

Proton spectroscopy of the corpus callosum in healthy controls: Detecting microstructural differences along the mid-sagittal length

E. Wignall¹, P. D. Griffiths¹, P. Greenwood¹, I. D. Wilkinson¹

¹University of Sheffield, Sheffield, South Yorkshire, United Kingdom

Introduction: MR Spectroscopy is often used to look at the integrity of brain parenchyma in white matter diseases, including areas such as the corpus callosum. There are however, few studies on the structure of the callosum in healthy controls. Histological studies show that the callosum differs across its midsagittal length, both in fibre type and density. The anterior of the callosum (genu) is comprised of small diameter fibres (less than 2 μ m), and the posterior (splenium) larger diameter fibres (between 2 and 5 μ m). In males fibre density is lower in the splenium than in the genu. This study used localised proton spectroscopy to see if any of the metabolites showed anatomical differences related to microstructure between the anterior and posterior of the callosum in healthy subjects.

Methods: Two single voxel (1.5x1.5x1cm) spectra were acquired in 10 healthy males (age range 24-36 yrs) at 1.5T (Infinion, Philips Medical Systems), using a PRESS technique (TR=1600ms, TE=135ms, Averages=256). One voxel was placed in the anterior of the callosum (genu), and one in the posterior of the callosum (splenium). The area under the three main metabolite resonances was calculated, using manufacturer's software, giving the following outcome measures: NAA/Cho, NAA/Cr and Cho/Cr ratios.

Results: There were significant differences in both NAA/Cho and NAA/Cr ratios between the anterior and posterior regions ($p < 0.01$), with the ratios being greater in the posterior portion. No significant difference was found in mean Cho/Cr (see fig 1 below).

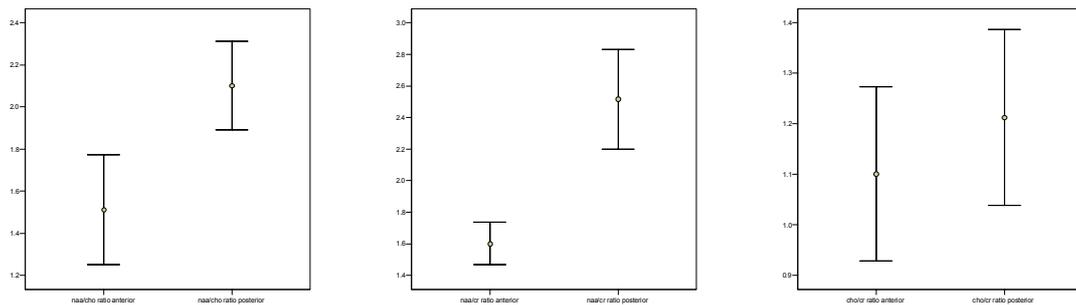


Fig. 1a NAA/Cho ratio from anterior and posterior regions (error bars indicate 95% confidence intervals from the means)

Fig. 1b NAA/Cr ratio from anterior and posterior regions (error bars indicate 95% confidence intervals from the means)

Fig. 1c Cho/Cr ratio from anterior and posterior regions (error bars indicate 95% confidence intervals from the means)

Discussion: MR spectroscopy can be used to distinguish between the genu and the splenium of the corpus callosum in healthy controls. It is most likely that this is due to variation in the NAA in the splenium as there was no difference between Cho/Cr ratios of the genu and splenium. This would imply greater NAA signal in the splenium, however, the density of fibres in the splenium is lower than that of the genu and these findings may reflect changes in metabolite T2 associated with such a difference in density.