Craniosynostosis: Risk Factors for Delayed Primary Surgery and Predictors of Early Operation

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BACKGROUND

Craniosynostosis is a congenital anomaly characterized by the premature fusion of one or more cranial sutures **(Fig 1).** Craniosynostosis can be classified as single suture or multisuture and can occur in isolation or as part of a genetic syndrome. Traditional surgical correction of craniosynostosis involves cranial vault remodeling which is invasive and typically deferred until the infant is around 6 to 12 months of age. Newer minimally invasive endoscopic techniques have been introduced for the treatment of craniosynostosis and are typically performed before 6 months of age. Overall, the ideal time for patients with craniosynostosis to undergo primary surgical intervention is <12 months. Surgery after 12 months places patients at higher risk of complications and is conventionally considered "delayed."

PURPOSE

Identify risk factors for delayed surgical correction of craniosynostosis and factors predictive of younger patient ages at time of operation in order to facilitate earlier and safer interventions

METHODS

- Retrospective chart review was conducted from November 2011 to September 2018 on patients with a diagnosis of craniosynostosis presenting for primary surgical management
- Nineteen risk factors potentially associated with delayed primary surgical intervention were analyzed **(Table 1)**
- Wilcoxin rank sum test was used to determine p-values for comparisons between patients in different age cohorts at time of sugery

Table 1: Nineteen risk factors that were potentially associated with delayed primary surgical intervention

Risk Factors Potentially Associated with Delayed Primary Surgical Intervention	
Gender	Race
Primary language	Home distance from hospital
Insurance company	Adoption status
Birth order	Family home makeup
Type of craniosynostosis	Congenital anomalies
Syndromic status	Presence of developmental abnormalities
Service first referred after presentation	Symptomatology at time of referral
Pre-referral imaging (obtained vs not)	Age at presentation
Age at surgery	Patient's median income
Comorbidities	

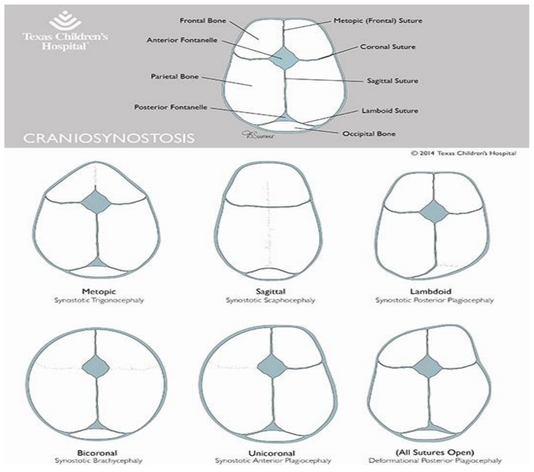

Fig 1: Different types of craniosynostosis

METHODS

- Logistic regression was used to model the relationship between potential risk factors and patient age at surgery
- Odds ratios and 95% confidence intervals were generated for each variable
- A p-value of <0.05 was considered statistically significant

RESULTS

- A total of 123 patients out of 208 (59.1%) met final inclusion criteria and were evaluated
- A higher percentage of white patients received surgery before 12 months of age compared to non-white patients (58.5% vs 41.5%, p = 0.046)

RESULTS

- Significant differences in patient age at time of surgery were noted based on type of craniosynostosis (p = 0.004). Patients with sagittal craniosynostosis were more likely to receive surgery before 12 months of age while those with unilateral coronal and multisuture craniosynostosis were more likely to receive surgery after 12 months of age.
- Patients with syndromic craniosynostosis and congenital anomalies were significantly more likely to receive surgery after 12 months of age (p = 0.019, p = 0.007).

CONCLUSION

- This study is the most comprehensive assessment of risk factors for delayed management of craniosynostosis to date and the first to assess delayed surgical intervention along with delayed presentation.
- Wide variability between time of presentation and time of operation suggests that patient age at time of surgery may be a better metric for assessing risk of delayed operation than timing of presentation.
- Non white patients and patients with syndromic, unilateral coronal, or multisuture craniosynostosis are more likely to undergo delayed surgical intervention for craniosynostosis.
- Addressing the particular risk factors associated with delayed primary surgical correction of craniosynostosis can help promote earlier and safer interventions.

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