Proton Magnetic Resonance Spectroscopic Imaging in Obsessive-Compulsive Disorder: Differences betweenTreatment Tesponders and Non-Responders

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Introduction

Obsessive-compulsive disorder (OCD) is characterized by the inability to suppress repetitive, intrusive thoughts and/or the performance of repetitive actions. Lifetime prevalence is estimated at 2.5%. Clinical and neuroimaging studies suggest the involvement of the orbitofrontal-basal ganglia-thalamic pathway in the pathology of OCD (1). In spite of good results in the treatment of OCD patients with selective serotonin reuptake inhibiting (SSRI) antidepressants, 20% to 40% of the patients show only minimal or no symptomatic improvement. This study used proton magnetic resonance spectroscopic imaging (MRSI) to investigate brain metabolism in OCD, and to is different between OCD patients who do or do not respond to therapy.

Materials and Methods

All scans were performed on a Philips Intera 1.5 Tesla. Routine brain MRI and multi-slice proton MRSI were performed. The MRSI scan consisted of 3 slices (15 mm thick) recorded with a spin-echo sequence, frequency-selective water suppression and outer-volume lipid suppression pulses (2). Scan parameters were TR/TE 1900/280 msec, 24 cm FOV using 28 x 28 circular phase-encoding scheme, nominal voxel size 1.1 cm^3, MRSI acquisition time 20 min. Peak areas were determined by integration and metabolite ratios calculated for thalamus, basal ganglia, dorsolateral prefrontal cortex (DLPFC), insular cortex, centrum semiovale, frontal and parietal cortex.

Patients suffering of OCD for at least one year, without other comorbidity, their diagnosis confirmed by the structured clinical interview (SCID) for DSM-IV, were recruited. They were between the age of 18 and 55 years, physically healthy right handed (3) and free of medical illness, including tics and soft neurological signs. Responders improved significantly on pharmacotherapy and rated on the Yale-Brown obsessive-compulsive scale (YBOCS) below 10. Non-responders failed at least two clinically adequate drug treatments, having had sufficient length and doses of medications, and their YBOCS decreased less than 30% from the time they felt the “worst”. The study group consisted of 10 normal control subjects (4 men, age 35.6±10.9 years) and 10 OCD subjects (4 men, age 36.9 ±4.2). Of the OCD cases 5 were responders (37.8±14.7 years) and 5 non-responders (34.8±11.7 years). While all patients were on SSRIs, previous studies have not indicated any change in NAA associated with treatment (4, 5). Between group comparisons were performed using students T-test, with correction for multiple comparisons. The level of significance was set at $P < 0.05$.

Results

Table 1 shows the NAA/Cho ratios for the selected brain regions for all 3 subjects groups (controls, responders and non-responders).

Region	Responders: Mean (St.Dev.)	Non-Responders: Mean (St.Dev.)	Controls: Mean (St.Dev.)
Thalamus	1.31 (0.39)	1.98 (0.54)	1.38 (0.35)
Insular Cortex	1.47 (0.28)	1.72 (0.39)	1.67 (0.37)
Basal Ganglia	1.59 (0.30)	1.96 (0.39)	1.44 (0.23)
DLPFC	1.88 (0.34)	1.99 (0.78)	2.03 (0.45)
Centrum Semiovale	1.52 (0.22)	1.71 (0.26)	1.74 (0.35)
Frontal Cortical GM	2.21 (0.66)	2.13 (0.61)	1.85 (0.43)
Parietal GM	2.00 (0.66)	2.15 (1.03)	1.85 (0.31)

Significantly higher levels of NAA/Cho and were found in the thalamus for non-responders compared to both controls ($P < 0.0001$) and responders ($P < 0.0002$). NAA/Cho was also higher in the basal ganglia in non-responders ($P < 0.0001$ and < 0.01, non-responders vs. controls and responders, respectively). Thalamic ($P < 0.05$) and basal ganglia ($P < 0.01$) NAA/Cr ratios were also significantly higher ($P < 0.05$) in non-responders compared to controls. Thalamic and basal ganglia Cho/Cr ratios were not significantly different between groups. No group differences were found between responders and controls, with the exception of NAA/Cr levels in the insular cortex, which was lower in responders ($P < 0.0001$).

Discussion

Our results are consistent with involvement of basal ganglia and thalamic regions in OCD. Interestingly, these changes were found in non-responders, both compared to controls and responders, with apparently increased levels of NAA. Increased NAA has been previously reported in the DLPFC of treatment naïve pediatric OCD patients (6), which was interpreted as possibly representing neuronal hypertrophy or hyperplasia, and/or abnormal neuronal pruning. These findings, if replicated in a larger study group, may indicate a role for proton spectroscopy in predicting treatment response in OCD, and improve the understanding of the underlying etiology.

References

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