

Anisotropy of callosal motor fibers predicts functional impairment in children with periventricular leukomalacia

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Purpose: Patients with periventricular leukomalacia are known to have altered white matter structure of motor tracts¹. We aimed to evaluate the microstructure (DTI), interhemispheric inhibitory competence as measured by transcranial magnetic stimulation (TMS) and hand motor function in children with mild cerebral palsy compared to normal controls.

Methods: We examined 8 children (mean age 15.0 ± 2.4 years) with known mild bilateral cerebral palsy (gross motor function measure I-II) caused by periventricular leukomalacia (PVL) and 12 healthy age-matched controls (mean age 14.9 ± 1.8). Fractional anisotropy (FA) values of transcallosal motor fibers (TCMF), corticospinal tract (CST) and thalamocortical projections (TCP) were calculated and correlated to parameters of interhemispheric inhibitory competence and to the degree of mirror movements as measured by clinical examination and a computer-based hand motor function test.

Results: Anisotropy values were significantly lower in children with PVL as compared to age-matched healthy controls regarding the TCMF (0.382 vs. 0.427; $p < 0.003$). FA values of the CST and TCP tended to be lower in patients with PVL, but no statistically significance was found. FA values in transcallosal motor fibers correlated with the parameters of hemispheric inhibitory competence (ISP duration: $R = 0.80$; $p < 0.002$; ISP extend: $R = 0.77$; $p < 0.003$; Spearman-Rho) and with the degree of mirror movements ($R = 0.54$; $p = 0.05$). Mirror movements were elevated in the PVL group by the factor 2. The number of transcallosal fibers was lower in children with PVL ($p < 0.02$).

Conclusion: Anisotropy values of transcallosal motor fibers appear to correlate with functional impairment of hand motor function in children with PVL. The microstructure of transcallosal motor fibers could serve as a potential predictor for hand motor function in patients with cerebral palsy.

1. Nagae LM, Hoon AH, Jr., Stashinko E et al. Diffusion tensor imaging in children with periventricular leukomalacia: variability of injuries to white matter tracts. *AJNR Am J Neuroradiol.* 2007;28:1213-1222

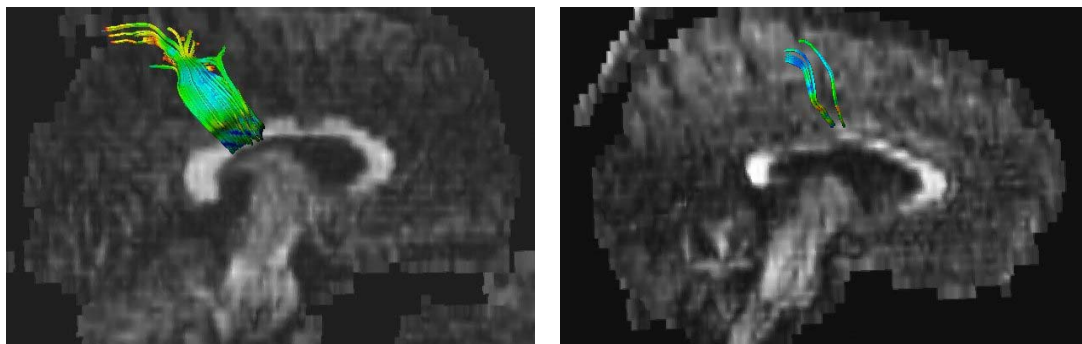


Figure 1: Transcallosal motor fibers in a healthy subject (left) and child with PVL (right)

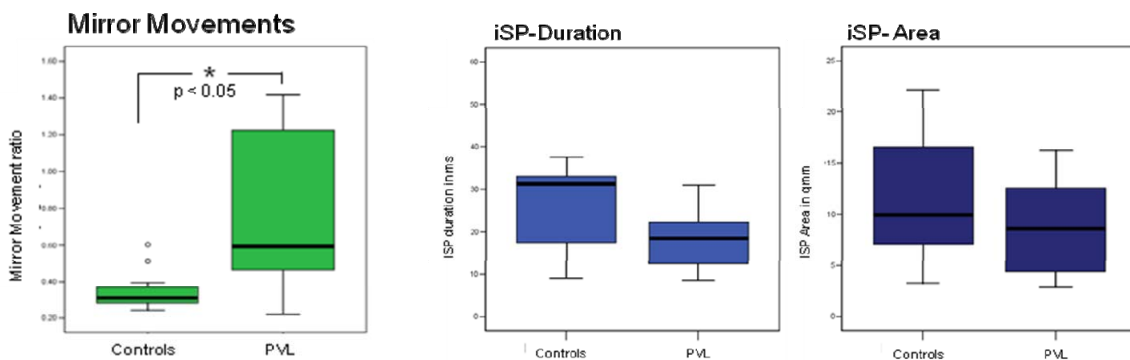


Figure 2: Children with PVL showed increased mirror movements (left), shorter ISP duration (middle) and lower values of extend of ISP (right).