Central Pontine Myelinolysis

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Central pontine myelinolysis (CPM), a neurologic disorder caused most frequently by rapid correction of hyponatremia, is characterized by demyelination that affects the central portion of the base of the pons. There are no inflammatory changes, and blood vessels are normal. Clinical features usually reflect damage to the descending motor tracts and include spastic tetraparesis, pseudobulbar paralysis, and the locked-in syndrome. Magnetic resonance imaging of the brain, the imaging procedure of choice, shows an area of prolonged T1 and T2 relaxation in the central pons, which may have a characteristic shape. Recovery varies, ranging from no improvement to substantial improvement. To avoid CPM, correction of serum sodium in patients with hyponatremia should not exceed 12 mEq/24 h. We describe a case of CPM in a hyponatremic patient who presented with a cerebellar syndrome with no pyramidal tract involvement and in whom the rate of correction of serum sodium was within the recommended limits.

REPORT OF A CASE

A 47-year-old man was transferred to the Medical College of Ohio Hospital because of sudden onset of clumsiness and difficulty with walking. Three weeks previously, he had been admitted to a hospital after a period of heavy drinking, experiencing fever, cough, and vomiting. Right upper and lower lobe pneumonia and acute gastritis were diagnosed. On admission, his serum sodium level was 123 mEq/L (reference ranges shown parenthetically) (140-148 mEq/L); and vitamin B12, 633 pg/mL (157-1059 pg/mL). Findings on cerebrospinal fluid examination were normal. Chest radiography showed evidence of pneumonia involving the right upper and lower lobes. Sputum culture grew a combination of pneumococcus and *Klebsiella pneumoniae*. Blood cultures were negative. After intravenous administration of antibiotics, his pneumonia resolved, but pronounced appendicular ataxia and axial ataxia were noted. The patient was then transferred to the Medical College Hospital for evaluation of these neurologic findings. On examination, he was fully conscious; was oriented to time, place, and person; and comprehended all commands but had dysarthria. Strength was normal in all extremities. He was clumsy while performing finger-nose and heel-knee maneuvers on both sides. His ability to perform rapid alternating movements was impaired in both hands. Mildly reduced vibration sense was noted at his ankles, but sensations were otherwise normal. Deep tendon jerks were 2+ and symmetric, and Babinski sign was negative bilaterally. The patient was unsteady on sitting up and was markedly ataxic while walking with a wide-based gait. Magnetic resonance imaging (MRI) of the brain showed an area of decreased signal in the pons on T2-weighted images and a decreased signal intensity on T1-weighted images (Figures 1 and 2). The lesions did not enhance. T1-weighted sagittal images showed mild vermian atrophy. During the following week, the patient’s dysarthria improved, but he still experienced ataxia at the time of discharge. He did not return to the outpatient clinic for follow-up.

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DISCUSSION
The patient has a long-standing history of alcohol abuse and presented with hyponatremia complicating an acute medical illness. The hyponatremia was corrected and was followed by the onset of new neurologic signs; a pontine lesion on MRI was characteristic in appearance and location. These features support the diagnosis of CPM. This case was unusual in at least 2 respects. First, isolated cerebellar symptoms are a rare manifestation of CPM. Second, the condition developed in the presence of relatively mild hyponatremia and when the rate of correcting serum sodium was within the currently recommended limits.

Figure 1. T2-weighted magnetic resonance images at the level of the pons. Coronal (left) and axial (right) views show an area of hyperintensity in the central pons. Note the bat’s wing configuration in the coronal image (left) and the triangular shape in the axial image (right).

