

## Comparing Alcohol Related Seizures And Primary Seizures In Terms Of Serum Calcium Levels

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Received: 29-11-2021 / Revised: 07-12-2021 / Accepted: 01-01-2022

### Abstract

**Background:** Alcohol-related seizures are defined as adult onset seizures that prevail in long term alcohol dependence. Ethanol can cause hypocalcemia and can lead to seizures. Therefore, this study is to establish the hypocalcemia prevalence in the general convulsive population and to look if there was a threat from hypocalcemia among alcoholics. **Aim of the study:** To compare alcohol related seizures and non-alcoholic primary idiopathic seizures in terms of serum calcium. To study the hypomagnesemia prevalence in hypocalcemic cases in both alcohol related seizures and primary idiopathic seizures. **Materials and Methods:** This study was a case control study done in 110 patients between November 2020 – October 2021 at ASRAM Medical college, Eluru, Andhra Pradesh. Grounded on former records and past negative neurological history, blood, radiological investigations, persons were divided into cases (with alcohol history) and controls (without alcohol history). Serum calcium and magnesium levels were measured in both groups and compared. All the results were tabulated and statistical significance was calculated using Pearson's chi square tests. **Results:** On comparing hypocalcemia persons in both cases and control groups there is no statistically significant difference (p value – 0.24). Hypomagnesemia prevalence among hypocalcemic patients in the case group is significant (p value - 0.03) but not in controls (p value – 0.56). **Conclusion:** Hypocalcemia prevalence among alcohol related seizures was linked but not statistically significant while hypomagnesemia prevalence was significant in the hypocalcemic alcoholic cases.

**Keywords:** Alcohol related seizures, Primary idiopathic seizures, hypocalcemia, hypomagnesemia.

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### Introduction

An epileptic seizure is a temporary physiologic dysfunction in the brain caused by a self-limited, abnormal, hypersynchronous electrical discharges of cortical neurons. A seizure is a transient epileptic event because of disturbed brain function. Seizures may be self-limited till treating the underlying disorder. Vitamin D and Parathyroid hormone are two primary regulators of calcium homeostasis. It is free ionized calcium and not protein-bound calcium that is responsible for the excitability of muscle cells and neurons. The symptoms of Hypocalcemia depends on degree of reduction in serum calcium level & acuteness of the fall in serum ionized (free) calcium concentration. Symptoms of acute hypocalcemia are: 1. Circumoral paresthesia 2. Muscle cramps 3. Carpopedal spasm 4. Tetany 5. Laryngeal stridor 6. Tremors 7. Chorea 8. Seizures. Seizures may occur irrespective of tetany. The different types of seizures in Hypocalcemia are generalized tonic-clonic, focal motor, atypical absence and less frequently akinetic seizures. Alcohol distributes throughout the body and affects all the systems of the body mostly including water, electrolyte and acid base disturbances. Alcoholism temporarily mimics conditions like Diabetes mellitus and Depression. Ethanol and its metabolite acetaldehyde has an effect on both the developing and mature nervous system. Alcohol overuse causes epileptic

generalized tonic-clonic seizures that occur within 6 to 48 hours after the last drink. Without treatment, approximately 60% of patients develop multiple seizures and interval between the first & last seizure is typically less than 6 hours. Alcohol related seizures usually occur in the absence of other signs of alcohol withdrawal and sympathetic activity such as tachycardia, hypertension and fever. Hypocalcemia is a common electrolyte abnormality observed in alcoholic patients and may be evoked by various pathophysiologic mechanisms.

### Methods and Materials

The study was conducted between November 2020 - October 2021 at Alluri Sitarama Raju Academy of Medical Sciences, Eluru, after getting approved by the institutional ethical committee.

### Study group

- **Case:** Patients with alcohol related seizures who are satisfying CAGE criteria.
- **Control:** Patients with primary idiopathic seizures.
- **Size:** 110 ( 56 cases + 54 controls )
- **Study design:** Analytical case control study
- **Place of Study:** ASRAM Medical college, Eluru
- **Duration of study:** 1 year
- **Conflict of interest:** Nil.
- **Hazards of study:** Nil

### Methodology

Patients who were presented with seizures at emergency department of Alluri Sitarama Raju Academy of Medical Sciences hospital were screened after obtaining written informed consent.

