

# Seizure Disorder in Diabetes Mellitus – Case Reports

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## ABSTRACT

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Seizures are often observed in patients with Diabetes Mellitus and more often are linked to glycemic status of the patient. Approximately 25 % of patients with diabetes mellitus experience different types of seizures. Hypoglycemia is one of the leading causes. Furthermore, diabetic patients who presents with diabetic ketoacidosis also have seizures more frequently. The precise pathogenesis of seizures remains undetermined.

**Keywords:** Diabetes Mellitus, Seizures, Hypoglycemia, Diabetic Ketoacidosis

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## INTRODUCTION

The Human Brain depends on glucose as its main source of energy. In the adult brain, neurons have the highest energy demand, requiring continuous delivery of glucose from blood. In Humans brain accounts for ~2% of body weight, but it consumes 20% of glucose derived making it the main consumer of glucose @ 5.6 mg glucose /100 g brain tissue/min.

Glucose metabolism provide the fuel for physiological brain function through the generation of ATP, the foundation for neuronal and non neuronal cellular maintenance as well as generation of neuro transmitters. Thus a disturbed glucose metabolism in brain underlies several disorders including seizures.

The association between diabetes mellitus and seizures are more than coincidental than previously thought according to data from various recent researchers. It is often linked to the glycemic status of the patient. Currently the leading hypothesis in literature suggests that multiple physiological factors such as immune abnormalities, microvascular brain lesions, focal brain damage, metabolic factors and gene mutations can contribute to seizures in diabetes.

Seizure disorders in diabetes are due to various causes. It can be a manifestation of various complications of Diabetes Mellitus.<sup>2</sup>The usual causes are:

- Hypoglycemia

- Hyperglycemic seizure
- Hyperglycemic hyperosmolar state (HHS)
- Diabetic ketoacidosis
- Stroke in Diabetes Mellitus
- Chronic Kidney Disease (CKD) with Hypocalcemia and Hypomagnesaemia
- Hyponatremia

### Case -1

A 60 year old female with Uncontrolled Diabetes presented with focal seizures of Right side of face and right hand since one day. Examination revealed a fully conscious patient with continued focal seizures of right side of face and right hand without any focal neurological deficits. Blood Parameters showed polymorphonuclear leucocytosis; ESR 30 mm/hr. RBS at the time of admission was 600 mg/dl. Blood urea - 60 mg/dl and serum creatinine - 1.5 mg/dl. Electrolyte showed sodium 140 mEq/l. Serum Potassium 4 mEq/L. Chloride -104 mEq. Serum osmolarity 329 milliosm. CT Brain: Age related brain atrophy. Urine Ketones: Negative

These features are suggestive of Hyperglycemic Hyper Osmolar State presenting as focal seizures

### Case -2

An 80 year old male, diabetic patient on regular treatment brought to the Casualty with history of

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Generalised tonic clonic seizures at night and altered sensorium. Examination showed patient with diaphoresis, pulse: 100 beats per min, regular, high volume. BP 150/100 mm Hg. Patient was stuporous responding to painful stimuli. No Focal neurological deficits. Random Blood sugar was 40 mg/dl. Normal serum electrolytes and Renal Function test.

Patient became conscious after I.V glucose administration. It is a case of Hypoglycemia due to skipping of meal the previous night.

**Case -3**

A 55 year old male patient presents with Generalised tonic clonic seizures. Not a known diabetic. Examination showed stable vitals. No meningeal signs, No lateralising signs and normal pupils. Blood Examination showed RBS 500 mg/dl. Electrolytes and RFT normal. S.Osmolarity 302 milliosmoles. CT Brain was normal. No focal lesions. Patient was treated with insulin and antiepileptic. This is a case of seizure probably due to hyperglycemia without hyperosmolar state

**Case-4**

A 56 year old female brought to casualty with altered sensorium, seizures and weakness of right side of the body. Examination Revealed stable vitals. Positive response to verbal stimuli; Right UMN facial palsy and Right pyramidal signs. Other systems were within normal limits. Blood investigations showed RBS 50 mg/dl. Serum electrolytes and renal function test were normal. CT head showed an acute infarct Left Fronto parietal region. Patient was treated with anti coagulants, antiplatelet, statins and correction of blood sugar. This case showed acute ischemic stroke with hypoglycaemia augmenting the neurological deficit.

