراسة الضوء على أهمية دمج البيانات السريرية والبيوكيميائية لتحسين إدارة الصرع والنتائج العلاجية. إن مراقبة مستويات الدم ومعالجة أي اختلالات يمكن أن يساعد في إدارة الأعراض والحد من النوبات. كما تؤكد الدراسة على الحاجة الى إتباع منحى العلاج الفردي وإجراء المزيد من الدراسات المستقبلية لكشف الأسباب المحتملة للصرع وتحسين أنظمة العلاج.

الكلمات المفتاحية: التشنجات، الصرع، المرض العصبي، السمات السريرية، المعلمات البيوكيميائية.