### Inclusion criteria

**Case:** Patients who are more than 18 yrs of age, who had seizures and satisfying CAGE criteria of alcohol dependence.

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seizures. Alcohol-related seizures are typically brief and is usually

**Control:** Patients more than 18 years of age and with primary idiopathic seizures

**Exclusion criteria**

1. Age less than 18 years of age
2. Stroke
3. Previous head injury
4. K/C/O Seizures/Epilepsy disorder
5. Meningitis, encephalitis or any other CNS infections
6. Structural brain lesion and intra cranial space occupying lesions
7. Metabolic diseases
8. Drugs that cause neurological damage or disturbances

This study is a case control study. Grounded on former records and past history of any CNS infections, head injury, structural brain lesions, cerebrovascular accidents, metabolic conditions and illicit drug abuse , persons with all these negative history were subjected to blood and radiological investigations like serum electrolytes, random blood sugar, serum amylase, serum bilirubin and CT- brain. Among these, persons who had all values within normal limits were taken into study population. Among the persons in study population, persons with no history of alcohol consumption with all screening blood investigations within normal limits and those with EEG and CT Brain

findings suggestive of primary seizures were considered under controls. Persons satisfying CAGE criteria with screening blood examinations and CT- Brain normal were considered under cases. Also, serum calcium levels, serum albumin levels and serum magnesium levels were measured in both cases and controls. Corrected calcium was calculated if there is coinciding hypoalbuminemia. Patients with serum calcium levels between 8.70 - 10.20 mg/dl were taken as normal. Later Serum calcium levels were compared in cases with controls. Hypomagnesemia prevalence in these persons in association with hypocalcemia was also assessed. All the results were tabulated and by using pearsons chi square tests their statistical significance was calculated.

**Results**

Out of the 110 patients 56 were grouped into cases and 54 into control group

The mean age of the case group is 42.81 years (min 28 yrs and max 53 yrs). The mean age of the control group is 40.58 years (min 17 yrs and max 54 yrs)

In the study group normal levels of random blood sugar, serum sodium, serum potassium, serum amylase , serum bilirubin and CT brain were present in both cases and controls .

**Table 1:** The mean calcium values in the case and control population were 9.211 and 9.065 respectively

	Group	N	Mean	Std. Deviation	Std. Error Mean
Serum Calcium	Control	54	9.065	.4149	.0565
	Cases	56	9.211	.5530	.0739

**Table 2:** The mean magnesium values in the case and control population were 1.791 and 1.797 respectively

	Group	N	Mean	Std. Deviation	Std. Error Mean
Serum Magnesium	Control	54	1.791	.4708	.0641
	Cases	56	1.797	.2776	.0371

There is no significant difference in the mean serum calcium with magnesium levels among cases and controls .In the case group out of 56 patients, 39 patients had normal calcium level, 15 were hypocalcemic and 2 were hypercalcemia. Thus, about 26.81% of the cases were in hypocalcemic range, 69.62% in normocalcemic range and 3.57 % in hypercalcemic range.

In the control group of 54 patients , the number of patients in normocalcemic, hypocalcemic and hypercalcemic range were respectively 45,8 and 1. The percentage of patients presenting with hypo, normo and hypercalcemic range within the control group were 14.8 % , 83.3 % and 1.9 % respectively

**Table 3:** Hypocalcemia, Normocalcemia, Hypecalcemia patients in cases and controls group

			Group		Total
			Control	Cases	
Serum Calcium	Hypo	Count	8	15	23
		% within Serum Calcium	34.8%	65.2%	100.0%
		% within Group	14.8%	26.8%	20.9%
	Normal	Count	45	39	84
		% within Serum Calcium	53.6%	46.4%	100.0%
		% within Group	83.3%	69.6%	76.4%
	Hyper	Count	1	2	3
		% within Serum Calcium	33.3%	66.7%	100.0%
		% within Group	1.9%	3.6%	2.7%
Total		Count	54	56	110

On comparing the case and control group , 65.21 % of the hypocalcemic patients were in the case group. Only 34.79 % of the patients were in the control group. On applying the chi-square tests,

the p value is found to be 0.240. Thus, there is no statistically significant difference in the prevalence of hypocalcemia among the case and control group.

