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Lesson of the week

Osmotic demyelination syndrome

Rachel Abbott, Eli Silber, Joerg Felber, Enefiok Ekpo

Patients with chronic alcoholism are commonly admitted to hospital and given intravenous fluids as part of the treatment of alcohol withdrawal. These patients are predisposed to chronic severe hyponatraemia because of a variety of mechanisms including psuedohyponatraemia, hypovolaemia, "beer" potomania syndrome, cerebral salt wasting syndrome, and reset osmostat syndrome.[1] If hyponatraemia (serum sodium concentration <136 mmol/l) is present it is important to correct this slowly, at a rate of less than 8 mmol/l/day to minimise the risk of developing osmotic demyelination syndrome, the general term for central pontine and extrapontine myelinolysis.[2]

Case report

A 42 year old man with chronic alcoholism presented with confusion. He had no significant medical history and was not taking any regular medications. On the day of admission his serum sodium concentration was 105 mmol/l at 5 pm. His serum was hypo-osmolar at 212 mmol/kg and his urine sodium concentration was

It is important to identify patients at risk from osmotic demyelination syndrome and to correct their hyponatraemia appropriately

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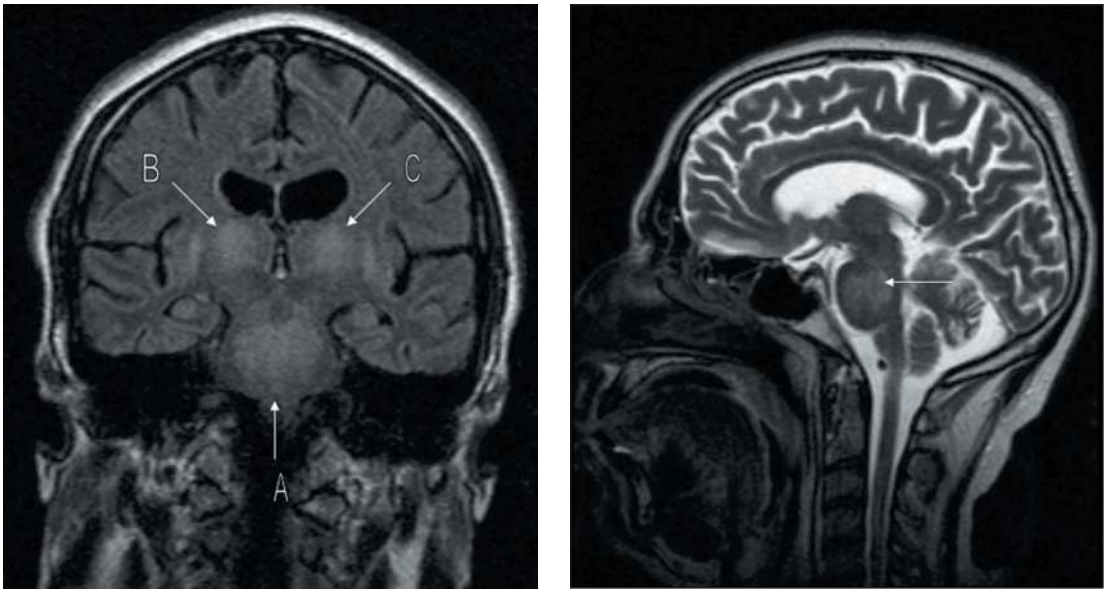
BMJ 2005;331:829–30



Magnetic resonance images of patient's brain. Left: FLAIR sequence coronal view showing an altered sequence within the pons (A), thalami, and basal ganglia (B and C). Right: T2-weighted sagittal image through the midline showing extensive T2 hyperintensitivity in the pons (arrow)

22 mmol/l, suggesting hypovolaemia. Over the next 11 hours he was given 1 litre of intravenous 0.9% saline with 40 mmol potassium chloride, followed by another litre over the subsequent 24 hours, as well as intravenous multivitamins (Pabrinex) and oral chlordiazepoxide. His serum sodium level increased to 119 mmol/l by 11 am the following day and reached a peak of 132 mmol/l on the fourth day after admission. At this time, he complained of general weakness. He was then discharged home.

