Association Between Exposure of Young Children to Procedures Requiring General Anesthesia and Learning and Behavioral Outcomes in a Population-based Birth Cohort

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Abstract

Background: Exposure of young infants to general anesthesia (GA) causes neurodegeneration and lasting behavioral abnormalities; whether these findings translate to children remains unclear.

Objective: To test the hypothesis that multiple, but not single, exposures to procedures requiring GA prior to age 3 years are associated with adverse neurodevelopmental outcomes.

Methods: A retrospective study cohort was assembled from children born in Olmsted County, MN from 1991 to 2000 (inclusive). Propensity matching selected children exposed and not exposed to GA prior to age 3. Outcomes ascertained via medical and school records included learning disabilities (LD), attention deficit hyperactivity disorder (ADHD), and group-administered ability and achievement tests. Analysis methods included proportional hazard regression models and mixed linear models.

Results: For the 116 multiply exposed, 457 singly exposed, and 463 unexposed children analyzed, multiple, but not single, exposures were associated with an increased frequency of both LD and ADHD (hazard ratio for LD of 2.17 (95% CI 1.32 to 3.59) with unexposed as reference). Multiple exposures were associated with decreases in both cognitive ability and academic achievement. Single exposures were associated with modest decreases in reading and language achievement but not cognitive ability.

Conclusions: These findings in children anesthetized with modern techniques largely confirm those found in an older birth cohort, and provide further evidence that children with multiple exposures are more likely to develop adverse outcomes related to learning and attention. Although a robust association was observed, these data do not determine whether anesthesia per se is causal.

Methods

Study cohort (n=890) • Born between 1991 and 2000 • Enrolled in OSLA T

LD Subtypes

Mathematics LD

Multiple, but not single, exposures prior to age 3 are associated with increased frequencies of three subtypes of LD (reading, mathematics, and written language).

ADHD

• Multiple vs. None (p<0.03 (2.36 to 3.39))
• Single vs. None (p=0.24 (0.28 to 1.00)

Conclusions

• LD and ADHD
• Multiple, but not single, exposures prior to age 3 are associated with increased frequencies of LD, including three subtypes of LDs (reading, mathematics, and written language) and ADHD.
• A tendency of increased ADHD observed for single exposure, but no statistical significance
• IEP-113 and IEP-ESD
• No association of anesthesia with significant disruption of speech/language or emotionality behavior that can interfere with learning.
• Group-administered tests
• Multiple exposures associated with globally decreased performance in academic achievement and school ability.
• Single exposures demonstrated selectivity decreased performance in subdomains of reading and written language.