Blood Sugar in mg/dl	Response by the body
<80	Insulin production ceases
<70	Anti insulin hormones act
<60	Sympathetic nervous system acts
<50	Neuroglycopenic symptoms
<40	Encephalopathy, coma, seizures. Irreversible brain damage if hypoglycaemia persisting

**DISCUSSION**

The above 4 cases reveals the various mechanisms of seizures in Diabetes Mellitus. The cause of seizures in Diabetes Mellitus is due to those directly related to diabetes and those indirectly related (**figure 1**). The directly related ones are hypoglycaemia, hyperglycaemia, HHS and those indirectly related are ischemic stroke and other metabolic abnormality like hyponatremia, CKD with hypocalcemia and hypomagnesaemia.<sup>5</sup>

Diabetes and autonomic neuropathy are more prone for hypoglycemic seizure because of unawareness of hypoglycaemic symptoms and unresponsiveness in hypoglycaemia.<sup>1</sup> Nocturnal hypoglycaemia, seizures and cardiac arrhythmia may lead to sudden death. The table below describes the adaptive response of the body to hypoglycaemia: (**Table 1**)

Studies have shown that hyperglycemia itself is a pro-convulsant. The possible mechanisms are hyperosmolarity, a low level of gamma amino-butyric acid (GABA), and focal ischemia. Brick et al.<sup>7</sup> suggested that the Krebs cycle is inhibited in hyperglycaemic hyperosmolar state.

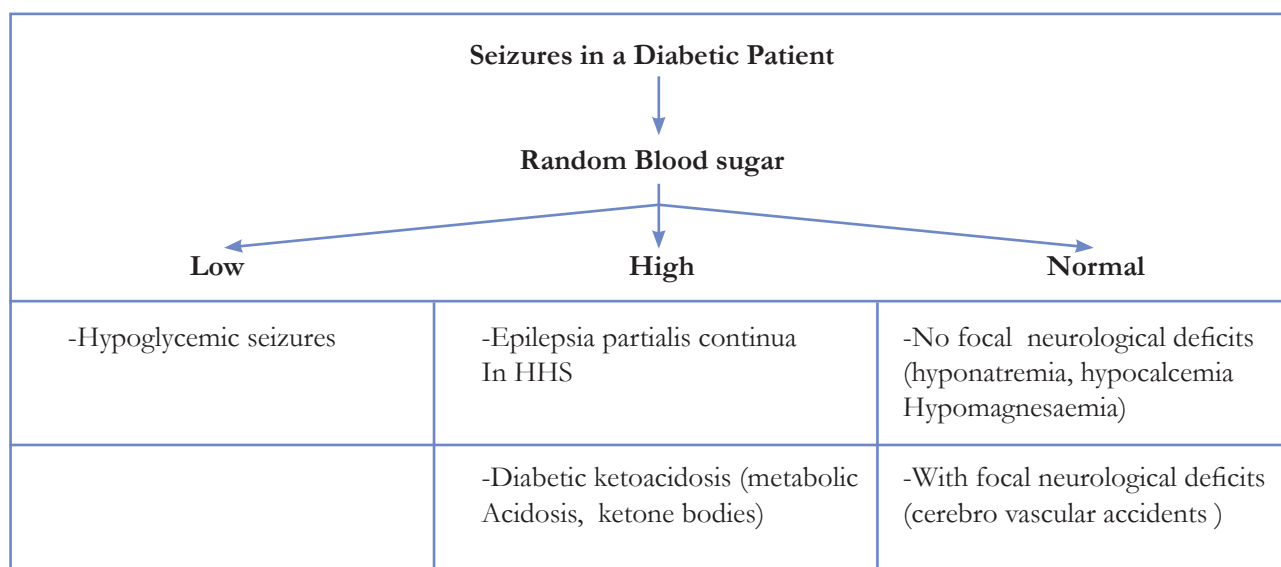


Figure 1. Seizures in a Diabetic Patient

HHS is observed in elderly uncontrolled diabetics with super added infection and on steroid therapy presenting as focal seizures<sup>4</sup> with altered sensorium. Occasionally rapid rise of blood sugar not amounting to hyperosmolar state may elicit seizures.<sup>3,6</sup>

It is suggested that a previously existing cortical lesion of an ischemic nature might lead on to seizures under altered metabolic conditions because both hyperglycemia and hypoglycaemia could result in reversible focal ischemia without structural damage by decreasing blood flow in certain cerebral areas.<sup>8</sup>

## CONCLUSION

Seizures in a diabetic patient are a medical emergency. Emergency physician will find the simplified algorithm given below useful for the correct diagnosis and prompt treatment

This article is to highlight the seizure disorder in Diabetes Mellitus which are due to various etiologies, requiring correction of blood sugar and achieving euglycemic state.

## END NOTE

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