Ten days after his initial presentation he was readmitted with confusion and ataxia. He was drooling saliva, his speech was slurred, and he was ataxic with a coarse tremor. He was reviewed by the speech and language team and given nasogastric feeding. A computed tomogram of the brain was reported as normal. A neurologist reviewed him and noted weakness and incoordination of his bulbar muscles, brisk reflexes throughout, including jaw jerk with extensor plantars.

Magnetic resonance imaging of the brain showed prominent high signal seen within the pons, basal ganglia, and thalami on T2-weighted and fluid-attenuated inversion recovery (FLAIR) imaging (see figure)—appearances consistent with osmotic demyelination syndrome.[3]

Four months after the diagnosis, the patient has mild dysarthria and drooling, which is controlled by a topical hyoscine patch. He is tolerating a puréed diet with supplemental nasoenteric feeding and is walking independently. He is soon to be discharged from a neurorehabilitation centre

Discussion

Osmotic demyelination syndrome is a well recognised complication of treatment of patients with severe and prolonged hyponatraemia, particularly when corrected too rapidly. This was first recognised by Tomlinson in 1976.[4] It has also been described in patients who are treated for hypernatraemia and in patients with a prolonged period of serum hyperosmolality.[5] Other conditions associated with an increased risk of the syndrome include chronic alcoholism, malnutrition, prolonged diuretic use, liver failure, receiving an organ transplant, and extensive burns.[5] The exact incidence of osmotic demyelination syndrome is unknown. In a study of 3000 brains examined postmortem there were 15 cases of asymptomatic central pontine myelinosis.[6]

Adams and colleagues first described central pontine myelinosis as symmetrical, non-inflammatory demyelination in the pons in 1958.[7] Extrapontine myelinolysis, with or without pontine involvement, was recognised in 1962[5] and occurs in at least 10% of patients with central pontine myelinosis, most often in the basal ganglia and thalamus.[8] Although both conditions share the same pathology, the location of the lesions results in different clinical presentations. Classically, central pontine myelinosis is associated with dysarthria and dysphagia, due to corticobulbar fibre involvement, as well as an initially flaccid quadraparesis due to lesions in the corticospinal tract. Extrapontine myelinolysis is characterised by tremor and ataxia and may be associated with movement disorders including mutism, parkinsonism, dystonia, and catatonia.[5]

Optimal approach to rehydration in the hyponatraemic patient

Depending on the severity of the patient's symptoms, aim to raise the serum sodium concentration between 1 mmol and 3 mmol (maximum) every 3 hours. Use the following formula to work out the rate of infusion of the chosen infusate, then measure the serum sodium concentration every 3 hours. The rate of correction in asymptomatic patients should not exceed 10 mmol/l/day.

$$\text{Change in serum } Na^+ = \frac{(\text{Infusate } Na^+ + \text{Infusate } K^+) - \text{serum } Na^+}{\text{Total body water (l)} + 1}$$

Adapted from Adrogue and Madias[2]

Microscopically, the lesions show symmetrical myelin destruction affecting all the fibre tracts, with a loss of oligodendrocytes.[7] A recent study has shown substantial axonal damage in central pontine myelinosis, which is also present in other demyelinating diseases, where it is associated with an inflammatory infiltrate.[8]

The mechanism by which osmotic demyelination syndrome develops involves rapid correction of a chronic osmolar abnormality when there is a deficit of organic osmolytes. This places brain cells, particularly oligodendrocytes, at risk of cell shrinkage and hence demyelination.[9] It is thought that alcoholics and malnourished patients have a general deficiency of organic osmolytes, which puts them at greater risk of cell shrinkage.[9]

Treatment is supportive, and the outcome is variable. Patients who survive central pontine myelinosis are likely to require extensive and prolonged neurorehabilitation. In a recent study of 34 patients with osmotic demyelination syndrome two died, and, of the remaining 32, a third recovered, a third were debilitated but independent, and a third were dependent.[10]

Contributors: All authors contributed to revisions of the document. RA performed the literature search and wrote the first draft, and is guarantor for the report. ES made the diagnosis. EE was responsible for the patient's general medical care.

Competing interests: None declared.

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(Accepted 8 June 2005)