Symposium I

Diagnosis of cerebral function disorders
——NMR-CT, SPECT, PET——

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DIAGNOSIS OF CEREBRAL DYSFUNCTION USING MR IMAGING

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The brain is particularly obedient to imaging with magnetic resonance.A high level of gray-white matter contrast is available providing anatomic detail not demonstrated with other techniques.Coronal and sagital images of the brain can be obtained and unlike X-CT,artifact from the bone surrounding the posterior fossa is not a problem.

The MR studies wereperformed using an imager based on 0.26 Tesla superconducting magnet,with a useful aperture of 30 cm, which is the aperture of the head coil. Slice thickness is 10 mm.Spin-echo(SE;TR= 1500-2000 msec.TE=40-120msec.)and Inversion-recovery(IR;TR=2080msec.TI=500 msec.TE=40msec.)techniques were used in most patients.

The diagnostic entities in 162 patients are detailed in the following.

Brain tumors 54 Vascular disease 35
Cerebral trauma 4 Subdursl hemorrhage 3
Multiple sclerosis 5 Epilepsy 20
Other disease 41

In case of infarction,IR images displayed a well defined region of loss of gray-white matter contrast with a long Tl value.SE scans displayed area of increased T2 corresponding in position to the lesion seen with IR images.It is possible to see if the infarcted areas reached white matter.

In case of occipital or temporal lobe infarction,homonymous hemianopsia is seen. That are neuron fiber damage in white matter.Then,we thirc that it is able to determine the optic neuron fiber tract by many infarcted patients using MR imaging. By the same method,we recognised that damaged area of white matter overlaped at very small area in three agraphic patients.We belive it is able to diagnose cerebral dysfunction using MR imaging.

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NUCLEAR MAGNETIC RESONANCE COMPUTED TOMOGRAPHY IN THE FUNCTIONAL DISORDERS OF THE BRAIN.

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In Japan nuclear magnetic resonance computed tomography (NMR-CT) has been able to utilize clinically for three years. During this time resistive type units were mainly used at some hospitals and institutes, and clinically utilities of NMR-CT in the organic disorders of the central nervous system had been reported. However as regards the functional disorders of the brain NMR-CT has not yet been evaluated sufficiently and we cannot expect its abilities, because NMR-CT is still in its early stage of the development.

IN such circumstances we evaluated the clinical utilities of NMR-CT in diagnosing the functional disorders of the brain. For this purpose we chose sixteen patients who had been clinically diagnosed arteriovenous malformations (AVM) in 6, occlusions of middle cerebral aa. and Moya Moya diseases and encephalitises in 2 each, and thrombosis of the cortical vv. and multiple sclerosis and dysmyelinationary disease and lipidosis in 1 each. NMR images of them were obtained by Magnetom using a superconducting magnet (0.35T) operating at a proton resonance frequency of 15 MHz. Spin echo sequences (TR/TE:400/35,70;1600/35,70) were mainly used and inversion recovery sequences were used according to the need. T_1 or T_2 calculated images were obtained by two spin echo images with different repetition times(TR) or echo times(TE) respective respectively.

Most valuable advantages of NMR-CT in diagnosing the functional disorders of the brain were high contrast resolution among the soft tissues and high sensitivities to the histological changes. For those reasons white matter and gray matter of th brain could be easily distinguished and extent of the cerebral edema, degree of the cerebral atrophy, disorders of the white matter such as dysmyelinationary disease, multiple sclerosis, deep white matter infarcts, subcortical arteriosclerotic encephalopathy, or various forms of hydrocephalus were more clearly demonstrated by NMR-CT than X-X-CT. Extent of the ischemic area around AVM and affected area due to encephalitis were also demonstrated more exactly by NMR-CT than X-CT. Most useful imaging method among the pulse sequences that we performed was T_2 weighted spin echo imaging (TR/TE: 1600/70msec) on which images most lesions with long T_1 and T_2 relaxation times were seen as high intensity area compared with those of the normal cerebral parenchyma and cerebrospinal fluid.

On the other hand disadvantage of NMR-CT was the fact that at present it was difficult for NMR-CT to provide any information about metabolism, tissue perfusion, and neuroreceptors, because only static proton images were now obtainable. In the future it will be possible to provide such information by usung not only ^1H-1 but also C-13, F-19, Na-23, P-31, and so on.

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