SPECIALTY AREA: Clinical Interpretation & Advanced Imaging

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TITLE: MRS in the Musculoskeletal System: Tumors & Other Muscluloskeletal Disorders

HIGHLIGHTS
1. MRS may be combined with anatomic and functional MRI sequences, to provide complementary information regarding musculoskeletal pathology.
2. MRS may be performed with qualititative or quantitative methodology.
3. MRS is sensitive to biochemical changes in metabolite content (of trimethylamines, creatine, lipid), even in the absence of signal abnormalities by conventional MRI
4. There are a number of applications for MRS, including the detection, characterization, and the assessment of severity and treatment response of musculoskeletal abnormalities.

TARGET AUDIENCE: Physicians and researchers interested in the imaging and work-up of musculoskeletal diseases.

OBJECTIVES: To understand the complementary information provided by MRS over other MRI sequences, and the potential applications of MRS for assessing musculoskeletal diseases, with a focus on musculoskeletal tumors and chronic muscle disorders.

PURPOSE: MRS is a non-invasive tool which can impact clinical care by detecting metabolic aberrations in tumors and otherwise normal-appearing musculoskeletal tissues (by conventional techniques), providing information for the characterization of disease, assessment of disease severity and evaluation of treatment response.

METHODS: A variety of MRS techniques have been developed for the assessment of musculoskeletal abnormalities, including heteronuclear MRS and proton MRS, qualitative and quantitative approaches, as well as single voxel and multivoxel methodologies.

RESULTS/DISCUSSION: While phosphorous MRS has been applied to the study of bone tumors, normal muscle physiology as well as various muscle disorders, proton MRS is more easily integrated into a routine clinical MRI scan than heteronuclear MRS, and allows better determination of lipid content. As such, proton MRS has been utilized for the assessment of lipid content aberrations in the muscles of patients with chronic pain and various chronic endocrinologic, neurologic and inflammatory disorders, and alterations to creatine and trimethylamine content have also been shown in the absence of signal abnormalities on conventional MRI.
        Proton MRS can be integrated into a routine clinical MRI exam of musculoskeletal tumors, and has been studied for the evaluation of tumors, particularly for the characterization of lesions in the de novo setting. Proton MRS has been noted for its high negative predictive value for ruling out malignancy and is also potentially useful for assessing treatment response and tumor heterogeneity.

CONCLUSION: As MRS methodologies are refined, standard clinical practice may incorporate MRS findings into treatment planning algorithms for patients with musculoskeletal tumors and chronic musculoskeletal disorders.

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