AbstractID: 13781 Title: Quantification of FA and ADC changes with age in the brainstem of healthy children using diffusion tensor imaging

Purpose: To provide a benchmark for comparison with diseased and injured pediatric brainstem, we quantified age-dependent changes in fractional anisotropy (FA) and apparent diffusion coefficient (ADC) in 20 healthy children with diffusion tensor imaging (DTI).

Method and Materials: Diffusion raw images were acquired in 20 healthy volunteer children aged 6-25 years using a 3-T MR scanner (Trio, Siemens, Erlangen, Germany). Quantitative FA and ADC maps were computed offline using Siemens Neuro3D Syngo DTI task card. FA and ADC maps from multiple time points were co-registered through T1-weighted 3D structural scans. Regions-of-interest (ROIs) were manually delineated using an in-house image analysis package. FA and ADC averages across the previously defined ROIs were fitted over the natural logarithm of age. FA and ADC were also averaged on each slice to examine the inter-slice variation.

Results: The fitted curves show a rising trend of FA but a decreasing trend of ADC with age as indicated by their slopes (pons: FA 0.07, ADC -0.08; corticospinal tract: FA 0.07, ADC -0.03; medial lemniscus: FA 0.06, ADC -0.06). The average FA of brainstem ROI over each slice was low in the medulla oblongata and increased towards pons and midbrain, as opposed to the high ADC in the medulla oblongata, deceasing in the pons and the midbrain.

Conclusion: The increasing trend of FA and decreasing trend of ADC with age in pediatric brainstem was consistent with previous reports. The similar slopes with FA as compared to different slopes with ADC might indicate incongruence in characterizing the underlying structural changes. The slice-by-slice analysis demonstrates a large variation in FA and ADC in the craniocaudal direction within the brainstem. Our results from healthy subjects can provide an important benchmark for later comparison with pediatric patients receiving cancer treatment involving brainstem.

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