



## PREVALENCE OF DYSELECTROLYTEMIA IN ADULTS WITH SEIZURES IN A TERTIARY CARE HOSPITAL: A CROSS-SECTIONAL STUDY

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### ABSTRACT

**Background:** Seizures are transient events which has symptoms and/or signs of abnormal excessive hypersynchronous activity in the brain. Electrolyte disturbances can often affect the brain among many other organs and tissues and they have to be promptly recognized as they can lead to severe and life-threatening complications. **Aim:** This study was conducted with the aim of determining various electrolyte imbalances among the patients presenting with seizures. **Methods:** After obtaining ethical clearance from the Institutional Review Board, the proposed study was carried out. 106 patients were informed about the nature and purpose of the study and then interviewed using a predesigned, pretested questionnaire and assessed by clinical and laboratory methods. Further evaluation was done using appropriate investigations like serum electrolytes (serum sodium, potassium, chloride, calcium and magnesium). Data was analyzed using SPSS software v.20.0. and Microsoft Excel. **Results:** Majority of the seizure patients belonged to the age category of 41-60 years (65.09%). Most of the patients had generalised tonic-clonic seizures (71.7%), followed by focal seizures (25.47%), and status epilepticus (2.83%). Hyponatraemia (81.5%) was found to be the most common type of electrolyte abnormality. **Conclusion:** The study results showed that the most common electrolyte abnormality being hyponatremia followed by hypocalcaemia, and hyponatraemia with hypokalaemia. Remaining patients with electrolyte imbalance had hypomagnesaemia. Among the various causes of seizures, electrolyte abnormalities were most commonly seen in patients with metabolic causes and headache only as the commonest associated symptom.

**KEYWORDS :** Seizures, dyselectrolytemia, metabolic causes, EEG changes

### INTRODUCTION:

A *seizure* (from the Latin *sacire*, “to take possession of”) is a transient occurrence of signs and/or symptoms due to abnormal excessive or synchronous neuronal activity in the brain resulting in various manifestations, ranging from dramatic convulsive activity to experiential phenomena not readily discernible by an observer.<sup>1</sup> At least 5–10% of the population experience a minimum of one seizure episode, with majority occurring in early years of life and late adulthood which are associated with various factors influencing the incidence and prevalence of seizures.<sup>2</sup> Of them, only about 2-3% go on to develop epilepsy later point of time in their life.<sup>3,4</sup> The discharge can lead to loss of consciousness in the patient, convulsive movements, impairment of psychic function or disturbance of sensation. Epilepsy is a condition in which patient will experience recurrent episodes (two or more) of seizures due to a long standing, underlying process, usually starts from early years of age. The incidence of epilepsy is ~0.3–0.5% in different populations throughout the world, and the prevalence of epilepsy has been estimated at 5–30 persons per 1000.<sup>1</sup>

Electrolyte abnormalities are commonly encountered in clinical daily practice, and their diagnosis relies on routine laboratory findings. Dyselectrolytemia can often affect the brain among many other organs and tissues and they have to be promptly recognized as they can lead to severe and life-threatening complications when ignored or not appropriately treated by the doctor. The neurological symptoms and signs reflect the graveness of acute neuronal derangement and therefore require emergency treatment for the same.

Acute and/or severe dyselectrolytemia can manifest with rapidly progressive neurologic symptoms or seizures, which can be the only presenting symptom. Seizures are often observed in patients with sodium disorders (especially hyponatremia), hypocalcemia, and hypomagnesaemia. It has been observed to be less frequent in patients with hypernatremia, hypercalcemia and hypermagnesaemia, mostly due to indirect involvement of the brain.<sup>5,6</sup>

An accurate and prompt diagnosis should be established for successful management of seizures, as rapid identification and correction of the

underlying electrolyte disturbance are of crucial importance for the prevention and control of seizures and also for prevention of permanent brain damage.<sup>7</sup> Also, a syndromic diagnosis further helps in identifying the etiologic, therapeutic and prognostic implications.<sup>8</sup>

There are only a few studies supporting the incidence of seizures in patients with metabolic abnormalities, especially electrolyte imbalance. Hence along with detailed clinical history and evaluation, and basic blood workup, estimation of serum electrolytes should also be done. An accurate and prompt diagnosis is important because treatment of the underlying electrolyte imbalance can prevent further episode of seizures and brain damage. Hence this study was conducted with the aim of determining various electrolyte imbalances among the patients presenting with seizures.

