Acute and Subacute Proton MR Spectroscopy Findings in Osmotic Myelinolysis Syndrome

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Purpose
Osmotic myelinolysis syndrome (OM), encompassing central pontine myelinolysis (CPM) and extrapontine myelinolysis (EPM), is a well-described neurologic complication afflicting some patients subjected to rapid correction of hyponatremia(1, 2). We performed proton MR spectroscopy (MRS) in four patients to establish if osmotic myelinolysis possesses characteristic proton MR spectroscopic findings that may support the clinical diagnosis of OM before abnormal imaging findings are apparent, and to evaluate whether MRS is useful as an adjunct to the conventional MR imaging examination.

Materials & Methods
Four patients with clinical and laboratory findings of OM were studied with single voxel proton MR spectroscopy (PRESS, TE 136-272, 8 cm³ voxel, 128 signal averages) and conventional enhanced MR imaging. Two patients had clinical findings referable to the pons (CPM) only, one patient referable to deep and subcortical white matter and cortex (EPM) only, and one patient with features of both EPM and CPM. None of the patients were believed to have had a hypoxic-ischemic event. Duration of symptoms at time of radiologic study ranged from 6 to 30 days postpresentation. MR spectra were interpreted in conjunction with conventional MR imaging studies. One patient underwent postmortem examination.

Results
Patients meeting clinical and imaging criteria for central pontine involvement manifested an elevated pontine Cho/Cr ratio (1.65 ± 0.21, 95% CI 1.39 to 1.91) and normal NAA/Cr ratio (2.1325 ± 0.14, 95% CI 1.91 to 2.35). One of these patients with clinical findings of both CPM and EPM demonstrated notably abnormal spectra but minimal pontine T2 signal abnormality. At autopsy only mild pontine demyelination was revealed. Additionally, another patient with clinical EPM only and normal pontine signal also manifested an abnormally elevated Cho/Cr ratio.
Both patients with extrapontine clinical findings demonstrated multifocal subcortical white matter T2 hyperintensity as well as diffuse cortical MR signal abnormalities attributed to nonischemic metabolic injury. Spectra obtained over the abnormal deep white matter (centrum semiovale) revealed elevated Cho/Cr ratio (1.45 ± 0.21) and normal NAA/Cr ratio (2.1 ± 0.41). Voxels placed over the affected occipital lobes in both patients with cortical abnormalities demonstrated normal Cho/Cr ratio (0.94 ± 0.16, 95% CI 0.79 to 1.09), markedly diminished NAA/Cr ratios (1.11 ± 0.28, 95% CI 0.85 to 1.37), and lactate doublet peaks. The deceased patient revealed cortical necrosis with mild neuronal dropout atypical for diffuse hypoxic-ischemic insult at autopsy.

**Conclusion**
The MRS findings validate reported mechanisms for osmotic myelinolysis. An elevated Cho/Cr ratio within the pontine and extrapontine white matter during acute and subacute disease without corresponding NAA/Cr ratio diminution suggests accelerated membrane turnover during myelinolysis without axonolysis. Conversely, the marked decrease in NAA/Cr ratio within affected gray matter without elevation of Cho/Cr, in conjunction with autopsy results, implies neuronal dysfunction or dropout due to nonischemic metabolic cortical derangement without accelerated membrane turnover. Pontine spectroscopic abnormalities were detected in one patient with minimal pontine signal abnormality and another with no imaging stigmata of CPM. Proton MR spectroscopy appears sensitive to early metabolic alterations of osmotic myelinolysis syndrome, and may help bolster a clinical diagnosis of OM before corroborative imaging signs are apparent.

**References**