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Data Article

Change-point analysis data of neonatal diffusion tensor MRI in preterm and term-born infants

Dan Wu [a], Linda Chang [b], Kentaro Akazawa [a], Kumiko Oishi [c], Jon Skranes [d], Thomas Ernst [b], Kenichi Oishi [a,*]

[a] Department of Radiology, Johns Hopkins University School of Medicine, Baltimore, MD, USA
[b] Department of Medicine, School of Medicine, University of Hawaii at Manoa, Honolulu, HI, USA
[c] Department of Biomedical Engineering, Johns Hopkins University, Baltimore, MD, USA
[d] Department of Laboratory Medicine, Children's and Women's Health, Norwegian University of Science and Technology, Trondheim, Norway

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A B S T R A C T

The data presented in this article are related to the research article entitled “Mapping the Critical Gestational Age at Birth that Alters Brain Development in Preterm-born Infants using Multi-Modal MRI” (Wu et al., 2017) [1]. Brain immaturity at birth poses critical neurological risks in the preterm-born infants. We used a novel change-point model to analyze the critical gestational age at birth (GAB) that could affect postnatal development, based on diffusion tensor MRI (DTI) acquired from 43 preterm and 43 term-born infants in 126 brain regions. In the corresponding research article, we presented change-point analysis of fractional anisotropy (FA) and mean diffusivities (MD) measurements in these infants. In this article, we offered the relative changes of axonal and radial diffusivities (AD and RD) in relation to the change of FA and FA-based change-points, and we also provided the AD- and RD-based change-point results.

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* Corresponding author.
E-mail address: koishi2@jhmi.edu (K. Oishi).

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Specifications Table

Subject area	*NeuroImaging*
More specific subject area	*Neonatal brain MRI, Image analysis*
Type of data	*Figures*
How data was acquired	*Diffusion tensor MRI was acquired using a 3.0 T Siemens TIM Trio scanner*
Data format	*Analyzed*
Experimental factors	*Data from 43 term-born and 43 preterm-born infants were used in the analysis*
Experimental features	*The MRI data were first segmented to 126 brain regions with automated atlas-based image segmentation, and then the metadata from each region were fitted by a multivariate linear change-point model.*
Data source location	*Queen's Medical Center, University of Hawaii, Honolulu, Hawaii, USA*
Data accessibility	*Data is within this article.*

Value of the data

- The relative changes of AD and RD with GAB lead to distinct change patterns in FA before and after the change-points.
- The change-point analysis of AD and RD data offers complementary information to the change-points in FA and MD.
- The change-point model characterizes features of the brain developmental trajectory, and the whole map of change-points in 126 structures demonstrate regional variations of brain development associated with preterm-term birth.

1. Data

1.1. GAB-dependent changes of RD and AD in relation with FA

The change of FA is driven by the relative change of axial and radial diffusivities (AD and RD). Two different patterns of GAB-dependent FA changes were demonstrated in Fig. 1 of the related paper [1]. Therefore, we plotted the changes of AD and RD with respect to GAB, in the structures corresponding to Fig. 1 in the research paper [1]. The red and blue dots in Fig. 1 denote data from preterm and term-born neonates, respectively, after correcting for PMA at scan and gender. The dashed vertical lines indicate the change points analyzed using the FA data. The structures shown in Fig. 1A (correspond to the first pattern in Fig. 1A in [1]) exhibited the following characteristics: 1a) increased FA with GAB before the change-points and small changes thereafter; and 1b) faster rate of decrease in RD with GAB compared to that in AD before the change-points, and similar rates of decrease in RD and AD thereafter. Conversely, the structures shown in Fig. 1B (correspond to the second patter in Figure 1B in [1]) demonstrated: 2a) relatively stable FA before the change-points which decreased with GAB thereafter; and 2b) similar rates of decrease in AD and RD before the change-points, and slow decrease of AD and slight increase of RD after the change-points.

1.2. AD- and RD-based change-point analyses

Change-point analysis was performed on the AD and RD data in 126 brain structures, and the change-points detected in individual regions were mapped onto an MD image from the JHU-neonatal atlas in Figs. 2B and 3B, respectively. The AD-based change-point analysis only showed significance (familywise $p = 0.01$) in the left fornix at GAB of 30 weeks (Fig. 2A, and bottom row in Fig. 2B), where