### OBJECTIVES:

To determine the prevalence of electrolyte imbalances in adults presenting with seizures in our tertiary care hospital.

### METHODS:

After obtaining ethical clearance from the Institutional Review Board, the proposed study was carried out at our tertiary care hospital.

Considering the prevalence of hypocalcaemia in epileptics to be 50% as reported in a study by Jamil et al<sup>9</sup> the sample size was calculated to be 106.

The sample size is derived from the following formula:

$$\text{Sample size (n)} = \frac{Z\alpha^2(p \cdot q)}{d^2} \text{ where;}$$

$Z\alpha = 1.96$  at 95% level of significance

$p =$  prevalence of 50%

$q = 100 - p = 100 - 50 = 50$

$d =$  relative precision of 20%

$n = 96.04$

considering a non-response rate of 10%, the final sample size was 106.

The study included a total of 106 patients who were required to satisfy the inclusion and exclusion criteria. Informed consent was obtained after informing all the participants about the nature and purpose of the study. Participants were then interviewed using a predesigned, pretested questionnaire and assessed by clinical and laboratory methods. The patients were further evaluated using appropriate investigations like serum electrolytes (serum sodium, potassium, chloride, calcium and magnesium).

**Inclusion Criteria:** Patients with seizures aged > 18 years.

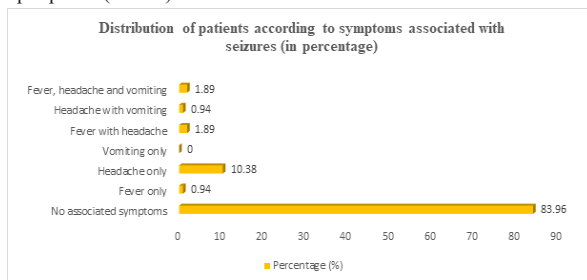
**Exclusion Criteria:** Persons with severe chronic illness, immuno-compromised individuals, those with physical disability, mental disability and pregnant & lactating women were excluded from the study.

#### Statistical Analysis:

All characteristics were summarized descriptively. For continuous variables, the summary statistics of mean, standard deviation (SD) were used. For categorical data, the number and percentage were used in the data summaries. Data were analysed using SPSS software v.20.0. and Microsoft Excel.

#### RESULTS:

In this study, majority of the seizure patients belonged to the age category of 41-60 years (65.09%), followed by 20-40 years (18.87%), and above 60 years age category (15.09%). Only 1 patient was aged below 20 years (0.94%). Most of the patients were males (72.64%), followed by females (27.36%). 71.7% patients had generalised tonic-clonic seizures, followed by focal seizures (25.47%), and status epilepticus (2.83%).



**Figure 1:** Distribution Of Study Participants According To Associated Symptoms With Seizures

Majority of the seizure patients did not have any associated symptoms (83.96%). (Figure 1)

