

# Characterization of cerebral white matter in preterm infants at term equivalent age using ADC, fractional anisotropy and T2

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**Background:** Diffuse periventricular white matter injury (PWMI) is the major form of brain injury in survivors of premature birth. The importance of detecting high risk preterm infants at term equivalent age who would most benefit from early interventional therapies has been recognised recently; furthermore, as neuro-protective therapies may soon be possible in the preterm, the development and validation of robust biomarkers will be essential.

**Aims:** To compare MRI apparent diffusion coefficient (ADC), fractional anisotropy (FA) and T2 in cerebral white matter in preterm infants at term equivalent age

**Methods:** 42 preterm infants with a median (range) gestational age (GA) at birth of 27 (23-32) weeks were scanned at a corrected GA of 39 (38-42) weeks on a Siemens Avanto 1.5T MR scanner using the Siemens CP extremity coil. A paediatric neuroradiologist assessed the T2 weighted images and divided the preterm infants in two groups: group 1, normal white matter signal intensity on T2 weighted images; group 2, diffuse excessive high white matter signal intensity (DEHSI) (Maalouf, Duggan et al. 1999). T2 relaxometry was acquired using the manufacturer's EPI SE sequence (TE = 89 and 200ms; 23 axial slices; FOV 210mm x 157.5mm, data matrix 128x96). Diffusion weighted imaging (DWI) and diffusion tensor images were obtained with the manufacturer's double spin echo EPI sequence [Heid 2000] (TR/TE=4200/118ms, 23 3mm axial slices; FOV 230mm x 172.5mm; data matrix 128 x 96; bandwidth 1260Hz/pixel, 3 averages, 6 directions, b 0 s/mm<sup>2</sup> and 600 s/mm<sup>2</sup>). T2 (ms), ADC (10<sup>-3</sup>mm<sup>2</sup>/s) and FA were measured in regions of interest of predefined size, which were drawn in the frontal (FWM), central (CWM) and posterior white matter (PWM) at the level of the centrum semiovale. Paired t test showed no significant differences in ADC, T2 and FA between both hemispheres, therefore mean values were calculated from bilateral measurements.

## Results:

	DEHSI (n=9)	Normal appearing WM (n=33)	<i>p</i>
FA in FWM	0.26	0.26	0.39
FA in CWM	0.32	0.29	0.31
FA in PWM	0.29	0.32	0.37
FA in PLIC	0.54	0.51	0.06
ADC in FWM	1.59	1.51	0.21
ADC in CWM	1.57	1.51	0.16
ADC in PWM	1.74	1.62	<0.01
T2 in FWM	255.43	251.02	<0.05
T2 in CWM	252.17	243.71	<0.05
T2 in PWM	283.68	272.65	<0.01

## Conclusions:

T2 was significantly prolonged in all measured white matter regions in preterm infants with DEHSI compared to preterm infants with normal appearing white matter on conventional MRI whereas FA values were similar in both preterm groups. ADC was similar in FWM and CWM but significantly higher ADC was found in the PWM in preterm infants with DEHSI. Correlation with outcome will determine the utility of T2 as a biomarker.