Introduction

Cerebral proton MRS has demonstrated its usefulness in many encephalopathies since the beginning of the 1990s. Apart from HIV-related encephalopathy which constitutes the main proton MRS application in viral brain infections, few literature data are available on other types of viral brain infections. This study describes brain metabolic anomalies in relation with HIV-related encephalopathy, progressive multifocal leukoencephalopathy, herpes encephalitis and subacute sclerosing panencephalitis (SSPE).

Methods

Magnetic resonance studies were conducted on a Siemens Magnetom SP63 (Erlangen, Germany) equipped with a 1.5 T magnet at the Timone Hospital in Marseille. Single-voxel proton MR spectroscopy was performed at 63 MHz immediately after standard imaging using the STEAM (stimulated echo acquisition mode) sequence (TE: 20 ms, TR: 1500 ms). A spectrum was acquired in 256 scans. The volume of interest (VOI = 2 cm x 2 cm x 2 cm) was always located in the parieto-occipital in AIDS patients, in the temporal area in the patient with herpes encephalitis and both in parieto occipital and frontal areas in the patient with SSPE.

Results and discussion

HIV-related encephalopathy

The encephalopathy induced by the human immunodeficiency virus (HIV) has been extensively described in the literature. HIV is a neurotropic virus and enters the CNS at the onset of the infection via an alteration of the blood-brain barrier and/or via infected macrophages (trojan horse hypothesis). Only macrophages and microglia are infected by the virus. Interactions between microglia and astrocytes play a central role in the extent of the cerebral infection, inducing the synthesis of cytokines responsible of demyelination and neuronal suffering and neuronal death. The NAA signal is generally decreased and the choline resonance is increased on short echo time spectra. Myo-inositol signal is also often increased on short echo time spectra (1, 2). These metabolic anomalies occur before the onset of clinical dementia (dementia complex), and can be reverted by antiretroviral treatment.

Interestingly, the brain spectra of HIV contaminated children are characterized by an additional abnormal signal of lipids, even in the absence of progressive encephalopathy.

Progressive multifocal leukoencephalopathy

Progressive multifocal leukoencephalopathy (PML) is a demyelinating infection of CNS which is frequently observed, is generally related to the clinical status. In many cases, inflammation and demyelination (increase in choline) are present. Glial activation (increase in myo-inositol) is also observed. When lesions are severe, lipids and lactate signals appear on the spectrum. MR spectroscopy of the brain allows not only to document the severity of various brain viral infections, but also to evaluate the brain metabolic consequences of the long term sequellae of such infectious diseases.

Conclusion

In viral infections of the brain, metabolic impairment is always observed. The extent of the reduction in NAA, which is frequently observed, is generally related to the clinical status. In many cases, inflammation and demyelination (increase in choline) are present. Glial activation (increase in myo-inositol) is also observed. When lesions are severe, lipids and lactate signals appear on the spectrum. MR spectroscopy of the brain allows not only to document the severity of various brain viral infections, but also to evaluate the brain metabolic consequences of the long term sequelae of such infectious diseases.

References


Acknowledgements

This work is supported by CNRS (UMR 6612), AP-HM (Assistance Publique des Hôpitaux de Marseille), SIDACTION, ANRS, and the Programme Hospitalier de Recherche Clinique (Ministère de la Santé).