Case Report

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Central and Extra Pontine Myelinolysis in the Setting of Hyperglycemia

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Introduction

Osmotic demyelination syndrome (ODS) was first described by Adams et al. in 1959 as a combination of quadriparesis, pseudobulbar paralysis, and the distinctive myelin loss in the pons, attributable to alcoholism or malnutrition.[1] ODS has since been commonly attributed to rapid correction of chronic hyponatremia. Other reported etiologies include alcohol withdrawal, liver transplantation, hypokalemia, hypernatremia as well as severe hyperglycemia. [2-6] (e1-20) Here, we describe a case of ODS associated with diabetic ketoacidosis (DKA) and review the existing literature on hyperglycemia-related ODS.

Keywords: Central pontine myelinolysis; Osmotic demyelination syndrome; Hyperosmolar state; Hyperglycemia

Case Summary

A 61-year-old right-handed man with type-II diabetes mellitus, hypertension, hyperlipidemia and necrotic fasciitis of his right lower extremity was found unconscious and brought to the emergency department. On presentation, patient was lethargic and hypotensive (blood pressure 85/50 mmHg). Initial labs showed hyperglycemia (700 mg/dl), high anion gap (25 mEq/L), elevated serum ketones (3.37 mmol/L) and hyperlactatemia (5.8 mmol/L). He was treated for DKA and sepsis followed by a right above knee amputation. The neurology service was consulted on day 7 due to persistent dysarthria, disorientation, and quadriplegia despite resolution of hyperglycemia and sepsis.

On neurological assessment, patient was alert, oriented to self but unable to provide a clear timeline for his symptoms. His cranial nerves examination was intact. Motor exam was notable for quadriplegia with trace movements in the legs, hyper-reflexia and a positive Hoffman sign. Sensory exam was intact to light-touch, pin-prick and proprioception.

Cervical-spine MRI was unremarkable. Brain MRI showed symmetric diffuse bilateral diffusion restriction and T2-FLAIR abnormalities in the bilateral peri-rolandic regions, occipital lobes, and pons without contrast enhancement suggesting ODS (Figure 1). Cerebrospinal fluid analysis was within normal limits (white blood cells = 1/mm3, red blood cells = 1/mm3, protein = 46 mg/dl, glucose = 73 mg/dl with a serum glucose = 102, negative gram stain and meningitis/encephalitis panel). His serum sodium levels were normal on admission and remained stable throughout hospitalization. There was a drop in serum glucose levels from 700 mg/dl to 245 mg/dl and change in osmolarity from 377 to 347 mOsm/Kg on the first day of hospitalization (Figure 2e). Based on clinical and radiological features, and in the absence of other etiologies, we suggest that the findings were due to the hyperosmolar state secondary to DKA.

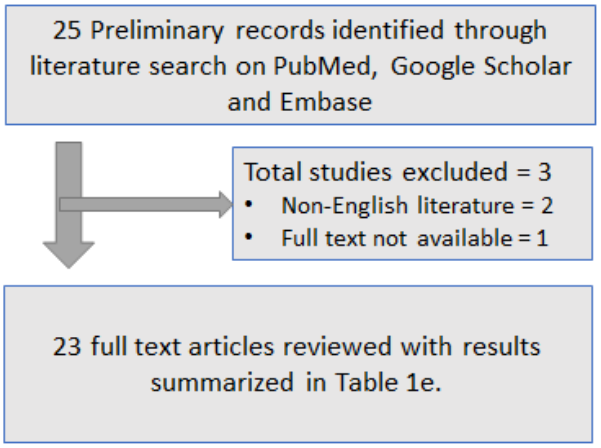
Literature search terms used for the review osmotic demyelination syndrome associated with hyperglycemia.

- Osmotic Demyelination Syndrome,
- Osmotic Pontine Myelinolysis
- Extra Pontine Myelinolysis
- Hyperglycemia
- Hyperosmolar Hyperglycemia
- Diabetic Ketoacidosis

Discussion

This case illustrates a rare case of ODS in the setting of hyperglycemia. We performed a literature search in PubMed, Google Scholar and Embase and found 25 cases reporting this association. A summary of these cases is presented in Table 1e.