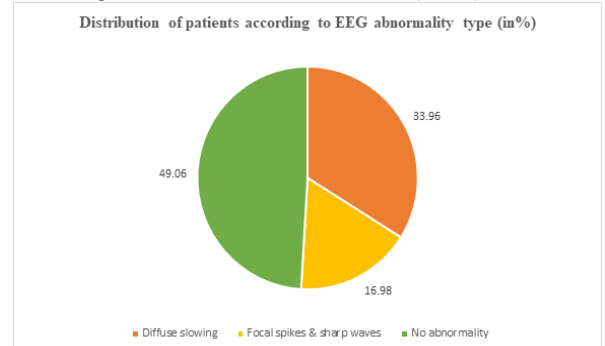
**Table 1: Distribution Of Study Participants According To Presence Of Comorbidities Among Them**

| Sl. No. | Comorbidities  | Frequency (N) | Percentage (%) |
|---------|----------------|---------------|----------------|
| 1       | No comorbidity | 50            | 47.17          |
| 2       | CAD            | 2             | 1.89           |
| 3       | CKD            | 2             | 1.89           |
| 4       | DM             | 25            | 23.58          |
| 5       | SHT            | 2             | 1.89           |
| 6       | CAD & DM       | 1             | 0.94           |
| 7       | CKD & DM       | 2             | 1.89           |
| 8       | COPD & DM      | 1             | 0.94           |
| 9       | SHT & DM       | 11            | 10.38          |
| 10      | SHT & CAD      | 1             | 0.94           |
| 11      | SHT & CKD      | 6             | 5.66           |
| 12      | CAD, DM & SHT  | 2             | 1.89           |
| 13      | CKD, DM & SHT  | 1             | 0.94           |
| Total   |                | 106           | 100            |

CAD - Coronary artery disease CKD - Chronic kidney disease  
DM - Diabetes mellitus SHT - Systemic hypertension  
COPD - Chronic Obstructive Pulmonary disease CVD - Cerebrovascular diseases

Most (52.83%) of the patients had several comorbidities like systemic hypertension, type 2 diabetes mellitus, coronary artery disease, chronic kidney disease and chronic obstructive pulmonary disease. (Table 1)

Of the 106 seizure patients, only 22 (21%) had the occurrence of focal deficit. Alcohol withdrawal seizures were more common (8.49%) when compared to alcohol intoxication seizures (4.72%).



**Figure 2:** Distribution Of Study Participants According To Type Of EEG Abnormality

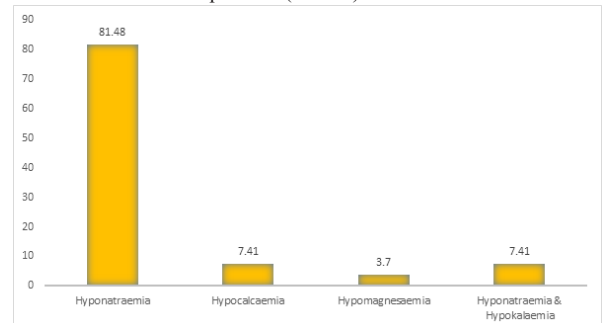
All the patients who were a part of the present study underwent EEG wherein the following abnormalities were detected: diffuse slowing, and focal spikes & sharp waves. 49.06% of the patients showed no abnormality in EEG. (Figure 2)

**Table 2: Distribution Of Study Participants According To Type Of Aetiology Of Seizures**

| Sl. No. | Type of Aetiology | Frequency (N) | Percentage (%) |
|---------|-------------------|---------------|----------------|
| 1       | Metabolic causes  | 49            | 46.23          |
| 2       | CVD related       | 29            | 27.36          |
| 3       | Alcohol related   | 9             | 8.49           |
| 4       | Infectious causes | 14            | 13.21          |
| 5       | ICSOL             | 1             | 0.94           |
| 6       | Idiopathic        | 4             | 3.77           |
| Total   |                   | 106           | 100            |

CVD - Cerebrovascular disease ICSOL - Intra-cranial Space Occupying Lesion

The most common cause observed in our study was metabolic which accounted for 46.2% of patients. (Table 2)



**Figure 3:** Distribution Of Patients With Electrolyte Abnormality According To Type Of Electrolyte Imbalance (in %) hyponatraemia (81.5%) was found to be the most common type of electrolyte abnormality among the patients with electrolyte imbalance. (Figure 3)

#### DISCUSSION:

Studies have linked incidence of seizures with metabolic causes like electrolyte imbalance which when detected and treated early can prevent further episodes of seizures and in turn brain damage to a large extent. The present study was conducted with the aim of determining prevalence of electrolyte imbalances among the patients presenting with seizures in our tertiary care hospital. This study included a total of 106 patients who fulfilled the inclusion criteria.

