



A STUDY ON CLINICAL PROFILE OF HYPERGLYCEMIC SEIZURES

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ABSTRACT **Background:** HYPERGLYCEMIC SEIZURE – a special Neuroendocrine syndrome most commonly due to Non Ketotic Hyperglycemia has got its unique way of presentation, the clinical recognition of this entity was first made by MACCAIRO in 1965. **Aim:** To study the clinical profile of Hyperglycemic Seizure (HGS). **Material And Methods:** This study included 50 patients diagnosed as Hyperglycemic Seizure on the basis of clinical evaluation Biochemical investigations and CT scan Brain and Electro Encephalographic studies, who were admitted to the Medical wards including neurology and Intensive Medical care units of Great Eastern Medical School Hospital, Srikakulam during July 2020 to July 2021. **Conclusion:** Seizures can manifest as the first symptom of Diabetes Mellitus. Hyperglycemic seizures can occur in Ketotic and Non Ketotic Hyperglycemia but commonly in patients with non ketotic hyperglycemia. Hyperglycemic seizures is rarely associated with Diabetic Keto acidosis. Generalized tonic clonic seizure as the first manifestation of Non Ketotic hyperglycemia is found to be rare. Hyperglycemic seizures occurred commonly above the age of 50 years and the incidence is more in males. Most of the patients with hyperglycemic seizures had blood glucose value between 250 – 300 mg/dl. In our study the mean blood glucose value was 277.3 mg/dl among patients with hyperglycemic seizures. The minimum blood sugar value at which hyperglycemic seizure occurred was 191 mg/dl and maximum blood sugar value at which hyperglycemic seizures occurred was 398 mg/dl. The osmolality was above the normal range in the maximum of 90% of cases.

KEYWORDS : Hyperglycemia, seizure, ketotic, blood sugar.

INTRODUCTION

The occurrence of seizures as a presenting feature of Hyperglycemia was first reported by Maccario et al in 1965. But its clinical recognition at present is common among neurologists and uncommon among General Practitioners.

The metabolic causes of seizure in patients in particular diabetes mellitus with Non ketotic hyperglycemia (NKH) and its association with focal seizures were recognized only in the last decade both in India and around the world.

Mechanism Of Hyperglycemic Seizures:^{1,2}

1. The Brain glucose utilization is reduced in non ketotic hyperglycemia, an increased rate of GABA utilization via the GABA shunt may be one of the sources of energy requirements, thereby further lowering the GABA level and reducing the threshold of seizure activity.

2. It seems, that an acute cerebral infarct or an older infarct, a scar formation, is triggered to produce focal epileptic activity by the superimposed metabolic disturbances especially hyperglycemic and hyponatremia.

3. Ketotic hyperglycemia is less frequently associated with seizure possibly because of the antiepileptic effect of ketosis.

4. Practically all, patients who present with epilepsy partialis continua should have immediate determination of blood glucose levels.

Hyperglycemic Seizures Was Diagnosed On The Basis Of Diabetic Patients Who Had Hyperglycemia With:^{3,4}

1. Abnormal involuntary Movements.
2. Paroxysmal choreo athetosis.
3. Focal Seizures
4. Generalized Tonic Clonic Seizure (GTCS).
5. Epilepsia partialis continua.

The detailed History and clinical examinations were done as outlined in the proforma and they were subjected to routine haematological, Biochemical investigations, CT scan evaluation including other systemic problem oriented evaluation. EEG studies was done in all patients.

MATERIALS AND METHODS

Study Design

This is observational and cross sectional study including 50 patients diagnosed as Hyperglycemic Seizure on the basis of clinical evaluation

Biochemical investigations and CT scan Brain and Electro Encephalographic studies, who were admitted to the Medical wards including neurology and Intensive Medical care units of Great Eastern Medical School for a period of July 2020 to Feb 2021.

