Memory function and hippocampal volumes in preterm born very-low-birth-weight (VLBW) adults

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Background: Hippocampus

- Link between hippocampal volume & working memory problems in VLBW teens
- Hippocampal functions:
  - Learning
  - Memory Consolidation
  - Spatial memory/navigation
  - Emotion
Background: VLBW

- VLBW $\leq 1500$g (3.5lb)
  - Premature birth
  - Common causes
  - Common deficits

Intro: Hypotheses

1. VLBW group will have reduced memory functions and smaller hippocampi compared to controls
2. Perinatal risk factors will be associated with the results
3. There will be an association between performance on memory tests and hippocampal volumes in both VLBW and full-term groups, but more pronounced in the VLBW group due to hippocampal pathology/lower test results
Methods: Participants

- VLBW & FT Norwegian babies born 1886-1988
- Data collected 2006 to 2008
- VLBW n=44
- FT control n=61

Methods: Assessments

- Wechsler Memory Scale – auditory, visual and working memory
- Wechsler Adult Intelligence Scale – general cognition
- Cerebral MRI

- Perinatal variables – weight, age, APGAR, ventilation, days in NICU
- SES & education – parent/s
Results: Clinical & Memory

- Clinical – VLBW adults had lower IQ & less educated/employed
- Memory tests – VLBW adults scored lower on WMS-III subtests; sig. neg. correlation between #NICU days and all memory indices & pos. correlation between weight and all indices
Results: Volumes & Associations

- VLBW had sig. lower intracranial & hippocampal volumes
- Perinatal assoc.: # days in NICU was neg. correlated with hippocampal volumes
- WMS-III assoc.: pos. correlation between total, left and right hippocampal volumes and all WMS-III indices in VLBW group.

*Fig. 2. Scatterplots of left and right hippocampal volumes for all the participants (VLBW in blue, controls in red). The volumes are corrected for total intracranial volume, sex and age at MRI by a univariate general linear model.*
Discussion: General

- VLBW have inferior memory function, compared to FT
- VLBW have smaller hippocampi, compared to FT
- Inferior memory was related to smaller hippocampal volume
- VLBW at a disadvantage for learning & memory tasks, compared to FT

Discussion: Memory

- VLBW poorer scores than FT in ~50% of subtests
- VLBW mild-mod reduced memory scores on all subtests
- Visual working memory deficits for VLBWs
- Lower score in visual than the auditory delayed index
- Unaffected: auditory recognitions delayed index (recognition vs recall)
Discussion: Volume & Memory

- Hippocampi were sig. smaller for VLBW
- Risk factors: birth weight & days in NICU
- White matter injury = less afferent input = smaller hippocampi
- Strongest correlation between size & working memory index
- Permanent trophic changes
- L&R hippocampi volumes

Discussion: Limitations

- Small sample size
- Participant drop outs
- Hippocampal MRI segments were subjectively inspected
Conclusions:

• VLBW adults have inferior memory skills
• Deficits in “visual delayed” and “working memory” WSM-III indices
• Reduced memory skills related to smaller hippocampal volumes, due to prematurity

Questions?

References:

Article:

Supplemental Information About VLBW:
• http://www.cdc.gov/reproductivehealth/MaternalInfantHealth/PretermBirth.htm
• http://mchb.hrsa.gov/chusa08/hstat/hsi/pages/203vlbw.html