Central Pontine Myelinolysis in Association with Correction of Hypokalemia with Asymptomatic Case of Gastroesophageal Reflux Disease

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ABSTRACT

This case report has described the patient having the central pontine myelinolysis (CPM) associated with hypokalemia correction with asymptomatic history of gastroesophageal reflux disease (GERD). It was suspected that due to GERD and vomiting there might be loss of electrolytes resulting to hypokalemia. The hypokalemia was corrected and patient was discharged from the tertiary neurological center in Nepal.

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Keywords: Central Pontline; GERD; Hypokalemia Myelinolysis; Neurology.

INTRODUCTION

Central pontine myelinolysis (CPM) is a rare neurological disorder which involves damage to the myelin sheath of neurons in the pontine part of the brainstem which is predominantly treatment-induced. Around 10 percent of the patients experience demyelination in the extra pontine parts too suggesting its association with Extra Pontine Myelinolysis (EPM). Traditionally, CPM is attributed to excessive and rapid correction of chronic hyponatremia (>48 hours) or severe hyponatremia (Na <120 mEq/L) in patients with chronic medical conditions, such as malignancy, malnutrition and chronic alcoholism. CPM was first reported in 1959 by Adams et.al. However, the relation of CPM with rapid correction of sodium was reported in 1976.[1,2] Nevertheless, there are cases that are occasionally not associated with drastic changes in serum sodium level.[3] Rather these cases are found to be associated with hypophosphatemia and hypokalemia.[3,4] Clinically, CPM presents with neurological symptoms like dysphagia, dysarthria, quadriplegia or encephalopathy. Additionally, neuropsychiatric symptoms including personality changes, inappropriate affect, emotional lability, disinhibition, catatonia, psychosis, and delirium, are also reported from some cases. Diagnosis of CPM can be confirmed by magnetic resonance imaging (MRI), rather asymptomatic cases can be reported too. We report here probably, the first case of a patient with CPM inflicted by the rapid correction of hypokalemia secondary to gastroesophageal reflux disease (GERD).

CASE REPORT

A 47-year-old female presented with chief complaints of

generalized weakness of the entire body for 1-week, multiple episodes of vomiting and decreased appetite at our tertiary neurological center. Patient had a similar history 4 months prior for which he had visited the local hospital. There he was diagnosed with GERD and acute severe hypokalemia for which conservative management was initiated as per GERD guidelines. She was satisfactorily discharged without impending medical problems.

After 4 months, on presentation she displayed weak palmar grasp apart from whole body weakness. No other significant neurological deficits were present. Her lab investigations (Table 1) revealed significant low serum potassium and calcium levels. In contrast, her magnesium levels were slightly above normal and sodium levels were within the normal range. The patient's hemoglobin was 15.8gm/dl, WBC: 13,300/cumm with 73% Neutrophils count, RBC: 5.3mmol/l, ESR: 22 mm in the first hour. Her thyroid function tests as well as serum urea and creatinine were within normal range. PTH levels were 16.pg/ml.

Table 1: Lab Investigations of Serum Electrolyte

Serum Electrolyte	Findings
Sodium	139mEq/L
Potassium	2.3mEq/L
Calcium	1.8mmol/L
Magnesium	3.12mg/dL

MRI brain (Figure 1) was indicative of CPM with a well defined focal intra-axial lesion measuring approximately 20x19x17mm showing hyper intense signal in T2W sequence in the midline pons with enhancement in the lower half of lesion in CE images. There was no restriction diffusion in the lesion in DWI images and no susceptibility artifact in SWI images. There was a ~26x14mm sized extra-axial cystic lesion in the left midline cranial fossa indicative of arachnoid cyst.

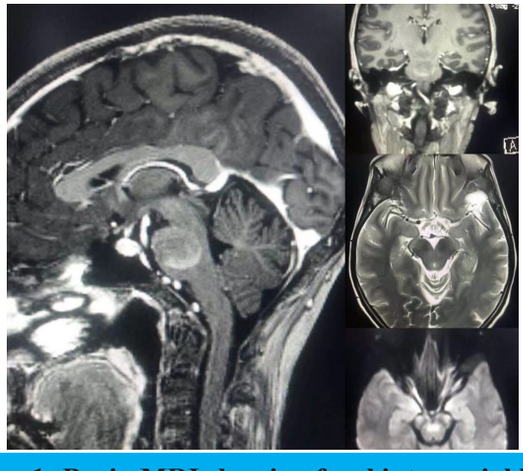

Figure 1: Brain MRI showing focal intra-axial lesion

Ultrasound of abdomen and pelvis was suggestive of few bilateral nephrolithiasis (L>R). There was a slight increase in echogenicity in bilateral kidneys with maintained CMD. No other abnormality was seen.