Inclusion Criteria:

1. Patients taken for this study includes Patients admitted with first time convulsions who was later found to be Diabetic and whose first admission Blood Sugar was in Hyperglycemic level.
2. Known Diabetic patients who had focal neurological symptoms / convulsions whose Blood sugar during convulsions showed Hyperglycemic Seizure level.
3. Other Systemic problem patients who had convulsions during their hospital stay and showed Hyperglycemic level of Blood glucose and later who were diagnosed as Diabetic patients.

Exclusion Criteria :

1. All patients with Seizure disorder of varying etiology without Hyperglycemia.
2. Patients with Diabetes and Cerebrovascular accidents without convulsions.
3. c Patients with previously known Structural Brain disorder with seizures or patients with convulsions following IV Glucose.

Statistical Methods

Following statistical methods were applied in the present study – 1. Cross tabs procedure, 2. Descriptive statistics ,3. Frequencies and percentages 4. Two way ANOVA – analysis of variance.

RESULTS

The total number of patients in this study was 50. The study was done during the period of July 2020 to Feb 2021.

The total number of patients included in the study was 50. Out of which 1 patient belong to the age group of less than 20 years. The youngest of them was 18 years old. 2 patients belong to age group of 30 – 39 years. 10 patients belong to age group of 40 – 49 years. 13 patients belong to age group of 50 – 59 years. 24 patients belong to age group of above 60 years. 13 patients were below the age of 50 years. 37 patients were above the age of 50 years.

Out of 50 patients, 32 were male patients and 18 were female patients.

Out of 50 study patients, 28 patients had first time seizure without known Diabetes. 22 patients had diabetes with seizures.

Out of 50 patients, 35 patients had focal seizure and 11 patients had

generalized tonic clonic seizure, 4 patients had epilepsy partialis continua features.

Among the 50 cases, 1 patient had blood sugar < 200 mg/dl and patients had blood sugar level was 200 – 249 mg/dl. 22 patients had 250 – 299 mg/dl. 15 patients had 300 – 349 mg/dl. One patient had 350 – 399mg/dl. None of the patient had found blood glucose level above 400 mg/dl.

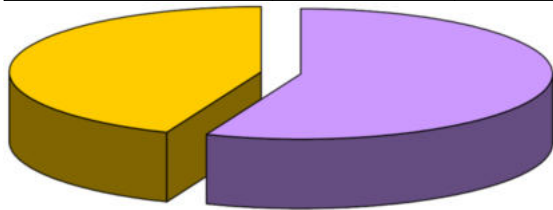
Among 50 patients serum osmolality was normal in 5 patients. 45 patients had hyperosmolality.

Among 50 patients, Plasma acetone and Urine acetone was positive in 1 patient.

Out of 50 study patients, 36 patients had normal CT Scan and 14 had abnormal CT scan. In among 14 patients, 13 patients had infarct in the CT scan and 1 patient had cortical Atrophy.

Out of 50 study patients, 42 patients had normal EEG and 8 patients had abnormal EEG. In among 8 patients, 2 patients had intermittent spike and sharp waves discharge on left parietal leads, and 4 patients had bilateral epileptiform moves on right side and 2 patients had epileptiform moves on left side.

Sl. No.	Details	No. Of Patients With Hyperglycemia Seizure Diagnosed	Percentage For Total Patients
1	Age < 19 Years	1	2%
2	Age 20 – 29 Years	0	0%
3	Age 30 – 39 Years	2	4%
4	Age 40 – 49 Years	10	20%
5	Age 50 – 59 Years	13	26%
6	Age > 60 Years	24	48%
Total		50	100%



First time Admission with seizures Diabetes Mellitus with seizures

Analysis Of Symptoms Sign Of Hyperglycemia

Sl. No.	Details of symptoms	No. of patients	Percentage for Total Patients
1	Focal seizures	27	54%
2	Focal Seizures with Altered Sensorium	6	12%
3	Focal Seizure with speech defect	2	4%
4	GTCS	6	12%
5	GTCS with Altered Sensorium	3	6%
6	GTCS with Speech defect – APHASIA	2	4%
7	Epilepsia partialis continua	4	8%
Total		50	100%

