

## A $^1\text{H}$ magnetic resonance spectroscopy study in adults with obsessive compulsive disorder: Relationship between metabolite concentrations and symptom severity

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### Introduction:

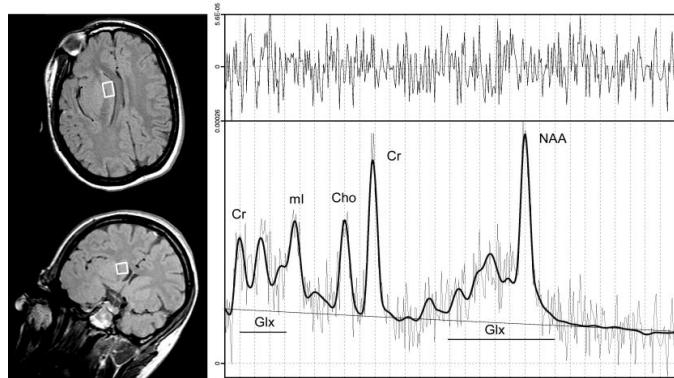
$^1\text{H}$  MRS studies exploring brain metabolites, especially glutamine+glutamate (Glx), in obsessive compulsive disorder (OCD) are of vital interest for trying to understand more about the pathophysiology of OCD. Aim of this study: 1) to compare MRS metabolites in three different localizations in a group of adult patients with OCD and a group of healthy controls, and 2) to examine the relationship between MRS metabolite concentrations and symptom severity in the patient group.

### Material and Methods:

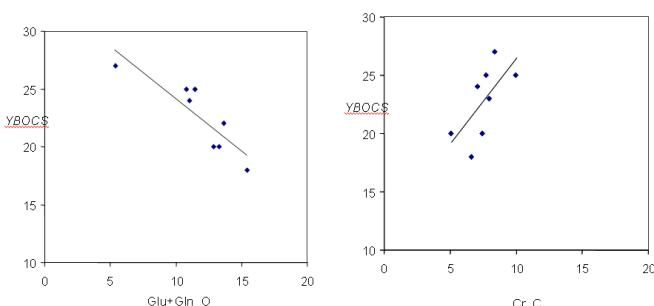
**Subjects:** 9 patients (YBOCS 18-27, i.e. moderate to severe OCD) and 16 healthy controls, all aged between 20 and 54. The study was approved by the Ethical Review Board at Göteborg University. **MR system:** Philips Gyroscan Intera 1.5 T release 9 and 11, with the T/R head birdcage coil (Philips, Eindhoven, the Netherlands). **MRI:** survey scan, sagittal, coronal (both 3D T1W TFE), transaxial (2D PDW TSE) and two double oblique scans showing a longaxis and a shortaxis of the right caudate nucleus (both 2D PDW TSE). **MRS:** PRESS, TE = 30 ms, TR = 2000 ms, WS = excitation (i.e. CHESS) and n=256 averages. Three brain regions were studied with MRS, the caudate nucleus (VOI 1.5 cm<sup>3</sup>) (fig 1), the anterior gyrus cinguli (VOI typically 3.6 cm<sup>3</sup>) and the occipital cortex (VOI ca 4.0 cm<sup>3</sup>). Maximum examination time: 90 minutes. 24 MRS examinations were fully performed. 72 spectra were collected; five were discarded due to movement during the examination, or due to unsatisfactory spectrum quality. **MRS quantification:** LC Model, software v. 6.1 **Statistics:** multivariate analysis including principal component analysis (PCA) and partial least square projection to latent structures (PLS).

### Results and discussion:

PCA did not reveal any tendencies for a separation between the patients with OCD and controls with respect to MRS metabolites. However, PLS disclosed a strong relationship between several of the metabolites and OCD symptom severity: it was found to be positively correlated to caudate Cr, Glx, Glu and Cho compounds as well as occipital cortex mI, and negatively correlated to occipital cortex Glx. The positive correlation between caudate Glx and creatine vs YBOCS did not surprise us, since hyperactivity has been reported in this region in several functional brain imaging studies in OCD (Rosenberg 2000). The strong negative correlation between occipital Glx and YBOCS was unexpected, given that the occipital cortex is usually not thought to be involved in OCD. However, there are reports pointing in a different direction, for instance, decreased metabolic activity in the left parieto-occipital region have been reported using PET (Nordahl 1989, Kwon 2003) and MEG (Ciesielski 2005).



**Fig. 1.** Typical  $^1\text{H}$  MR spectrum and MRS volume placement in right caudate nucleus in double oblique images. Lower right pane: Thick black line = fitted spectrum, thin line = acquired data, smooth thin line = baseline. Upper right pane: Difference between fitted spectrum and acquired data.



**Fig. 2.** Correlations vs YBOCS of the two MRS variables most distant to origo as observed in the PLS analysis; the occipital cortex Glx ( $r = -0.883$ ) and caudate nucleus Cr ( $r = 0.665$ ).

### References:

Rosenberg DR, J Am Acad Child Adolesc Psychiatry 39:1096-103, 2000;  
Nordahl TE, Neuropsychopharmacology. 2:23-8, 1989;  
Kwon JS, Psychiatry Res 122:37-47, 2003;  
Ciesielski KT, Neuroimage. 24:1180-91, 2005

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