PROCEEDINGS of the
23rd International Congress on Acoustics

9 to 13 September 2019 in Aachen, Germany

Assessing perinatal maturation of human primary and nonprimary auditory cortex

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EXTENDED ABSTRACT

Humans have precocial hearing, allowing the human fetus to learn seemingly complex features about the extrauterine environment *via* sound transmission into the womb. What is the neural architecture that facilitates auditory learning during this early developmental period? In general, primary sensory cortex matures in advance of nonprimary sensory cortex, but the timing differences between primary (pAC) and nonprimary auditory cortex (nAC) maturation in humans have been unclear. Tracking human perinatal cortical maturation *in vivo* has been made possible with modern advancements in magnetic resonance imaging (MRI). Diffusion MRI metrics of fractional anisotropy, mean diffusivity, axial diffusivity, and radial diffusivity show systematic changes as neuronal genesis, differentiation, and migration occur in the developing brain. Here we used diffusion MRI metrics to track these cortical maturational processes and microstructural changes along the length of Heschl's gyrus. We analyzed longitudinal data from infants born preterm who each underwent diffusion MRI up to four times between 26 and 40 weeks postmenstrual age. We also tested for associations between diffusion metrics in infancy and language developmental outcomes at age 2 years. We were able to distinguish between pAC and nAC as early as 28 weeks postmenstrual age, a time at which the sulcal boundaries of Heschl's gyrus are just beginning to appear. Our analysis revealed differing rates of maturation along the axis of Heschl's gyrus as cortex transitions from pAC to nAC. While pAC was further advanced along the developmental timeline at each timepoint, nAC showed much larger changes from 26 to 40 weeks postmenstrual age than did pAC. Disturbed maturation of nAC (but not pAC) in infancy was associated with poorer language performance at age two years.

Keywords: auditory cortex, human development, fetal hearing

The details of this study are published in open access Reference 1.

REFERENCE

1. Monson BB, Eaton-Rosen Z, Kapur K, Liebenthal E, Brownell A, Smyser CD, Rogers CE, Inder TE, Warfield SK, and Neil JJ. Differential rates of perinatal maturation of human primary and nonprimary auditory cortex. eNeuro. 2018;5(1):e0380-17.2017, 1-12. doi: http://dx.doi.org/10.1523/ENEURO.0380-17.2017