Journal of Computer Assisted Tomography
26(5):818–820

Methylsulfonylmethane Observed by In Vivo Proton Magnetic Resonance Spectroscopy in a 5-Year-Old Child with Developmental Disorder: Effects of Dietary Supplementation

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Abstract: Proton magnetic resonance spectroscopy (MRS) revealed a distinct resonance at 3.15 ppm in the brain of a 5-year-old male diagnosed with autism. The resonance assignment is attributable to ingestion of methylsulfonylmethane (MSM) as a dietary supplement. Glucosamine with MSM is marketed as a source of dietary sulfur and treatment of joint pain. Recognition of this chemical on brain proton MRS as an exogenous compound is necessary to avoid confusion as a pathologic metabolite of pediatric metabolic disease. **Index Terms:** Magnetic resonance spectroscopy—Methylsulfonylmethane, health food supplements—Human brain metabolism.

INTRODUCTION

In the effort to improve the health of their children, parents of children with autism and pervasive developmental disorders often augment traditional therapies with supplementation of alternative or natural products. Proton magnetic resonance spectroscopy (MRS) demonstrates that some of these supplements can cross the blood–brain barrier and accumulate in the brain. Previous reports have confirmed the assignment of methylsulfonylmethane (MSM) to a singlet resonance appearing at 3.15 ppm between the creatine and choline singlets observed on in vivo proton MRS (1,2). The potential side effects in children of this accumulation are unknown.

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CASE REPORT

A 5-year-old male patient previously diagnosed with autism was evaluated with magnetic resonance imaging and spectroscopy (MRI and MRS) performed at 1.5 Tesla. The patient had an expressive and receptive language disorder at presentation. The MRI demonstrated slight asymmetry of the lateral ventricles, but the results were otherwise normal. Proton MRS was

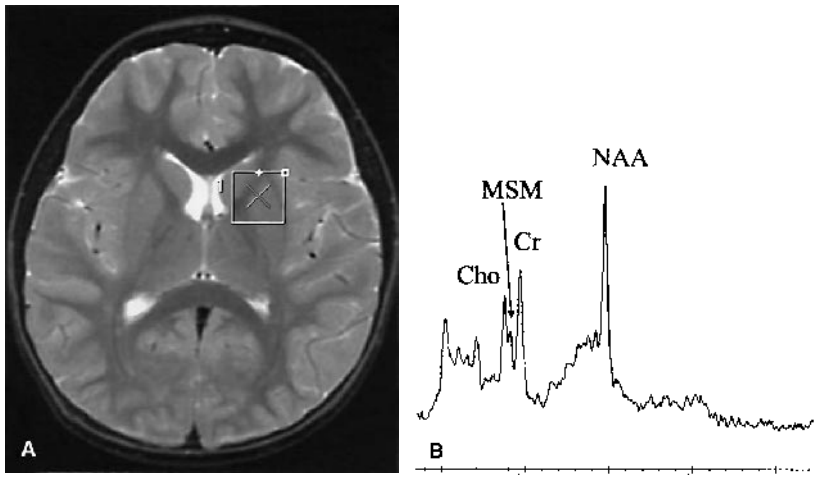

FIG. 1. A: A T2-weighted image demonstrating subtle ventricle size asymmetry and basal ganglia voxel placement for proton magnetic resonance spectroscopy (MRS). **B**: Proton MRS acquired at TE 35 milliseconds, TR 2000 milliseconds. Methylsulfonylmethane is noted at 3.15 ppm between the creatine (Cr) and choline (Cho) resonances.

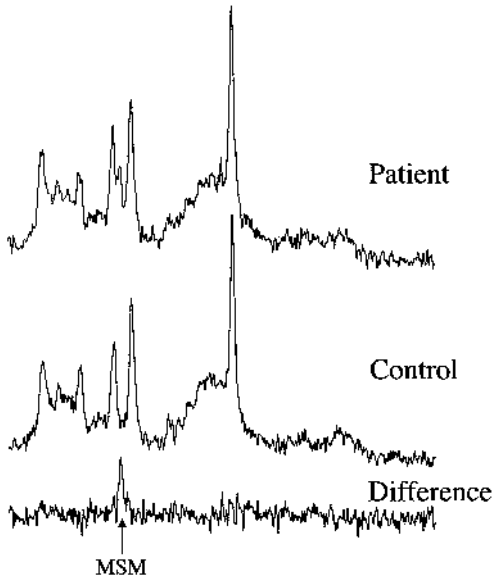

FIG. 2. Difference spectra, where a spectrum from the basal ganglia of a 5-year-old normal subject is subtracted from the patient's, demonstrate the methylsulfonylmethane resonance.

