Using clinical images to study the evolution of mean ADC values and brain volume of healthy pediatric subjects.

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Abstract:
Diffusion Tensor Imaging is a surrogate marker for myelin development [1], which undergoes dramatic changes as tracked by ADC values [2]. The aim of this study was to investigate brain MRI metrics of normative brain development from birth to early childhood. We used the Research Patient Data Registry (RPDR) to identify a pediatric cohort (0 - 6 yrs) and the mi2b2 workbench (mi2b2help.partners.org) to retrieve clinical brain MRI scans from 4745 patients. Data mining software and expert review of medical records verified absence of CNS pathology in 1765 potentially normative brain MRI studies from 1600 patients. After Q&A and visual inspection to remove images with artifacts, the remaining n = 301 high quality clinical ADC images were processed with multi-atlas-based skull-stripping tools [3] and brain morphometric measures were extracted. Whole brain mean ADC and volume measures were obtained using AFNI. Mean ADC values display a dramatic decrease during the first semester of life (Fig 1), and a plateau-effect starting at age one, consistent with the rapid myelination during early infancy and its consequent stabilization during childhood. A rapid rise in mean brain volume characterizes the first year of life, followed by a steady phase in early childhood (Fig 2).
This study demonstrates that clinical ADC images can be used to obtain meaningful quantitative measures of normative brain development in early childhood.
Figure 1: Whole brain average Apparent Diffusion Coefficient (ADC) values across the age span

Figure 2: Average Intracranial brain volume across the age span

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