

# Acute Disseminated Encephalomyelitis: Evaluation with Proton MR Spectroscopic Imaging

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## Introduction

The diagnosis of acute disseminated encephalomyelitis (ADEM) at initial presentation can be difficult. ADEM may mimic several other pathologies which require different management, both clinically and on neuroimaging. In addition, while some patients with ADEM have a monophasic course with complete recovery, other patients may have recurrent episodes and/or long-term neurological sequelae. The purpose of this study was to evaluate brain metabolism in patients with ADEM using multi-slice proton magnetic resonance spectroscopic imaging (MRSI), and to compare MRSI findings between patients with good outcome, versus those with recurrent disease or persistent neurological deficits.

## Materials and Methods

11 patients with ADEM (M:4, F:7, mean age: 8.8yrs) and 11 age-matched controls (M:5, F:6, mean age: 9.8yrs) were evaluated with routine brain MRI and MRSI within 7 days of symptom onset. MRI and neurological exam were repeated at least 6 months later in all cases. MRSI was performed at 1.5 Tesla using a multi-slice, spin echo technique with CHES water suppression and outer-volume lipid suppression (1, 2) (TR/TE = 2300/280ms, 4 axial slices, thickness 15mm, nominal voxel size 0.8 cm<sup>3</sup>). Regions of interest were chosen in both ADEM lesions, and normal appearing white matter in standardized supratentorial brain regions. The same regions were also measured in control subjects. Peak areas were measured by integration and metabolite ratios were calculated.

ADEM patients were classified into 2 groups depending on clinical outcome; the "good" outcome group had monophasic disease progression and no permanent neurological deficit on follow-up examination, while the "poor" outcome group had either multiphasic disease progression (with at least one relapse), and/or significant residual neurological deficit on follow-up clinical examination. Statistical analysis between groups was accomplished using students t-Test with correction for multiple comparisons. The level of significance was set at  $P < 0.05$ .

## Results

Metabolite ratios for lesions and normal appearing white matter in ADEM patients, and control data from the same regions are presented in Figure 1. Figure 2 shows an example of MRI and MRSI data in one ADEM case; this patient had monophasic disease and good clinical outcome. In total, 6 patients had a monophasic disease with good recovery, while 5 had either multiphasic disease and/or permanent deficits. N-acetyl-aspartate (NAA)/creatine (Cr) and NAA/choline (Cho) ratios in lesions within the basal ganglia and white matter (WM) of patients were reduced both versus controls ( $p < 0.01$ ) and versus contralateral brain regions ( $p = 0.02$  in basal ganglia,  $p < 0.01$  in white matter). Cho/Cr was unchanged in lesions compared either to contralateral brain regions or control subjects. In normal appearing white matter (NAWM) in ADEM patients, NAA/Cr and Cho/Cr were significantly reduced ( $p < 0.01$  and  $p = 0.013$ ) compared to controls. Patients with multiphasic disease and/or poor clinical outcome showed a significant reduction of NAA/Cho ( $p = 0.02$ ), and also a trend for an increase of Cho/Cr in NAWM versus patients with monophasic disease.

## Discussion

At presentation, brain lesions in ADEM primarily showed reduced NAA/Cr and NAA/Cho ratios, while Cho/Cr was within normal limits. This pattern seems to be consistent with lesions that primarily consist of vasogenic edema with neuronal/axonal dysfunction, rather than overt inflammatory demyelination (which is often accompanied by an increase in Cho in other pathologies). Brain involvement may be more extensive than suggested by conventional MRI, since NAWM also showed abnormal metabolism (low NAA/Cr). ADEM patients with recurrent disease or poor neurological outcome showed lower ratios of NAA/Cho (and a trend for increased Cho/Cr) compared to those with good outcome, suggesting a possible prognostic role for proton MRSI in ADEM.

## References

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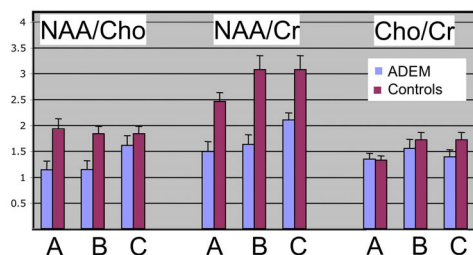


Figure 1. Metabolite ratios in ADEM and Control Subjects: (A) Basal Ganglia Lesions, (B) White Matter Lesions, (C) Normal Appearing White Matter

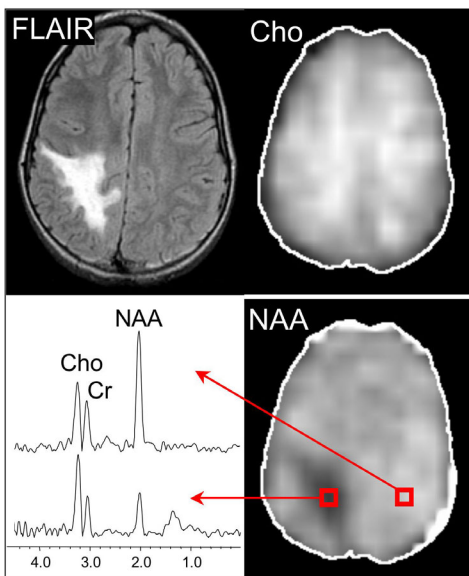


Figure 2. FLAIR MRI, metabolic images of Cho and NAA, and spectra from lesion and contralateral white matter in an ADEM case