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ROLE OF MR SPECTROSCOPY IN MUSCULOSKELETAL IMAGING

Radiodiagnosis

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ABSTRACT

The aim of this study is to review the technical considerations for performing MRS in the musculoskeletal system, focusing on proton MRS, and to discuss its potential roles in musculoskeletal tumor imaging and the assessment of muscle physiology and disease. On the basis of the physiological composition of the cell magnetic field is generated and is measured on MR spectroscopy . MR spectroscopy can be used as a measure to diagnose the primary case as well as can be used to check the progress of the disease and the credibility of the disease treatment .

MATERIAL AND METHODS :- Clinical MRS was performed at 1.5T . MRS was performed with an intermediate TE of 130-150 ms Preliminary anatomic images are acquired for localization of the voxel, prior to the administration of intravenous contrast. For quantification purposes, water-suppressed in addition to water-un-suppressed scans are performed for the determination of metabolite concentration using a point-resolved single-voxel spectroscopy sequence. Proton MRS can be performed with either a single-voxel technique or a multi-voxel technique (MRSI). Advantages of MRSI include the ability to analyze the entire lesion and surrounding tissue, as well as the potential to analyze multiple lesions at once. The patient were referred form the orthopaedics OPD and were subjected MRI on advice by the orthopaedician . Patient has been explained about the procedure and the written consent has been taken for the same by explaining the patient in the language they understand.

KEYWORDS

INTRODUCTION :-

Musculoskeletal pathology can be evaluated with a variety of radiologic modalities including radiography, computed tomography (CT), ultrasound (USG), and magnetic resonance imaging (MRI) for morphologic and functional features, as well as with positron emission tomography (PET) for metabolic features. Magnetic resonance spectroscopy (MRS) has emerged as a method for assessing biochemical processes within the musculoskeletal system.Magnetic resonance spectroscopy (MRS) is an imaging approach that allows for the noninvasive molecular characterization of a region of interest. By detecting signals of water, lipids, and other metabolites, MRS can provide metabolic information for lesion characterization and assessment of treatment response. Although MRS has been routinely used in the brain, clinical applications within the musculoskeletal system have only more recently emerged. Different metabolites can be observed depending on the MRS technique. For example, with phosphorus-31 (^{31}P) MRS, signals from tissue metabolites containing phosphorus are examined, including phosphocreatine, inorganic phosphate, and ATP, which are all metabolites of interest in muscle physiology and disease.

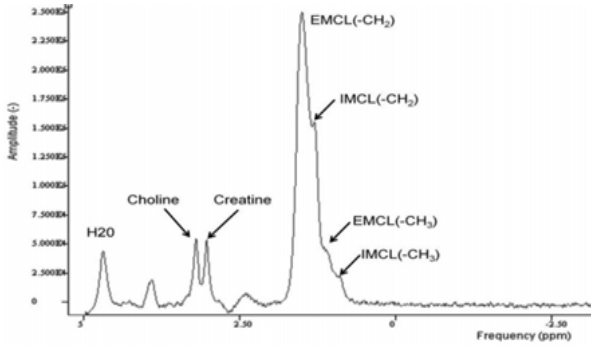

Figure 1. Graph demonstrates different molecular resonance frequencies for a variety of metabolites. The typical proton spectrum of normal muscle demonstrates frequencies corresponding to water, choline, creatine, and lipids. Total choline, a marker for malignancy, demonstrates a peak at 3.2 ppm. In addition, intramyocellular (IMCL) and extramyocellular (EMCL) lipid compartments are shown.

RESULTS:-

Here by we are discussing few of the cases of my study which has undergone MRI along with MRS and telling how it was useful to use MR spectroscopy in making in the final diagnosis

Case 1 A 36 year old man who presented with a spontaneous soft tissue mass in the thigh. Although a hematoma was suspected, the lack of history of trauma raised the possibility of a tumor. But MR spectroscopy shows no choline peak .Patient underwent biopsy and it comes out to be a Hematoma.

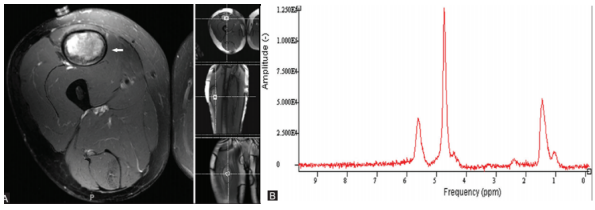

Figure 2. Axial fat-suppressed T2W image (A) shows the hyperintense mass. Proton MRS (B) no evidence of a discrete choline peak, suggesting benign etiology. The patient underwent a biopsy which showed no evidence of malignant cells, and then a follow-up which showed resolution of the hematoma.

Case 2:- An 11 year old male with history of neurofibromatosis type 1 presents with marked enlargement of the right sciatic nerve.

