Sir,

Hypoglycemia can manifest with various neurological symptoms such as seizure, confusion, coma, hemiparesis, and rarely with hyperkinetic movement disorders. Commonly reported hyperkinetic movement disorders following hypoglycemic insults are chorea, ballismus, and limb dystonia. Herein, we report an interesting case of a middle-aged diabetic lady with a history of hypoglycemic encephalopathy, who subsequently developed a combination of different movement disorders, including ballism, limb and oromandibular dystonia, bruxism, and stereotypy.

A 55-year-old lady with a 6-year history of diabetes mellitus suffered an episode of severe hypoglycemia 1 year back, which manifested as dizziness, pallor, and diaphoresis followed by a comatose state. It occurred because of an overdose of oral hypoglycemic agents. Her blood glucose level was documented to be 35 mg/dL. There was no other significant past medical history. With these complaints, she was hospitalized, intubated and mechanically ventilated. Her magnetic resonance imaging (MRI) brain done within 48 h of symptoms showed symmetric diffuse areas of altered signal in the bilateral cerebral hemispheres, basal ganglia, posterior limb of internal capsule, and splenium of the corpus callosum, showing a hyperintense signal on T2 weighted, FLAIR and restriction on DWI sequences [Figure 1]. Her electroencephalogram showed diffuse theta and delta slowing without any epileptiform discharges. Over the next 2 months, her sensorium improved. However, relatives noticed forceful involuntary movements in the right upper and lower limbs and posturing of the left upper and lower limbs and posturing of the left upper and lower limb. She had repetitive head movements, which were distractible. In addition to this, she had intermittent forceful jaw closure and teeth grinding during the awake state. These involuntary movements disappeared during sleep. On examination, she was conscious but not following commands. Her pupils were normal in size and reacting to light. The tone was increased in all four limbs and plantars were bilaterally extensor. She had right lower limb dystonic posturing of both upper limb and left lower limb. She also had jaw closure dystonia and bruxism.

Over the next 2 months, her sensorium improved. However, she continued to suffer from severe hypoglycemia. The episode was because of an overdose of oral hypoglycemic agents. Her blood glucose level was documented to be 35 mg/dL. There was no other significant past medical history. With these complaints, she was hospitalized, intubated and mechanically ventilated. Her magnetic resonance imaging (MRI) brain done within 48 h of symptoms showed symmetric diffuse areas of altered signal in the bilateral cerebral hemispheres, basal ganglia, posterior limb of internal capsule, and splenium of the corpus callosum, showing a hyperintense signal on T2 weighted, FLAIR and restriction on DWI sequences [Figure 1]. Her electroencephalogram showed diffuse theta and delta slowing without any epileptiform discharges. Over the next 2 months, her sensorium improved. However, relatives noticed forceful involuntary movements in the right upper and lower limbs and posturing of the left upper and lower limbs and posturing of the left upper and lower limb. She had repetitive head movements, which were distractible. In addition to this, she had intermittent forceful jaw closure and teeth grinding during the awake state. These involuntary movements disappeared during sleep. On examination, she was conscious but not following commands. Her pupils were normal in size and reacting to light. The tone was increased in all four limbs and plantars were bilaterally extensor. She had right lower limb dystonic posturing of both upper limb and left lower limb [Video 1]. She also had jaw closure dystonia and bruxism.

Different conditions, including hypoxic-ischemic encephalopathy (HIE), Creutzfeldt-Jakob disease (CJD), drug toxicity, and stroke, were considered differentials. Severe HIE most commonly affects gray matter of the peri-rolandic, occipital, medial prefrontal cortex, basal ganglia, thalami, hippocampus, and cerebellum. However, the temporal profile of the symptoms in our patient, documentation of hypoglycemia, and the involvement of posterior limb of the internal capsule, and splenium of the corpus callosum on MRI favored hypoglycemic encephalopathy. Finally, the diagnosis of hypoglycemic encephalopathy with extrapyramidal manifestation was made. Patient was started on tetrabenazine and clonazepam, but there was only a mild response to treatment after 3 months of follow-up.

Hypoglycemia can be associated with a myriad of clinical manifestations, including movement disorders. Most of the existing literature on movement disorders associated with altered glycemic control focused on hyperglycemia-induced choreo-ballistic movements. There is a dearth of literature on hypoglycemia-induced movement disorders. The pathophysiology of hypoglycemia causing movement disorders is poorly understood. The proposed mechanisms are asymmetric blood flow, energy failure, loss of ion homeostasis, arrest of protein synthesis, and excitotoxic oedema, resulting from the adaptative changes in the cerebral metabolism. The