performed in two locations: (1) basal ganglia including caudate, putamen, and internal capsule; and (2) parietal white matter. A point resolved spectroscopy (PRESS) technique was used for the 8 mL voxels (echo times [TE], 35 and 288 milliseconds; repetition times [TR], 2000 milliseconds). A singlet at 3.15 ppm was identified in both locations (Figs. 1 and 3). Methylsulfonylmethane concentrations at each location were determined using a method similar to that previously described (1) with reported relaxation constants (MSM T1, 2180 milliseconds; T2, 385 milliseconds (2)). The concentration within the basal ganglia was determined to be 0.93 mM, and in the white matter, 1.24 mM. After determining the likely metabolite, confirmation of the dietary supplementation (MSM hypoallergenic powder, daily dose 1250 milligrams per day for approximately 1 year) was obtained from the patient's parents. The patient weighed 20 kg. In addition, the parents fed the child a pureed, gluten-free diet. The patient declined to eat solid food with a few exceptions. The parents had decided voluntarily to discontinue use of the supplement just before the magnetic resonance imaging and MRS; however, MSM within the prepared batches of supplements remained in use.

DISCUSSION

The identification of MSM in the brain with in vivo proton MRS has been reported in adult patients with Alzheimer's and healthy adult volunteers (1,2). This is the first report of a pediatric patient demonstrating elevated MSM on proton MRS examination.

Many novel therapies for autism are being proposed that include dietary restrictions and natural supplementation. Developmental disorders may be related to aberrant immune and inflammatory responses (3). Reports indicate that 40% to 60% of autistic individuals have either chronic diarrhea or constipation (4,5). Some patients are reported to have gastrointestinal (GI) pathologic features similar to that of celiac disease. With this potential pathologic similarity, increased intestinal permeability may allow the passage of toxic substances from the GI tract to the circulation (6). Gluten- or casein-free diets, or both, have been implemented to reduce autistic behaviors (7). Many parents have been advised to provide MSM as a source of dietary sulfur. Autistic children may demonstrate a deficiency of sulfates in their plasma (8). Methylsulfonylmethane is marketed as a safe, natural supplement. Methylsulfonylmethane or dimethylsulfone occurs naturally in the body at small concentration levels (3 uM (9)). A variety of beneficial effects have been attributed to MSM, including improving the immune system and reducing inflammation (3,8).

No adverse clinical, structural, or neurochemical effects were observed in the patient as a result of this

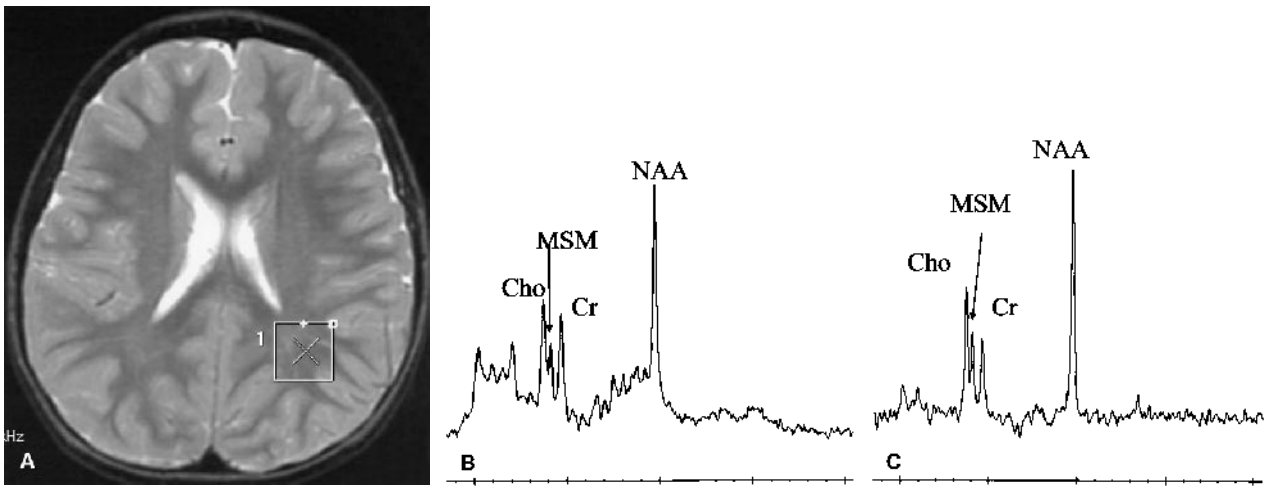

FIG. 3. A: A T2-weighted image demonstrating parietal white matter voxel placement for proton magnetic resonance spectroscopy (MRS). Proton MRS acquired with TR 2000 milliseconds at (**B**) TE 35 milliseconds and (**C**) TE 288 milliseconds. The improved resolution and spectral line widths within the white matter voxel enhance our recognition of methylsulfonylmethane.

supplement. However, significant concentrations in the human brain indicate the transfer of MSM across the intact blood–brain barrier. The effects of this supplement are unknown in children.

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