Blood Glucose Analysis

Sl. No.	Blood Glucose Level In Mgm/dl	No. of patients	Percentage for Total no. of Patients
1	< 200	1	2%
2	200 – 249	11	22%
3	250 – 299	22	44%
4	300 – 349	15	30%
5	350 – 399	1	2%
6	> 400	0	0%
Total		50	-

CT Scan Brain Analysis

Sl. No.	Details	No. of Patients	Percentage for Total No. of Patients
1	Normal	36	72%

2	Abnormal			
	a)	Infarct	13	26%
	b)	Cortical Atrophy	1	2%
Total			50	-

EEG Analysis

Sl. No.	Details	No. of Patients	Percentage for Total No. of Patients	
1	Normal	42	84%	
2	Abnormal			
	a)	Bilateral epileptiform moves on right side	4	8%
	b)	Bilateral epileptiform moves on left side	2	4%
	c)	Intermittent spike and sharp waves discharge on left parietal leads	2	4%
Total		50	100%	

DISCUSSION

50 patients who presented with new onset seizure and hyperglycemia were analysed as follows:

Maccario et al has shown that seizures occurred as the first manifestation of Non Ketotic Hyperglycemia.

The occurrence of seizure as a presenting features of Hyperglycemia with Non Ketotic Hyperglycemia was first emphasized by *Maccario et al.* in 1965.⁴

Age And Sex:

In our study 46% of patients had new onset seizures were above 60 years. They were found to have Non Ketotic Hyperglycemia

*Lammouchi T, Grira M, et al,*⁵ studied 22 cases. 11 out of 22 cases diabetes mellitus had not been diagnosed previously. In our study 28 out of 50 cases were not diagnosed previously.

Seizure Types In Hyperglycemia:

In a study conducted by *Vargese K.S, et al,*⁶ Focal seizure with (or) without generalization occurred in 65% of patients.

In our study Focal seizure without generalization occurred in 58% (29/50) case. Focal seizure with generalization occurred in 12% (6/50) cases.

Primary generalized seizure occurred in 22% of patients (11/50 cases).

Epilepsia Partialis Continua:

Epilepsia Partialis Continua is one of the early presentation of Non Ketotic Hyperglycemia.

In our study Epilepsia Partialis Continua occurred in 8% of patients.

*Singh BM et al,*⁷ studied 21 patients with seizures. He showed Epilepsia Partialis Continua occurred in 9 patients [9/21 □43%] with Non Ketotic Hyperglycemia.

In addition, patients studied in the above literature had hyponatremia and hyperosmolality along with Non Ketotic Hyperglycemia.

In our study, 4 patients had hyponatremia and hyperosmolality along with Non Ketotic Hyperglycemia.

Blood Sugar:

In our study, mean blood sugar was 277.3 mg / dl with the range of blood sugar was 191 – 398 mg/dl.

In two studies conducted by *Grant C, Charles Warlow, et al,*⁸ range of blood sugar was 234 mg / dl to 600 mg / dl among the patients with Non Ketotic Hyperglycemia.

The incidence of blood glucose level with which hyperglycemic seizures occurred in our study is comparatively less than their studies (191 – 398mg/dl).

*James C. Kolb,*⁹ seizures hyperglycemia evaluate the frequency and

type of seizure and glucose level of patient. Level of alertness he evaluated in 813 patients with blood glucose level above 400 mg and observed only 8 out of 813 patients (1%) had seizures with Non Ketotic Hyperglycemia. He concluded that focal or generalized seizure induced by hyperglycemia occurred in the absence of precipitating factors. This study also showed that seizures are rare with blood glucose more than 400 mg / dl. In our study patients with blood sugar value more than 400 mg had no seizures.

