An in vivo proton magnetic resonance spectroscopy study of brain metabolism in early-onset Parkinson's disease.

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Synopsis

Early-onset Parkinson's disease (EOPD) is a disorder genetically heterogenoeus, defined as Parkinson's disease (PD) beginning before the age of 50. The role of magnetic resonance spectroscopy in the differential diagnosis of parkinsonian syndromes is well recognized, although ^{1}H-MRS studies of PD patients have so far given controversial results. For the first time we used ^{1}H-MRS to study brain metabolism in nine idiopathic EOPD patients. EOPD patients showed a significant reduction in NAA to Cr ratio in both basal ganglia and cortex.

Introduction

In vivo magnetic resonance spectroscopy (^{1}H-MRS) has been mainly utilized to study basal ganglia metabolism in idiopathic Parkinson's disease (IPD) and other parkinsonian syndromes, such as multiple system atrophy, progressive supranuclear palsy, corticobasal degeneration (1). Results from MRS studies comparing IPD patients and control subjects are controversial (2). Dementia and mild cognitive impairment are common feature of IPD and a previous ^{1}H -MRS study demonstrated a significant temporo-parietal cortex reductions in NAA not only in demented IPD but also in non-demented patients. Early-onset Parkinson's disease (EOPD) is a disorder genetically heterogenoeus, defined as PD beginning before the age of 50. To our knowledge, this is the first ^{1}H-MRS study performed to assess the cerebral metabolism in the lentiform nucleus and cortex in idiopathic EOPD patients.

Methods

Nine idiopathic EOPD patients (5 males) and 9 sex- and age-matched healthy volunteers were recruited. The patients were diagnosed using UPDRS (Unified Parkinson's disease Rating scale) criteria, mean age at onset was 41 (range 32-48 yrs), mean duration of disease was 8 (range 1-21 yrs). Single-voxel ^{1}H-MRS was performed in a 1.5T General Electrics Medical Systems (Milwaukee, Wisconsin) Signa Horizon LX whole-body scanner using a 25cm diameter quadrature birdcage head coil. MRI study included coronal STIR images (slice thickness=5 mm, slice gap=6 mm, TE= 8.5 ms, TR=5000 ms, matrix=512x512, FOV=24x24 cm) axial FLAIR images (slice thickness=5 mm, slice gap=6 mm, TE= 85 ms, TR=8002 ms, matrix=256x256, FOV=24x24 cm). Volumes of interest were placed in the lentiform nucleus (volume ranging from 3.2 to 3.4 cm^3) and spectra were acquired using the PRESS single voxel localisation sequence (TE= 40 ms, TR= 1500 ms, number of acquisitions= 256) (figure 1) and in the mid-line parietal-occipital grey matter (volume=18 cm^3, TE= 35 ms; TR= 4000 ms; number of acquisitions= 32). Peak areas for NAA at 2.02 ppm, for creatine-phosphocreatine (Cr) at 3.03 ppm, for choline (Cho) at 3.22 ppm and for myo-inositol (mI) at 3.56 ppm were calculated using the time domain-fitting program AMARES/MRUI (htpp://carbon.uab.es/mrui). Peak integral values were expressed relative to the Cr peak. Statistical significance, determined by Student's unpaired *t* test, was taken as $p<0.05$.

Results

Cortical NAA/Cr (1.37±0.08, mean±SD) in EOPD patients was significantly lower than in healthy volunteers (1.45±0.06; p<0.05) (figure 2). EOPD patients also showed a significant reduction of NAA/Cr in the lentiform nucleus (1.17±0.14) compared to controls (1.37±0.17; p<0.05). In both brain localization Cho/Cr and mI/Cr were similar in patients and controls (data not shown).

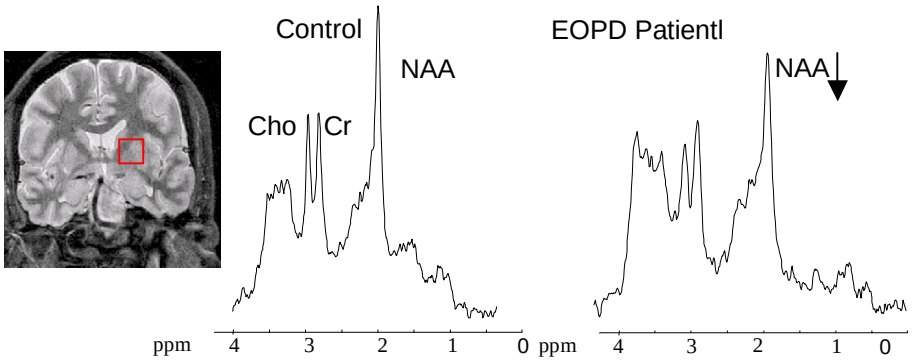

Figure 1. *Left*: Coronal STIR images showing basal ganglia localitation.
Centre and right: ^{1}H-MRS spectra from a healthy volunteer and a EOPD patient.

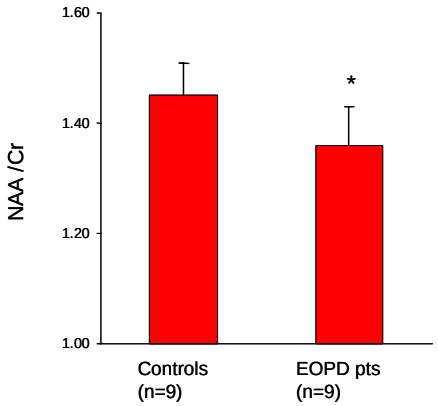

Figure 2. Mean cortical NAA/Cr in controls and EOPD patients.* $p<0.05$

Discussion

Our results show a reduction of basal ganglia NAA/Cr in patients with idiopathic EOPD, consistent with neuronal loss related to known degenerative alterations described in theese structures. The reduction of cortical NAA indicates the presence of sub-clinical cortical dysfunction and a full neuropsycological evaluation of these patients is under way. Further larger scale and longitudinal ^{1}H-MRS studies of EOPD patients will clarify the physiopathological and diagnostic relevance of these brain metabolic abnormalities.

References

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