In this study, majority of the seizure patients belonged to the age category of 41-60 years (65.09%), followed by 20-40 years (18.87%), and above 60 years age category (15.09%). Similar observations were made in a study conducted by Hosalli NK et al<sup>10</sup> in Mysuru. Among the patients who were a part of the present study, majority were found to be males (72.64%), followed by females (27.36%). In a study conducted by Bhatia MS et al<sup>11</sup>, majority of the patients with seizures were males (54.4%) and remaining were females (45.6%).

In this study, most of the patients had generalised tonic-clonic seizures (71.7%), followed by focal seizures (25.47%), and status epilepticus (2.83%). Similar findings were noted in a study conducted by **Kumawat R et al<sup>12</sup>** and **Hosalli NK et al<sup>10</sup>**. In both the studies, there was higher prevalence of generalised seizures as compared to that of focal seizures.

In the present study, majority of the seizure patients did not have any associated symptoms (83.96%). 10.38% of the patients had headache only as an associated symptom, while 1.89% had fever with headache as associated symptoms. Most (52.83%) of the patients had several comorbidities like systemic hypertension, type 2 diabetes mellitus, coronary artery disease, chronic kidney disease and chronic obstructive pulmonary disease. Also, alcohol withdrawal seizures were more common (8.49%) when compared to alcohol intoxication seizures (4.72%) which were similar to observations made by **Jwarchan et al** in their study<sup>13</sup>.

All the patients who were a part of the present study underwent EEG wherein the following abnormalities were detected: diffuse slowing, and focal spikes & sharp waves. 49.06% of the patients showed no abnormality in EEG. Of the patients who had abnormalities in EEG, 33.96% had diffuse slowing and 16.98% had focal spikes & sharp waves. Similar findings were noted in a study conducted by **Sheikh NA et al** in Kashmir<sup>14</sup>.

In this study, based on the aetiology of seizures the patients were categorized. The most common cause observed in our study was metabolic which accounted for 46.2% of patients. This was followed by cardiovascular disease related causes (27.36%), infectious causes (13.2%), alcohol related (8.5%), idiopathic (3.8%), and lastly intracranial space occupying lesions accounted for 0.94% of cases. Though there was discordance in findings of a study done by **Kumar JM et al<sup>15</sup>**, similar observations were made in a study conducted by **Hosalli NK et al<sup>10</sup>**.

25.5% of the seizure patients were found to be having electrolyte imbalance. Hyponatraemia (81.5%) was found to be the most common type of electrolyte abnormality among the patients with electrolyte imbalance which was similar to the observations made by **Bhatia MS et al<sup>11</sup>** in their study. This was followed by hypocalcaemia, and hyponatraemia with hypokalaemia which accounted for 7.4% of electrolyte imbalance among the patients. Remaining 3.7% with electrolyte imbalance had hypomagnesaemia.

## CONCLUSION:

The study highlights that hyponatremia is the most prevalent electrolyte abnormality observed in patients experiencing seizures, followed by hypocalcaemia and combined hyponatremia with hypokalaemia. Electrolyte disturbances are particularly common in patients with metabolic causes of seizures, with headache being the most frequently associated symptom. Effective seizure management relies on diagnosing and correcting these underlying electrolyte imbalances, as traditional antiepileptic drugs (AEDs) are often ineffective if the electrolyte issues remain unresolved. A complete serum chemistry profile, including sodium, calcium, and magnesium levels, should be part of the initial assessment for patients presenting with seizures. Prompt identification and treatment of these disturbances are crucial to preventing seizures and potential long-term brain damage. Physicians must be aware of the link between seizures and electrolyte disorders to provide timely and appropriate treatment.

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