During her hospital stay her electrolyte and metabolic homeostasis was kept in check with oral solution of Potassium Chloride. Her vomiting was controlled with antiemetic Ondansetron was given intravenously. She was further managed with steroids (Dexamethasone 4mg intravenous), proton pump inhibitors (PPIs) - Pantoprazole 4mg intravenous and IV fluids. Potassium Levels corrected and came back approximately normal within a week with this treatment strategy. Her low calcium levels (1.8mmol/L) were rectified with Calvit 60 mEq. Phenytoin (100 mg TDS oral) was added as a prophylactic measure. Additionally, she was prescribed Lactulose syrup (15ml) for her constipation along with potassium sparing diuretic Aldactone (oral, 25mg). Robust physiotherapy was advised for muscular weakness. The patient was satisfactorily discharged after a week with negligible medical deteriorations (Table 2).

Table 2: Improving range of Serum Electrolyte

Days	Potassium Levels (mEq/L)	Sodium Levels (mEq/L)
Day 1	2.3	139
Day 2	2.1	134
Day 3	2.2	142
Day 4	2.1	144
Day 5	2.6	143
Day 6	2.3	142
Day 7	3.1	144

DISCUSSION

We describe an unusual case of a patient who developed CPM with normonatremic hypokalemia due to GERD as the underlying cause. CPM is well recognized in relation to corrected hyponatremia, alcoholism, liver disease, malnutrition.[10] and diabetic ketoacidosis.[11] Interestingly our patient had no history of the aforementioned accompaniments. The characteristic neurologic symptoms seen in CPM {spastic quadriplegia, pseudobulbar palsy (characterized by head and neck weakness, dysphagia, and dysarthria) and encephalopathy in association with non-inflammatory demyelination centered within the pons} were totally absent. All this made it nearly impossible to diagnose and manage the condition. However, with advancements in diagnostic imaging techniques like MRI, cases of asymptomatic CPM can be easily reported like ours, which explains the unparalleled importance of MRI. But, repeat MRI after 2 weeks of the onset of symptoms

or correction of hyponatremia is required in cases of unremarkable results in suspected patients.

Although there have been a number of cases associated with hypokalemia, this is the very first case seen in relation to GERD to the best of our knowledge. Because of repeated vomiting, there is excessive loss of hydrogen, chloride, and water leading to alkalosis and the resultant shift of potassium into the cells developing hypokalemia .[7] An increase in potassium ion excretion in the urine owing to secondary aldosteronism as a cause of decreased total body water can also be a contributing factor to hypokalemia.[8] Hypokalemia can further complicate scenarios when involved with hyponatremia as observed in 89% of patients in a case series reported by Lohr et. al .[9] But, reports of hypokalemia in normonatremic patients is suggestive of the independent etiology of hypokalemia in CPM, exemplified by our case, Anorexia Nervosa.[14], Sjogren's syndrome.[12], SLE.[13] and chronic alcohol misuse. [15,16] Unlike a cohort of 25 patients who had ODS that concluded hypokalemia to be indicative of a poorer outcome. [17] our patient responded well to the treatment and had full recovery without any deterioration. This could be possible due to timely diagnosis (before the neurological picture depleted) and initiation of the therapy.

The mechanism of myelinolysis has been linked to intramyelinic splitting, vacuolization, and rupture of myelin sheaths, which results from the osmotic effects from the correction of hyponatremia.[5] Theoretically in acute hyponatremia, cells gain water leading to brain edema requiring immediate hospitalisation. Contrary to this, in chronic hyponatremia, cells lose osmolytes that create a comparative hypertonic milieu. With cells being under osmotic stress and their inability to replenish the lost osmolytes in time causes shrinkage of cells including neurons and oligodendrocytes, drifting the axons away from the myelin sheath, hence, demyelination. Subsequent shrinkage triggers apoptosis of the oligodendrocytes, thereby enhancing demyelination. The osmotic tension to endothelium of the Blood Brain Barrier (BBB) exposes the brain to myelinotoxic agents causing myelinolysis of oligodendrocytes and vasogenic oedema.[18] In cases of hyponatremia complicated by hypokalemia, a recent study proposed the susceptibility of the cell to osmotic injury because of a decreased concentration of Na/K ATPase during hypokalemia. Therefore, it's possible that our patient developed CPM attributable to the infusion of electrolytes, which was low to induce injury in normal state.

Learning Points

1. CPM is controllable and manageable if diagnosed in time and started over proper treatment regimen.

2. MRI is an essential early diagnostic and confirmatory method for both symptomatic and asymptomatic cases of CPM. However, it is recommended to repeat it after 2 weeks in suspected cases without any imaging evidence.

3. Electrolyte imbalance apart from sodium should be considered and resolved.

CONCLUSION

CPM is a rare neurological disorder due to long-standing hypokalemia (low level of serum potassium). Thus, abnormal level of serum electrolytes apart from sodium, such as potassium and phosphorus must be investigated and corrected. This unique case report suggests that further neurological examinations should include serum electrolytes assays to better aid the prognosis.

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