

Effects of Surgery on Brain Structure and Language Skills Among Children with Isolated Cleft of the Lip and/or Palate

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Introduction/Background

Oral clefts are a congenital abnormality causing children to be born with an opening or split in their lip and/or the roof of their mouth. According to a 2019 study, 1 in every 1,563 babies born in the United States has cleft lip with cleft palate (Mai et al., 2019). Moreover, around 70% of oral clefts are nonsyndromic, or isolated, meaning they are not associated with any known syndrome (van der Plas et al., 2012). As a result of this congenital abnormality, numerous studies have been conducted to determine the effects of having an isolated cleft of the lip and/or palate (iCL/P) on a child's neuropsychological development. For example, it was found that children with oral clefts demonstrate differences in reading skills (Conrad, 2018), quality of speech (Conrad et al., 2010), speech input skills (Southby et al., 2021), and gray matter volume and white matter tract integrity in the brain (Conrad et al., 2021). However, there is limited understanding of how their increased number of surgeries early in life may impact language and neurodevelopment outcomes.

Research Objectives

This study aims to answer the question, "How does surgery exposure impact the brain structure and language skills of children with oral clefts?" The purpose is to investigate the neurological impacts of surgery on patients with isolated cleft of the lip and/or palate. The study also examines the role of cleft type - lip only (iCLO), both lip and palate (iCLP), or palate only (iCPO) - on these relationships.

Method

A subsample of males (aged 8 to 16 years old) with iCL/P from previously collected data (Conrad, 2018), was split into three groups based on their cleft type ($n = 6$ iCLO, 11 iCLP, 10 iCPO). Variables of interest included: total number of surgeries prior to participation (obtained via chart review), performance on measures of receptive and expressive language, and structural brain volumes recorded from structural magnetic resonance imaging scans. First, Univariate Analysis of Variance (ANOVA) was run to evaluate possible cleft type differences in number of surgeries, language skills, and brain data. Post-hoc group difference statistics were run for those with significant F values. Then, Pearson's Correlation Coefficients (r) were calculated for each cleft type between the variables of interest. Finally, a Z-score transformation was conducted to evaluate significant differences between the correlation strengths across cleft type.

Results

The results from the ANOVA found that there was only a significant F-value for the total number of surgeries and cleft type ($p = .013$), but not for the other variables. After running the Pearson's Correlation Coefficients, it was found that the number of surgeries did not have a strong impact on language skills or brain structure. Additionally, there was not a strong relationship between language skills and brain structure in participants with iCLO and iCPO. However, there were significant relationships between language skills and the global and

regional brain data among participants with iCLP. This study may have been limited by a small sample size, not using a Bonferroni correction to determine significant relationships while controlling for the number of analyses, and only having one variable for surgery exposure.

Conclusions/Implications

The lack of significant results regarding surgery indicates that the total number of surgeries is not an accurate predictor of language skills or brain structure in boys with iCL/P. This may be because other factors faced by participants overshadow the effect of the number of surgeries. Future research could use additional variables to represent surgery exposure, such as the total amount of time in surgery or the amount of anesthesia the patient received. Future studies could also use a larger sample size to reevaluate the results of this study. Furthermore, a different method could be used to classify the cleft type, such as by separating the groups by unilateral vs. bilateral cleft. Additional studies could also investigate the impact of sex on neurological effects. Finally, research could be conducted on potential prevention methods for medical risks experienced by children with oral clefts that can impact neuropsychological development.

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