Summary

Multiple sclerosis (MS) is a condition marked by an extensive spectrum of neurologic signs and symptoms, and is believed to be caused by an autoimmune attack on the myelin and axons of the central nervous system. It is the most common cause of nontraumatic disability in individuals of young and middle age. The clinical course of the disease can be highly variable depending 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 progressive relapsing (PRMS). Diagnosis is made from clinical signs and symptoms referable to discrete areas of the central nervous system that are disseminated in time and space , supported by paraclinical laboratory and radiological, in particular MRI, findings.

MRI, in addition to advanced approaches, including PET scanning, can detect a broad range of brain and spinal cord abnormalities from discreet lesions to subtle changes in normal appearing white matter (NAWM) and normal appearing gray matter (NAGM). Although these techniques cannot stand alone in making the diagnosis of MS, they are key contributors to early detection and an understanding of the pathogenesis of the disease. Furthermore, it may be argued that neuroimaging plays the most important role in evaluating disease progression and the effects of various therapies by providing an ongoing measure of burden of disease (eg, number of lesions and degree of brain atrophy).

Currently, conventional MRI, with and without Gd, is useful for the routine diagnosis and evaluation of MS. It is highly sensitive to inflammation, although its specificity has limitations. Conventional MRI

(including T2-weighted images, T-1weighted images with and without gadolinium enhancement and fluid attenuated inversion recovery (FLAIR) is the gold standard imaging technique for identification of demyelinating lesions and it provide several markers of disease activity and evolution including the number of gadolinium enhancing and new T2-hyperintense and T1-hypointense lesions. Lesions may be observed anywhere in the CNS white matter including the brain supratentorium and infratentorium, the brain stem and the spinal cord. However more typical locations include corpus callosum and periventricular white matter. Typical MS lesions appear as T2 and FLAIR hyperintesities, they have ovoid appearance with their largest axis oriented perpendicular to the ventricular surface and several arise from the corpus callosum, this characteristic configuration has been demonstrated in the pathologic specimen and sometimes is referred to as “Dawson fingers”. Also gray matter is known to be involved in MS but its involvement has been hard to evaluate using c-MRI because lesion contrast in gray matter is less dramatic than in white matter. One goal for future applications of conventional MRI is an improved capability to detect lesions in gray matter.

Although lesion number and location add sensitivity and specificity to the diagnosis of MS, both subclinical disease activity (measured as new lesions on MRI in the absence of signs or symptoms) and non-radiologic disease progression (clinical progression in the absence of new MRI lesions) are not uncommon. This phenomenon has become known as the "clinical-imaging paradox" of MS. Furthermore, pathologic studies have clearly identified significant cortical demyelination and tissue injury, although conventional imaging studies have not demonstrated these abnormalities. These observations have led to the development of several advanced MRI

measures to identify better imaging correlates of MS disease-related injury and progression.

Advanced MRI methodologies, such as MT, MRS and DTI provide further insight into tissue integrity and its disruption in MS; MTI and DTI reveal injury to NAWM. Continued perfection of these techniques as well as volumetric MRI may provide a practical means of monitoring the efficacy of various disease-modifying therapies for individual patients and in clinical trials. Finally, MRS and PET scanning, though dramatically different techniques, provide insights into the biochemistry of the nervous system and what goes wrong by tracking the behavior of various metabolites in the CNS.

Finally Conventional magnetic resonance imaging techniques is highly sensitive in detecting multiple sclerosis plaques and provide a quantitative assessment of inflammatory activity and lesion load. However, there is a persisting mismatch between clinical and magnetic resonance imaging efficacy, Advanced MRI sequences such as Proton Magnetic Resonance Spectroscopy (1HMRS), Magnetization transfer imaging (MTI), Diffusion-weighted imaging (DWI), Diffusion Tensor-MRI, Fiber Tractography & other are a non-invasive techniques that have improved our ability to quantify the pathological changes in MS, they also helps in:

-Monitoring the Disability

-Evaluating Occult Disease

-Establishing a Prognosis

-Monitoring the effects of Therapies.