

Regional Assessment of Neurochemical Pathology by Magnetic Resonance Spectroscopy in Schizophrenia

S. Erfan, Y. Ragab, and F. Zeinhom

ABSTRACT

Studies with proton magnetic resonance spectroscopy (1H-MRS) have reported abnormalities in N-acetyl aspartate (NAA) and choline (Cho) to creatine plus phosphocreatine (Cr) ratios associated with schizophrenia. Objectives: are to study the metabolites NAA, Cho and Cr in order to test a neurodegenerative hypothesis in schizophrenia (decrease of NAA; increase of Cho), and to examine the relations of these metabolites to clinical variables. Method: 1H MRS was performed in 25 schizophrenic patients and 20 ages matched healthy subjects in the three cerebral areas highly involved in path physiology of schizophrenia (the prefrontal cortex, thalamus, and the hippocampus). The ratio amplitudes between metabolites and creatine (Cr) were determined. A scale for positive and negative symptoms (PANSS) was applied in addition to a semi structured interview that covers demographic and clinical data. Results: upon comparison with healthy subjects NAA/Cr was significant lower in the hippocampal region bilaterally and in the left prefrontal cortex. NAA/Cho was significantly lower in the hippocampal region bilaterally, and in the left thalamic region. There was no relationship between the metabolites and duration of illness, age of onset, family history, and medication status or symptom severity. NAA/Cr was significantly higher in the left hippocampal region of drug naive schizophrenic patients, NAA/Cr and NAA/ Cho were significantly higher in the left prefrontal region of paranoid schizophrenics. Conclusion: the reduced NAA/Cr might suggest a neurodegenerative process in the prefrontal and hippocampal regions of schizophrenic patients.

Abbreviations

NAA: N-Acetyl Aspartate; **Cho:** Choline; **Cr:** Creatine plus phosphocreatine; **1H-MRS:** Proton Magnetic Resonance Spectroscopy; **PANSS:** Positive and Negative Symptom Scale

Introduction

Neuropathological and neuroimaging studies provided evidence of alteration of cerebral structures in schizophrenia, but the nature of the neurobiological process that could be at origin of schizophrenic symptoms is still unknown. A neurodegenerative process could be investigated with 1H-MRS, which is commonly used to measure NAA, ml, Cho and Cr. NAA the most prominent peak in the proton spectrum other than water, is found largely, if not entirely within neurons (Urenjak et al. 1993) it reflects the number and viability of neurons or axons. Cho signal reflects brain choline stores, with major contributions from glycerophosphocholine and phosphocholine (Barker et al. 1994). The Cr signal measures both creatine and phosphocreatine, metabolites involved in cellular energy metabolism.

Magnetic resonance spectroscopy is one of the

most important tools for qualitative analysis of chemical composition and structure, and its non-invasive technique is now being applied in vivo to study biochemical processes in those neuropsychiatric disorders that are part of the phospholipids spectrum. (Cox and Puri, 2004). It is an extraordinary useful advance in neuroimaging technology and one that will undoubtedly have many clinical uses in the near future (Malhi et al., 2002). Up till now, most 1H-MRS Studies have focused on NAA in schizophrenia and have led to inconsistent results. Several studies (Maier 1995; Yuegelun-Todd et al. 1996), have reported a decrease of NAA/Cr in the temporal lobes of chronic treated schizophrenic patients.

This reduction of NAA/Cr was present in first episode patients (Renshaw et al. 1995; Cecil et al. 1999). In the dorsolateral prefrontal cortex,