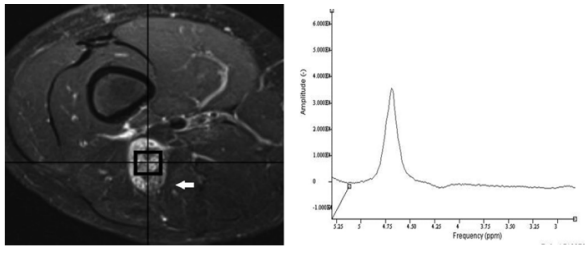

Figure 3 . Axial fat-suppressed T2W fast spin-echo MRI image (A) demonstrates a mass that was found to be a benign neurofibroma. Single-voxel proton MR spectroscopic map (B) no discernible choline peak at 3.2 ppm , compatible with a benign lesion.

Case 3 :_ An 81 year old female with pleomorphic rhabdomyosarcoma .Initial large size of the lesion corresponds with the high cholinepeak and after chemotherapy the size of the lesion decreases in the size as well as the choline peak decreased in size. Hence MR spectroscopy can be used as a modality to check the progress of the disease.

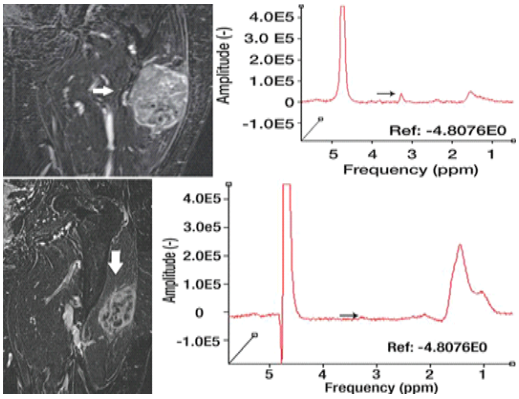

Figure 4. Coronal delayed contrast-enhanced MRI (A) and proton MRS (B) demonstrate an avidly enhancing mass with a discrete choline peak at 3.2 ppm. The patient was subsequently treated with chemotherapy. Post-treatment coronal delayed contrast-enhanced MRI (C) demonstrates substantially decreased enhancement within the lesion. Post-treatment proton MRS (D) demonstrates marked interval decrease of choline peak at 3.2 ppm, indicating chemotherapy-related tumor necrosis.

Case 4 :- A 31 year old male with high-grade osteosarcoma of the right thigh.

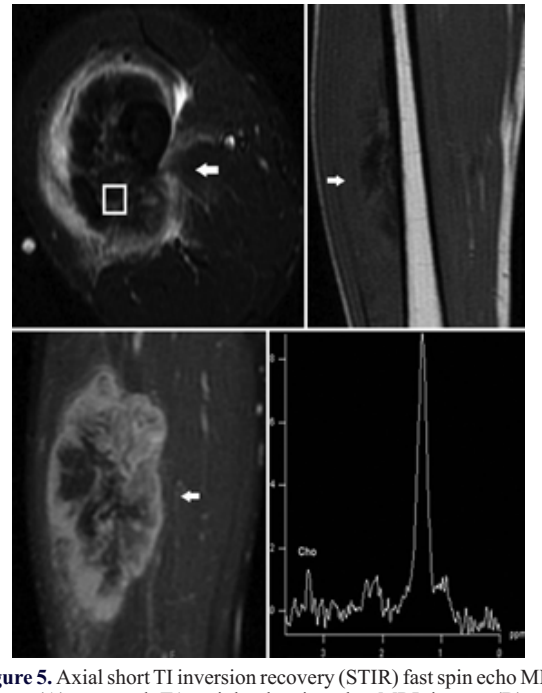

Figure 5. Axial short TI inversion recovery (STIR) fast spin echo MRI image (A), coronal T1-weighted spin-echo MRI image (B),and coronal fat-saturated dynamic contrast-enhanced fast spin-echo MRI image acquired 40 s after contrast injection (C) demonstrate a heterogeneous enhancing mass in the anterolateral right thigh with central areas of necrosis and surrounding edema. A single-voxel MR spectroscopic map (D) demonstrates a discrete choline peak at 3.2 ppm.

Case 5 :- A 28 year old woman with a soft tissue mass of the thigh.

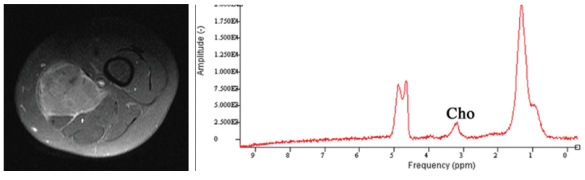

Figure 6. Axial T1W image following contrast administration (A) the large enhancing soft tissue mass. Proton MRS (B) a discrete choline peak within the mass indicating malignant histology, concordant with the eventual biopsy results (Ewings sarcoma)

CONCLUSION :

The evaluation of total choline content, in particular, has important implications for differentiating malignant and benign musculoskeletal lesions. The assessment of creatine content is important in studying muscle disorders, and the assessment of lipid content has demonstrated potential in the evaluation of bone marrow pathology as well as muscle physiology and disease.

However, further research is still needed to determine the reproducibility of MRS in the musculoskeletal system and definitively elucidate its clinical applications.

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