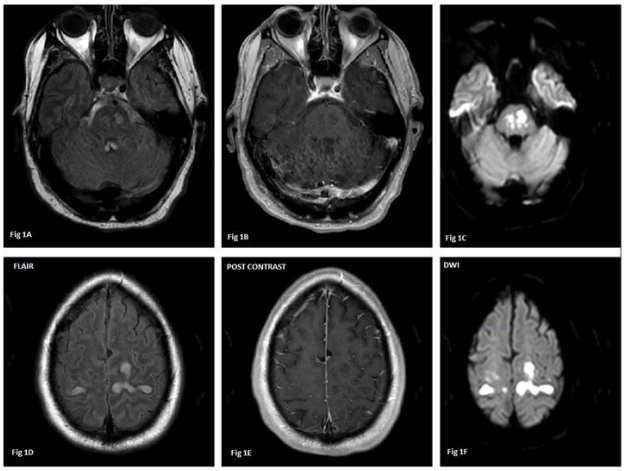
Figure 1: Flow diagram of literature review for association of osmotic demyelination syndrome with hyperglycemia.



There are two possible explanations for the pathogenesis of ODS, osmotic shifts due to rapid correction of the hyper osmolar state or a hypertonic insult that overwhelms the neuronal compensatory capacity. Rapid osmotic shifts resulting from rapid correction of a hyper-osmolar state, lead to an efflux of osmolytes or influx of water into brain cells and cause neuronal damage. This is the proposed mechanism in the rare instances of ODS in the setting of rapid correction of hypernatremia. [3,7] An alternative explanation is a hypertonic insult in which the serum or the extracellular space becomes hypertonic overwhelming the compensatory mechanism of neuronal cell bodies leading to astrocytic lesions and demyelination.[3,6] Serum glucose does not contribute to osmolality as much as serum sodium. However, both of these mechanisms have been proposed to cause ODS with dramatically elevated serum glucose levels. [4] (e1-e20) The duration of glucose and sodium elevation is unclear in most of these cases given their rarity and absence of lab data prior to presentation.

ODS prevention is focused on slow correction of the hyperosmolar state. [1-3] Treatment of ODS includes supportive care and treating the underlying condition. The outcomes are variable ranging from near complete recovery to a completely dependent state or even death. (See table 1e). Treatments with glucocorticoids, intravenous immunoglobulin, intravenous thyrotropin-releasing hormone, and plasma exchange had been tried but additional studies are warranted before their implementation in clinical practice [5] (e8).

Figure 2: Diffusion weighed Images(DWI) in Fig 1C and 1F notable for patchy diffusion restriction in the central pons and perirolandic regions. Corresponding T2 FLAIR abnormalities are seen in Figure 1A and 1D. Post contrast scans (Fig 1B and 1E) do not show any notable contrast enhancement.



Case Report	Age (years)	Sex	Glucose (mg/dl)	Osmolality (milli osmoles/Kg	Na (mEq/L)	BUN (mg/dl)	Hb A1c %	K (mEq/L)	Presentation	Outcomes
ODS cases attributed to hyperglycemic hyperosmolar state										
Our Case	61	M	748	374	141	145	10.9	4.7	Found unconscious followed by persistent dysarthria and quadriparesis.	Discharge to inpatient rehab at 1 month. Improved mobility and swallowing but required total care.
Hirosawa et al (e1)	55	M	1011	324	126	43.8	17.8	3.2	AMS x 3 days and dysmetria.	Return to baseline over several weeks
Saini et al (6)	45	F	491	307	132	4	18	4.3	Ataxia, R UE pronator drift x 2 weeks	Gradual improvement in gait by second week
Pliquett et al (e2)	55	M	524	296	133	-	17.6	-	Dysmetria and Dysarthria x 5 days. Liver cirrhosis	Discharged to outpatient rehab

										Able to walk by 3 months
Hegazy et al (4)	43	F	828	-	181	11		4.6	AMS. Brisk plantar response developed during admission	Complete recovery by week 4
McComb et al (e3)	54	F	954	-	169				Obtunded	Deceased at 21 days
Mao et al (e4)	55	M	685	318	134	-	17.5	4.3	R focal seizures which evolved into EPC, R hemiplegia.	Regain of function by 1 m
Guerrero et al (5)	25	M	> 700	-	-	-	-	-	L hemiparesis developed as AG closed	-
Rodríguez-Velver et al (e5)	47	F	838	320	133	21	10.1	4.6	AMS and GTC. Worsening weakness on 24 hours	Return to baseline by 6 months
Kusumoto et al (e6)	87	F	1000	459	179	-	10.8	5.1	Fever, involuntary trunk and UE movements followed by coma	Return of spontaneous speech reported on 1 year followup
Gouveia et al (e7)	38	M	1225	412	154	38		5.4	AMS x 5 days, h/o chronic alcoholism	Remained poorly arousable, transferred to inpatient rehab
Yoshikawa et al (e8)*	84	F	465	308	113	168	-	6.3	AMS, worsened on HD 8.	Died in a few weeks
Bline et al (e9)*	14	F	> 600		130	64	13.8	2.8	Obtunded and emesis x 4days. Decline in mental status on HD 6.	Return to baseline by week 6
Kim et al (e10)	61	M	627	324	133	43.9	18.1	3.4	Dysarthria, dysphagia, dysmetria x 10 days. H/O cirrhosis	Gradually regained swallowing and mobility over weeks.
Kote et al (e11)	37	F	482	327.66	140	30.5	8.8	3.35	Dysarthria and dysmetria x 10-14 days. Exam	Deceased at 15 days

