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REVIEW PAPER

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The role of MRI in the central nervous system

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ABSTRACT

Introduction. Magnetic Resonance Imaging (MRI) has modified the practice of radiology. MRI is base on safe interaction between radiowaves at a particular frequency and hydrogen nuclei in the body. Metabolic encephalophaties are by definition those disorder of the central nervous system that are not due primarily to structural abnormalities.

Aim. Here we present the ^{1}H MRI and functional MRI (fMRI) method applied to diagnosis of disorders of the central nervous system.

Material and methods. Analysis of literature and self-research.

Results. We have discussed the major MRI applications in the characteristic of the central nervous system. The relationship beteen the motion of flowing blood and the representation of the blood on images is complex. This work is an introduction to the basic ideas and techniques of fMRI. Therefore, both, ^{1}H MRI and functional MRI, methods are ued in neuroscience.

Conclusion. Nonivasive MRI and functional MRI are daily diagnostics methods in neurology.

Keywords. ^{1}H MRI, functional MRI, metabolic brain disfunctions

Introduction

Magnetic Resonance Imaging (MRI) has modified the practice of radiology. MRI is base on safe interaction between radiowaves at a particular frequency and hydrogen nuclei in the body. Metabolic encephalophaties are by definition those disorder of the central nervous system that are not due primarily to structural abnormalities.

Fundamental applications of ^{1}H Magnetic Resonance Imaging in metabolic brain disfunctions are:

- in herpes simplex encephalitis
- in neurosacarcoidosis
- in Sjögren's syndrome
- in toxoplasmosis
- in isolated angiitis of the nervous system

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Participation of co-authors: A – Author of the concept and objectives of paper; B – collection of data; C – implementation of research; D – elaborate, analysis and interpretation of data; E – statistical analysis; F – preparation of a manuscript; G – working out the literature; H – obtaining funds

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In herpes simplex encephalitis

Cerebro spinal fluid (CSF) characteristically shows a lymphotic pleocytosis with mild or moderate elevation of protein and local normal glucose.[1] CSF analysis is a set of laboratory tests. CSF test includes visual observation of color and clarity, tests for glucose, protein, lactate, lactate dehydrogenase, red blood cell count and white blood cell count. Documentation of temporal lobe involvement may be obtained by ECG, radionuclide brain scan, computed tomography (CT) scan, or Magnetic Resonance Imaging (MRI). The role of each of these metabolities in the diagnosis of herpes simplex virus encephalitis is changing.[1] The ECG has been felt by the most consistently useful diagnostic modality early in the curse of infection. Radionuclide and CT scans should be used together since either test may be initially normal. The diagnostic accuracy of MRI as compared to radionuclide and CT has much greater clarity of morphologic details has been shown to provide elegant localizing informations in herps simplex encephalitis and in particular with gadolinium enhancement should provide earlier more precise localization of temporal lobe injury than can be achieved using CT.[1]

In neurosacarcoidosis

A brain CT scan can detect discreate brain mass lesions, multiple nodles hydrocephalus, diffuse inflammation and areas of periventricular white metter hypodensity.[2] CT scaning is helpful in monitoring disease activity as juged by the size of a mass lesion or the degree of enhancement of diffuse inflammation.[2] MRI is very sensitive in detecting of sarcoidosis and is good for evaluating the paraseller area, posterior fossa and spinal cord. MRI has demonstrated hypothalamic lesions not seen on CT scan and has revealed clinically unsuspected disease involving white matter in the periventricular white matter in the periventricular regions. Althought both CT scan and MRI scan easily demonstrated hydrocephalus, MRI can better define an obstructing lesion at the levelof cerebral aqueduct or fourth ventricle. Furthermore, MRI can access CSF flow at sites of possible obstructing lesion at the level of the cerebral aqueduct. MRI with contrast agent is the preferred technique for the evaluating sarcoidosis. Enhanced images frequently reval diffuse or focal leptomeningeal disease and can demonstrate iflamation. A normal enhanced MRI scan does not exclude the diagnosis of sarcoidosis. MRI angiography has little to contribute in sarcoidosis.[2]

In Sjögren's syndrome

Sjögren's syndrome is an autoimunne disease affecting lacrimal and salivary glands causing symptoms of xerophthalmia and xerostomia (sicca syndrome). Diagnosis is based on electencephalography and cerebrospinal fluid analysis are each abnormal in about two-thirds of patients with active central nervous system manifestation. MRI of the head has proved positive in 75 percent of cases with manifestations of Sjögren's syndrome.[3]

In toxoplasmosis

The lumbar puncture is not helpful in making the diagnosis of toxoplasmosis. The useful finding is a nonspecific lymphocytic pleocytosis. Imaging of the brain with CT is the most useful test for toxoplasmosis.[4] MRI appears to be more sensitive than for demonstrating the lesions o f cerebral toxoplasmosis.

In isolated angiitis of the nervous system

CT and MRI show multiple lesions in both gray and white matter. Normal results of any of the above tests can be suggestive of angiitis and exclude more common explanations for central nervous system. Angigraphic findings in cerebral artretis are classically described as intermittet narrowing and dilatation of blood vessels.[5] Angiitis confined to small vessels has been found at postmortem in case with normal angiography.

Functional Magnetic Resonance Imaging

The field of functional magnetic resonance (fMRI) has extended enormously since mid-1990 and is dominated by basic neuroscience.[6-11] FMRI is very interdyscipinary and is providing the area to study a detailed map of the brain activation.[11-15] The possibility of measuring changes in brain blood flow associated with neural activity in the brain was known from 1998. FMRI results depend from blood volume. ach dot of light on the fMRI, the voxel (the pixel of fMRI screens), captures blood flow in the region of approximately 80,000 neurons and more than 4 million synapses.[15-24] This dot of light on the screen is the average measurement of activity over one second in this region. However, neuronal signaling occurs a thousand times faster, in the milliseconds. [24-34]

Conclusion

MRI is used in practically the entire body. However, technological advances enable this technique to be applied in neuroscience.

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