Impact of Age at Whole-Vault Cranioplasty and Reoperation on Long-Term Neurocognitive Outcomes in Sagittal Craniosynostosis

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PURPOSE: Neurocognitive studies in school-age children with craniosynostosis reveal lower scores compared to controls. Optimal age at surgery in craniosynostosis continues to be debated. In addition, individuals with craniosynostosis may undergo reoperation to improve residual skull irregularities. It is unknown whether reoperation affects neurocognitive outcome. This study examined impact of age at whole-vault cranioplasty and reoperation on neurocognitive outcome in children with nonsyndromic sagittal craniosynostosis (NSC).

METHODS: 39 school-age children (age 6-16 years) diagnosed with NSC who underwent whole-vault cranioplasty were included in this analysis. Participants were administered the Wechsler Abbreviated Scale of Intelligence (WASI) and the Wechsler Fundamentals (WF) subject tests. The WASI assesses full-scale IQ, verbal IQ, and performance IQ, while the WF assesses achievement in word reading, reading comprehension, spelling, and numerical operations.

RESULTS: Children with NSC operated at age 3-6 months (n=17) performed significantly better on all neurocognitive testing measures compared to children operated on after age 6 months (n=25). Score on full scale IQ was 114.59 (SD = 10.91) vs 101.00 (SD = 12.48) (p=0.002), verbal IQ was 117.29 (SD = 9.83) vs 100.48 (SD = 15.00) (p=0.001), and performance IQ was 110.18 (SD = 10.57) vs 101.52 (SD = 11.18) (p=0.027). All findings remained significant after controlling for patient sex and maternal educational attainment.

Controlling for patient sex, maternal educational attainment and patient IQ, score on word reading was 120.20 (SD = 13.69) vs 85.31 (SD = 22.54) (p=.001), reading comprehension was 113.05 (SD = 10.55) vs 84.00 (SD = 18.79) (p=.003), spelling was 112.25 (SD = 16.06) vs 81.64 (SD = 16.89) (p=.004), and numerical operations was 108.60 (SD = 12.24) vs 84.86 (SD = 13.79) (p=.002).

Of the original sample, reoperation status was available for 27 participants. 9 participants underwent reoperation (6 augmentation cranioplasties, 3 cranial vault osteotomies) and 18 did not. No statistical differences in intelligence and achievement measures were observed in those who underwent reoperation versus those who did not. Sample size limited ability to examine potential statistical differences between reoperation types. However, participants with minor reoperations obtained higher means on all measures than those with extensive reoperations.

CONCLUSIONS: Earlier age at whole-vault calvarial reconstruction for NSC is associated with improved neurocognitive outcomes. Preliminary subanalysis suggests that reoperation does not impact neurocognitive outcomes in NSC.