Diabetic Keto Acidosis:

Engel and Pedley³ studied, ketotic hyperglycemia is less frequently associated with seizure possibly because of the antiepileptic effect of ketosis.

Vargees KS, et al, studied 40 cases and observed none of the patients with Diabetic Ketoacidosis had seizures.

In our study 2% of patients with Diabetic Ketoacidosis had seizures.

Hyperosmolality:

In our study, 90% of patients had increased osmolality with range between (295 – 330m.osm/l), 5 cases (10%) had serum osmolality in the normal range (275 – 295m.osm/l).

Vargese K.S, et al studied 40 patients with Seizure and hyperglycemia observed in 90 % of study group had increased serum osmolality.

Lammouchi T, Grira M, et al⁵ studied 22 patients with Non Ketotic Hyperglycemia and observed that the serum osmolality increased in all 22 cases with mild to moderate extent. (266 – 309.2 m.osm/l)

In our study, 90% of cases had serum osmolality above 295m.osm/l.

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In our study, 90% of cases had serum osmolality above 295m.osm/l.

In our study, 4 Patients with Epilepsia Partialis Continua had serum osmolality above 295 m.osm/l.

CT Scan Brain:

In our study, 36 out of 50 patients (72%) had normal CT Scan Brain. In the remaining 14 cases, 13 patients (26%) had infarct and one patient (2%) had cortical atrophy.

Vargese K.S, et al studied 40 cases out of which 24 patients (60%) had normal CT Scan Brain and 16 patients (40%) with seizures had infarct. Lammouchi T, Grira M, et al⁵ studied 22 cases out of which 17 patients had normal CT scan Brain. In our study, 72% of patients had normal CT Scan Brain.

EEG

In our study, 8 out of 50 (16%) with hyperglycemic seizures had abnormal EEG.^{3,10}

In our study, 10 patients with hyperglycemia seizure had associated with systemic disease. In among 10 patients, 3 patients had hypertension and CAHD but had no evidence of Hypertensive Encephalopathy.

5 patients had renal failure. Probably the seizure associated with these patients may be due to Hyperglycemia or Uremia.

2 patients with hypothyroidism had seizure associated with hyperglycemia.

Almost all patients recovered completely with routine line of

management with insulin, anti epileptics and dehydration correction. However, irrespective of management 2 patients had status epilepticus and died and 2 patients had developed coma and died.

CONCLUSION:

HYPERGLYCEMIC SEIZURES is a special neuro – endocrine syndrome. Seizures can manifest as the first symptom of Diabetes Mellitus.

Hyperglycemic seizures can occur in Ketotic and Non Ketotic Hyperglycemia but commonly in patients with non ketotic hyperglycemia. Hyperglycemic seizures is rarely associated with Diabetic Keto acidosis.

Generalized tonic clonic seizure as the first manifestation of Non Ketotic hyperglycemia is found to be rare.

Hyperglycemic seizures occurred commonly above the age of 50 years and the incidence is more in males.

Most of the patients with hyperglycemic seizures had blood glucose value between 250 – 300 mg/dl.

In our study the mean blood glucose value was 277.3 mg/dl among patients with hyperglycemic seizures.

The minimum blood sugar value at which hyperglycemic seizure occurred was 191 mg/dl and maximum blood sugar value at which hyperglycemic seizures occurred was 398 mg/dl.

The osmolality was above the normal range in the maximum of 90% of cases.

The CT Scan brain evaluation showed normal without structural brain lesion in 72% of patients.

EEG was normal in majority of patients with Non Ketotic hyperglycemic seizures.

The correction of Non Ketotic hyperglycemia with insulin and IV fluids showed early and complete recovery.

From the above study, it is shown that all patient with new onset seizures above the age of 50 years should also be thought of Diabetes Mellitus and evaluated for it.

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