EARLY PAIN EXPOSURE AND REGION SPECIFIC BRAIN CORTICAL THICKNESS INTERACT TO PREDICT EXECUTIVE FUNCTION AT 8YRS IN CHILDREN BORN VERY PRETERM

Mark Bichin, BSc
University of British Columbia
Student/Trainee

INTRODUCTION / AIM

Children born very preterm display poorer executive functions (EFs) compared to fullterm, however little is known about the etiology. In healthy adults, thinner cortex is associated with poorer EFs. We previously found a relationship between neonatal pain-related stress (pain/stress) and cortical thickness in children born very preterm. However, there are no studies examining the possible connection between neonatal pain/stress, cortical thickness and their relationship with EFs. Objectives: To determine whether EF abilities at age 8 years are related to regional cortical thickness associated with neonatal pain/stress in children born very preterm.

METHODS

N = 46 children born very preterm (24-32 weeks gestational age [GA]), at 8 years of age (M = 7.6, SD = .27) underwent 3D T1 structural magnetic resonance imaging. Regional cortical thickness was computed using FreeSurfer software. EFs assessed with a computerized flanker task (selective attention, inhibition, flexibility, working memory) and cognitive assessment (WISC-IV) were administered by a psychometrician. Medical/nursing chart review was carried out from birth to term equivalent. Neonatal pain/stress was operationalized as the number of skin breaking procedures (e.g., heel lance, tube insertion). Generalized linear modelling was used to predict the % correct flanker task trials from brain regional cortical thickness at 8 years, and neonatal skin breaking procedures adjusting for neonatal clinical factors (GA, morphine mg/kg adjusted for daily weight, severity of illness [SNAP-II] day 1, infection, number of surgeries, and WISC verbal IQ). We excluded children with major brain injury and/or sensory, motor or cognitive impairments.

RESULTS

After adjusting for multiple comparisons (α = .05), flanker % correct was significantly predicted by the interaction between neonatal pain/stress and cortical thickness in 8 brain regions (left caudal middle frontal, left & right rostral middle frontal, right superior frontal and temporal, left lingual, right inferior temporal and left superior parietal gyri; p values ranged from p < .001 to p = .003 [after adjustment for neonatal confounders]). Greater exposure to neonatal pain/stress was associated with poorer flanker % correct, in the presence of relatively thinner cortex in each of these brain regions, but not with thicker cortex.

DISCUSSION / CONCLUSIONS

This is reference material for delegates of the Canadian Pain Society Annual Scientific Meeting 2016 and is not intended for any other use or distribution.
More exposure to pain-related stress in very preterm neonates is associated with poorer executive functions at school age, but only in children with thinner cortex in specific brain regions at age 8 years. These regions have all been shown to be engaged during EF performance in healthy adults. Efforts to reduce pain and stress exposure during neonatal intensive care may provide new opportunities to improve cortical development and thereby executive functions outcomes at school age in children born very preterm. Funded by: NICHD/NIH grant HD039783 to REG

OTHER AUTHORS

Cecil MY Chau
Manon Ranger
Steven P Miller
Amanmeet Garg
Mirza F Beg
Kevin Fitzpatrick
Bruce Bjornson
Adele Diamond
Anne R Synnes & Ruth E Grunau