Figure 2. T1-weighted magnetic resonance images. Sagittal (left) and axial (right) views show hypointensity in the base of the pons. Note that the cerebellum and middle cerebellar peduncles are not involved (right).
First described in 1959 by Adams et al., CPM is an infrequent condition characterized by loss of myelin in the central part of the pons. Their patients had chronic alcoholism, but later reports emphasized that CPM is a distinct entity related to rapid normalization of serum sodium in patients with chronic hyponatremia.\textsuperscript{2,4} Usually, CPM occurs when correction of the serum sodium level exceeds 12 mEq/L a day. The mechanism of myelin loss in CPM is poorly understood. One study suggested that the increase in serum sodium produces an osmotic endothelial injury that leads to local release of myelinotoxic factors derived from the more vascular gray matter.\textsuperscript{3} The fact that myelinolysis does not occur in pure white matter tracts, such as the internal capsule, supports this hypothesis. Invariably, patients with CPM have an underlying medical disease, and 1 hypothesis is that such associated diseases, especially alcoholism and liver disease, make patients more susceptible to the development of CPM. In these situations, the brain may be incapable of generating new osmoles in response to a rapid increase in serum osmolality, resulting in excessive endothelial shrinkage and injury. The characteristic clinical manifestations of myelinolysis are spastic tetraparesis and pseudobulbar paralysis. Pseudobulbar paralysis leads to dysphagia, dysarthria, weakness of the tongue, and emotional lability. These findings are caused by destructive lesions in the corticospinal and the corticobulbar tracts in the pons. A large central pontine lesion can cause a locked-in syndrome.\textsuperscript{4} In the locked-in syndrome, the lesions in the descending motor tracts deprive the patient of speech and the capacity to respond in any way except by vertical gaze and blinking. Variations include weakness that is worse in the arms compared with the legs and weakness in a hemiplegic distribution.\textsuperscript{7} Lesions involving the descending oculosympathetic tracts can cause bilateral miosis, whereas lesions that involve the lower pons can cause unilateral or bilateral sixth nerve palsy.\textsuperscript{5} The patient’s level of consciousness may be impaired, varying from lethargy to coma. Such changes in consciousness are usually due to the lesion extending from the base of the pons into the tegmentum of pons.

In addition to lesions in the pons, other areas in the central nervous system can be affected by myelinolysis. Such lesions are collectively referred to as extrapontine myelinolysis (EPM).\textsuperscript{8,10} These lesions, in order of frequency, occur in the cerebellum, lateral geniculate body, thalamus, putamen, and cerebral cortex or subcortex. Usually, EPM accompanies CPM but can occur in isolation. Symptoms such as cerebellar ataxia and dystonia occur in patients with EPM and reflect the area that is predominantly involved.

Autopsy studies have shown a single large symmetric focus of demyelination in the central part of the base of the pons, with sparing of axis cylinders and unaffected blood vessels. No inflammatory changes are seen within the lesion. Brain MRI, the imaging procedure of choice, shows an area of prolonged T1- and T2-relaxation in the central pons, sparing the tegmentum of pons and the ventrolateral pons. The lesion is often triangular on axial images and has a bat’s wing configuration in coronal images.\textsuperscript{11,12} In the past, myelinolysis was believed to have a grim prognosis; however, it is now clear that manifestations can vary, and patients with severe complications can survive. The outcome varies widely, from almost complete recovery to little or no improvement.\textsuperscript{13,14}

The prominent cerebellar signs in our patient in the absence of lesions in the cerebellar hemispheres or peduncles indicate involvement of the pontocerebellar fibers, which traverse the base of the pons as they travel from the nuclei pontis to the middle cerebellar peduncles. Our patient’s presentation suggests that the pontocerebellar fibers may be more susceptible to the effects of myelinolysis and that in severe cases involvement of the corticospinal fibers masks the cerebellar signs because of the associated weakness. Ataxia due to involvement of the pontocerebellar fibers also occurs in ataxic hemiparesis, a type of lacunar stroke.\textsuperscript{15} Well-documented reports describing a cerebellar syndrome as a presenting feature of CPM are rare.\textsuperscript{16} Although our patient had preexisting atrophy of the vermis secondary to alcohol abuse, this was most likely an incidental finding because he had no prior symptoms, and acute dysarthria and appendicular ataxia are not features of degeneration of the vermis, which usually presents with chronic progressive gait ataxia.

The other noteworthy finding in our patient is that CPM developed in the setting of relatively mild hyponatremia even though the rate of correction of the serum sodium level was within the currently recommended limits. This confirms some isolated published reports that neurologic injury can occur when hyponatremia is mild and with modest rates of correction.\textsuperscript{17,18} Our experience also suggests that the current recommendations of limiting the increase in serum sodium concentration to 12 mEq/L in the first 24 hours and to 20 mEq/L in the initial 48 hours\textsuperscript{19,20} are not safe and that a lower rate of increase in serum sodium may be warranted.

REFERENCES