									decline after 6 hours of initiating treatment	
Kumar et al (e12)	62		542	316	135	38	10.6	3.8	Dysphagia, dysarthria, and ataxia x 10-14 days	Improved dysphagia, dysarthria and walk independently upon discharge.
Lee et al (e13)	36	M	823	336	145	-	-	-	Dysphagia, dysarthria, and ataxia Chronic alcoholism	Dysphagia and ataxia resolved by 1 month, Dysarthria persisted at 4-month follow up.
Sharma et al (e14)	20	F	402	318	142		14.2	4.2	Dysarthria and generalized weakness x 15 days	Return to baseline by 30 days.
Yoong et al (e15)	53	M	594.6	340	135		14	4.6	Frequent falls and dysarthria x 2 months	Near complete recovery reported
Ramineni et al (e16)	50	M	546	318	136	66	13	3.6	Dysarthria, ataxia and generalized weakness x 10 days	Mild dysarthria at 1 month. Independent in all ADLs
Talluri et al (e17)	45	M	178	317	140	95		3.9	Intermittent ataxia, dysarthria and pseudobulbar affect	Return to baseline at 8 weeks
Cases attributed to treatment of hyperglycemic hyperosmolar state										
O'Malley et al (e18)	49	F	1910	399	134	23.3		2.2	Drowsy. No focal deficits. Flaccid quadriparesis noted on day 9 when weaned off sedation	Inpatient rehab, near complete recovery at 6 months
Burns et al (e19)	93	M	524	343	137	48		4.6	AMS and emesis. Ataxia developed 48 hours after admission	Improved gait at 1 month

Hsieh et al (e20)	29	M	646	-	138	-	-	2	AMS x 3 days. Declined 40 hours after admission	Remained vent dependent x 6 weeks, discharged to rehab.

Table 1: Literature summary of cases with osmotic demyelination syndrome associated with hyperglycemia.

*Unclear if acute treatment played any role in development of ODS

Abbreviations: AMS = Altered Mental Status; UE = Upper extremities; R = Right, L = Left

H/O = History of; GTC = Generalized tonic clonic seizure; HD = Hospital day

Conclusion

Severe hyperglycemia is one of the uncommon and possibly under-reported cause of ODS. The proposed underlying mechanisms are a direct hyperosmolar insult or the osmotic shifts resulting from the rapid correction of the hyper osmolar state.

References

1. Adams RD, Victor M, Mancall EL. (1959) Central pontine myelinolysis: a hitherto undescribed disease occurring in alcoholic and malnourished patients. AMA Arch Neurol Psychiatry.81(2): 154-72.
2. Lambeck J, Hieber M, Dreßing A, Niesen W-D. (2019) Central Pontine Myelinosis and Osmotic Demyelination Syndrome. Dtsch Arztebl Int. 116(35-36): 600-6.
3. Aegisdottir H, Cooray C, Wirdefeldt K, Piehl F, Sveinsson O. Incidence of osmotic demyelination syndrome in Sweden: A nationwide study. Acta Neurol Scand. 2019; 140(5): 342-9.
4. Hegazi MO, Mashankar A. (2013) Central pontine myelinolysis in the hyperosmolar hyperglycaemic state. Medical principles and practice. 22(1): 96-9.
5. Guerrero WR, Dababneh H, Nadeau SE. (2013) Hemiparesis, encephalopathy, and extrapontine osmotic myelinolysis in the setting of hyperosmolar hyperglycemia. Journal of Clinical Neuroscience. 20(6): 894-6.
6. Saini M, Mamauag MJ, Singh R. (2015) Central pontine myelinolysis: a rare presentation secondary to hyperglycaemia. Singapore medical journal. 56(4): e71.
7. Mastrangelo S, Arlotta A, Cefalo MG, Maurizi P, Cianfoni A, Riccardi R. (2009) Central pontine and extrapontine myelinolysis in a pediatric patient following rapid correction of hypernatremia. Neuropediatrics. 40(3): 144-7.