Role of advances magnetic resonance imaging sequences in multiple sclerosis

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Multiple sclerosis (MS) is a condition marked by an extensive spectrumof neurologic signs and symptoms, and is believed to be caused by anautoimmune attack on the myelin and axons of the central nervous system. Itis the most common cause of nontraumatic disability in individuals of youngand middle age. The clinical course of the disease can be highly variabledepending on the number and severity of relapses and degree of progression.It can present in different forms, such as, relapsing remitting (RRMS),secondary progressive (SPMS), primary progressive (PPMS) and progressiverelapsing (PRMS). Diagnosis is made from clinical signs and symptomsreferable to discrete areas of the central nervous system that are disseminatedin time and space , supported by paraclinical laboratory and radiological, inparticular MRI, findings.MRI, in addition to advanced approaches, including PET scanning, candetect a broad range of brain and spinal cord abnormalities from discreetlesions to subtle changes in normal appearing white matter (NAWM) andnormal appearing gray matter (NAGM). Although these techniques cannotstand alone in making the diagnosis of MS, they are key contributors to earlydetection and an understanding of the pathogenesis of the disease.Furthermore, it may be argued that neuroimaging plays the most importantrole in evaluating disease progression and the effects of various therapies byproviding an ongoing measure of burden of disease (eg, number of lesionsand degree of brain atrophy).Currently, conventional MRI, with and without Gd, is useful for theroutine diagnosis and evaluation of MS. It is highly sensitive toinflammation, although its specificity has limitations. Conventional MRI125(including T2-weighted images, T-1weighted images with and withoutgadolinium enhancement and fluid attenuated inversion recovery (FLAIR) isthe gold standard imaging technique for identification of demyelinatinglesions and it provide several markers of disease activity and evolutionincluding the number of gadolinium enhancing and new T2-hyperintense andT1-hypointense lesions. Lesions may be observed anywhere in the CNSwhite matter including the brain supratentorium and infratentorium, the brainstem and the spinal cord. However more typical locations include corpuscallosum and periventricular white matter. Typical MS lesions appear as T2and FLAIR hyperintesities, they have ovoid appearance with their largestaxis oriented perpendicular to the ventricular surface and several arise fromthe corpus callosum, this characteristic configuration has been demonstratedin the pathologic specimen and sometimes is referred to as “Dawsonfingers”. Also gray matter is

-known to be involved in MS but itsinvolvement has been hard to evaluate using c MRI because lesion contrastin gray matter is less dramatic than in white matter. One goal for futureapplications of conventional MRI is an improved capability to detect lesionsin gray matter.Although lesion number and location add sensitivity and specificity tothe diagnosis of MS, both subclinical disease activity (measured as newlesions on MRI in the absence of signs or symptoms) and non-radiologicdisease progression (clinical progression in the absence of new MRI lesions)are not uncommon. This phenomenon has become known as the ”clinicalimagingparadox” of MS. Furthermore, pathologic studies have clearlyidentified significant cortical demyelination and tissue injury, althoughconventional imaging studies have not demonstrated these abnormalities.These observations have led to the development of several advanced MRI126measures to identify better imaging correlates of MS disease-related injuryand progression.Advanced MRI methodologies, such as MT, MRS and DTI providefurther insight into tissue integrity and its disruption in MS; MTI and DTIreveal injury to NAWM. Continued perfection of these techniques as well asvolumetric MRI may provide a practical means of monitoring the efficacy ofvarious disease-modifying therapies for individual patients and in clinicaltrials. Finally, MRS and PET scanning, though dramatically differenttechniques, provide insights into the biochemistry of the nervous system andwhat goes wrong by tracking the behavior of various metabolites in the CNS.Finally Conventional magnetic resonance imaging techniques is highlysensitive in detecting multiple sclerosis plaques and provide a quantitativeassessment of inflammatory activity and lesion load. However, there is apersisting mismatch between clinical and magnetic resonance imagingefficacy, Advanced MRI sequences such as Proton Magnetic ResonanceSpectroscopy (1HMRS), Magnetization transfer imaging (MTI), Diffusionweightedimaging (DWI), Diffusion Tensor-MRI, Fiber Tractography &other are a non-invasive techniques that have improved our ability toquantify the pathological changes in MS, they also helps in:-Monitoring the Disability-Evaluating Occult Disease-Establishing a Prognosis-Monitoring the effects of Therapies.