**Table 4:** Hypomagnesemia, Normomagnesemia, Hypermagnesemia in cases and control groups

			Group		Total
			Control	Cases	
Serum Magnesium	Hypo	Count	5	10	15
		% within Group	9.3%	17.9%	13.6%
	Normal	Count	48	46	94
		% within Group	88.9%	82.1%	85.5%
	Hyper	Count	1	0	1
		% within Group	1.9%	.0%	.9%
Total		Count	54	56	110

The prevalence of hypomagnesemia in the case and control group is 17.9% and 9.3 % respectively. On applying the chi-square test, the p value is 0.263 which is  $>0.05$ , thus there is no statistical difference in the hypomagnesemia prevalence among cases and control

On comparing the prevalence of hypomagnesemia in hypocalcemic patients in the case group, the p value is found to be 0.030 which is significant.

Among controls the p-value is 0.562, thus the prevalence of hypomagnesemia among hypocalcemic patients is statistically insignificant

Among the 72 patients excluded from the study, 51 patients satisfied CAGE criteria and 21 patients were non alcoholics. Among the alcoholics, the most common cause of seizures was found to be metabolic (hypoglycaemia) and among the nonalcoholics previous cerebrovascular accident was the common cause.

### Discussion

Alcohol related seizures accounts for one third of seizure related admissions. Seizures occur in alcoholics as an effect of alcohol intoxication / alcohol withdrawal. The diagnosis of alcohol related seizures is based on history taking & examination. The risk factors in these group of patients are pre-existing epilepsy, structural brain lesions , metabolic diseases , head injury and use of drugs that damage CNS. It is also a known fact that various electrolyte abnormalities can lead to seizures, especially hypocalcemia. In previous studies it has been proven that alcohol can interfere with calcium metabolism, acute alcohol consumption causes parathormone deficiency and increases the urinary calcium excretion, leading to hypocalcemia. Chronic alcohol consumption causes vitamin D metabolism disturbance leading to inadequate dietary calcium absorption. The purpose of this study is to find the prevalence of hypocalcemia among alcohol related seizures after excluding the secondary causes of seizures and other electrolyte abnormalities and to compare with primary seizures disorder patients who do not take alcohol . Hypocalcemia as a cause of seizure in neonates is well documented whereas hypocalcemia as a cause of seizures in adults is still not studied good enough. Other factors responsible for seizures in alcoholics were also analysed . Ethanol reduces both calcium and magnesium levels. This study emphasized the importance of serum calcium measurement in alcoholic seizure patients and suggested that hypocalcemia correction may be considered in these patients. This study had proven the increased prevalence of hypocalcemia in alcohol related seizures patients and also an increased prevalence of hypomagnesemia in this population. Further studies are needed to check the correlation of hypocalcemia, hypomagnesemia with other electrolyte abnormalities.

### Conclusion

The burden of alcohol related health problems are often underestimated in developing countries. This study emphasizes the incidence of alcohol related admissions to the emergency department presenting as seizures. Several aetiologies for alcohol related seizures has been postulated above electrolyte abnormalities mainly hypocalcemia. High hypocalcemia prevalence in alcohol related seizures was identified in this study ,though a statistical significance against primary seizures was not proven. This study showed hypomagnesemia prevalence was statistically significant in the hypocalcemic alcoholic patients. So, hypomagnesemia as a cause of seizures in these patients requires further studies. If hypocalcemia and

hypomagnesemia as a cause of Alcohol related seizures could be proved on further studies , initiating Calcium and Magnesium as a treatment for alcohol related seizures can be considered .

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**Conflict of Interest: Nil Source of support: Nil**