---

**Figure 1:** MRI brain showing symmetric diffuse areas of hyperintense signal in bilateral cerebral cortex and basal ganglia on T2 weighted (a) and FLAIR (b) sequences and diffusion restriction in the bilateral cerebral cortex, basal ganglia, and splenium of corpus callosum on DWI sequence (c)
role of excitatory amino acids aspartate and glutamate release in the cerebral cortex, corpus striatum and hippocampus during hypoglycemia have also been implicated.[9] The brain areas most vulnerable to hypoglycemia are the temporal lobe, hippocampus, basal ganglia, and corpus callosum. The propensity for these structures is due to regional variability in glucose level and differences in amino acid distribution.[5] Whereas the cerebellum, brainstem, and thalamus are spared in hypoglycemic brain insults. This disparity is because of the higher activity of glucose transporters in the latter and higher levels of adenosine triphosphate in the thalamus.[6] SPECT imaging in patients with hypoglycemia and chorea has shown decreased blood flow in the basal ganglia and increased perfusion of the thalamus contralateral to the side of the body manifesting chorea.[7] These findings suggest that decreased pallidal inhibitory input to the thalamus leads to increased thalamic output, resulting in hyperkinetic movements.

Our case is an exciting example of a combination of different hyperkinetic movement disorders, which can be seen in hypoglycemic brain injury associated closely with concurrent encephalopathy. Both choreothetosis and paroxysmal dyskinesias have been previously reported after hypoglycemic episodes.[2,3] Dystonia involving limbs has also been described to be associated with hypoglycemia, which is often paroxysmal. Similar to our case, Deleo et al.[3] reported one case with stereotypies, dystonia, and choreothetosis following hypoglycemic insult. Recently, Shah et al.[9] reported jerky head movement in a patient with hypoglycemia. But the unique finding in our case is prominent jaw closure dystonia with awake bruxism and stereotypic repetitive head movement, which has not been reported previously to the best of our knowledge. It is a matter of debate whether awake bruxism is a part of oromandibular dystonia or stereotypy. The disappearance of bruxism during sleep, coexisting jaw closure dystonia, and the involvement of the same region in both these conditions have led us to consider that bruxism could be a form of oromandibular dystonia. However, the phenomenological features of awake bruxism like repetitive and focal mandibular movements, unrelated to specific actions (i.e., non-goal directed), and associated limb stereotypes favors it to be a form of oromandibular stereotypy. The exact pathogenesis of awake bruxism is not known but it could be linked to the limbic part of basal ganglia dysfunction.[10]

Our case broadens the spectrum of hypoglycemia associated movement disorders to include oromandibular dystonia and stereotypes along with chorea, ballism, and limb dystonia. The awareness of such atypical manifestations of hypoglycemic brain injury will allow making an early diagnosis and avoid unnecessary work up in a patient with relevant clinical settings.

Declaration of patient consent
The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

References
1. Malouf R, Brust JC. Hypoglycemia: Causes, neurological manifestations, and outcome. Ann Neurol 1985;17:421-30.
2. Guerrero WR, Okun MS, McFarland NR. Encephalopathy, hypoglycemia, and flailing extremities: A case of bilateral chorea-ballism associated with diabetic ketoacidosis. Tremor Other Hyperkinet Mov (N Y) 2012;2:tre‑02‑58‑235‑1.
3. Deleo F, Matricardi S, Didato G, Montano N, Gnakovsky V, Romito LM, et al. An unusual behavioural and motor paroxysmal disorder caused by insulinoma-related hypoglycemia: A possible cause of epilepsy misdiagnosis. Seizure 2014;23:909‑11.
4. Mohseni S. Neurologic damage in hypoglycemia. Handb Clin Neurol 2014;126:513‑32.
5. Fujioka M, Okuchi K, Hiramatsu KI, Sakaki T, Sakaguchi S, Ishii Y. Specific changes in human brain after hypoglycemic injury. Stroke 1997;28:584‑7.
6. Ma JH, Kim YJ, Yoo WJ, Ihn YK, Kim JY, Song HH, et al. MR imaging of hypoglycemic encephalopathy: Lesion distribution and prognosis prediction by diffusion-weighted imaging. Neuroradiology 2009;51:641‑9.
7. Kim JS, Lee KS, Lee KH, Kim YI, Chung YA, et al. Evidence of thalamic disinhibition in patients with hemichorea: Semiquantitative analysis using SPECT. J Neurol Neurosurg Psychiatry 2002;72:329‑33.
8. Takahashi S, Ohkawa S. [Paroxysmal bilateral ballism induced by hypoglycemia]. Rinsho Shinkeigaku 2006;46:278‑80.
9. Shah VS, Sardana V. Sudden jerky head movement in hypoglycemia. Ann Mov Disord 2020;3:44‑6.
10. Ella B, Ghorayeb I, Burbaud P, Guehl D. Bruxism in movement disorders: A comprehensive review. J Prosthodont 2016;26:599‑605.

Videor available on: www.annalsofian.org
Submitted: 11-Jan-2022 Revised: 04-Feb-2022 Accepted: 19-Mar-2022 Published: 26-Jul-2022

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShaReAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

DOI: 10.4103/aian.aian_39_22