

Examining the Utility of Extended Strip Craniectomy for the Treatment of Sagittal Synostosis: Cranial Index, Nasofrontal Angle, and Reoperation Rate

Christopher Michael Bonfield MD; Philip Lee MD PhD; Matthew Armand Adamo MD; Ian F. Pollack MD Children's Hospital of Pittsburgh of the University of Pittsburgh Medical Center, Pittsburgh, PA, USA



Introduction

Sagittal synostosis is the most common non-syndromic single suture craniosynostosis. Different techniques of surgical correction, including Extended Strip Craniectomy (ESC), have been used as treatment. The aim of this study is to evaluate radiologic changes and rate of symptomatic restenosis after dynamic shortening of cranial length using ESC with suture internal fixation in a very large group of patients less than 12 months of age with non-syndromic sagittal synostosis.

Methods

A retrospective cohort study of patients from 1990 to 2012 with nonsyndromic sagittal synostosis was performed comparing cranial index (CI) and nasofrontal angle (NFA) before and after surgical correction by ESC. Also, the frequency of subsequent reoperations for symptomatic restricted head growth was determined. Differences were evaluated by the Wilcoxon Signed-Rank Test.



CT illustrating sagittal craniectomy and osteotomies

Cranial Index

Cranial Index (CI) is calculated by dividing the cranial width by the cranial length.



Comparison between Pre-op and Post of Cranial Index

Nasofrontal Angle

Nasofrontal Angle (NFA) is definined by the glabella-to-nasion line intersecting with the line from the nasion following the nasal bone.



Nasofontal Angle Measurement



Results

A total of 238 patients underwent ESC for sagittal synostosis. Follow-up information was available for 182 patients. The average age at the time of the operation was 4.5 months and the mean duration of follow-up was 49.6 months. The average post procedure radiologic follow-up (22 patients) was 40.7 months. No adjunctive helmet therapy was needed.

The mean CI increased from 0.68 to 0.75 (p<0.001) after ESC [Table 1]. Also, mean NFA increased from 127 to 133 degrees (p<0.001). There were 5 patients (2.7%) that required a second operation due to symptomatic cranial growth restriction [Table 2]. Reoperation occurred at an average of 26.5 months after the initial procedure. The most common symptom reported was headache [Table 3].



Conclusions

ESC is an effective procedure in the treatment of non-syndromic sagittal synostosis. It improved NFA without the need for direct frontal bone resection or frontal orbital osteotomy and significantly improved CI without adjunctive helmet treatment. Patients should be followed for at least 3 years after surgical correction as symptomatic restenosis, although rare, can occur.

Learning Objectives

By the conclusion of this session, participants should be able to: 1) Know the most common single suture craniosynostosis, 2) Be able to calculate Cranial Index (CI) and Nasofrontal Angle (NFA), 3) Identify Extended Strip Craniectomy as an effective procedure in the treatment of sagittal synostosis in children less than 1 year of age.

Table 3					
	Age at 1 st Operation (mo)	Age at 2 nd Operation (mo)	Time Between Operations (mo)	Symptoms	Reoperation Procedure
Patient 1	11.0	27.9	16.9	Headache, elevated pressure on LP	CVR
Patient 2	2.70	36.9	34.2	Headache, papilledema, elevated pressure on LP	CVR
Patient 3	1.07	14.8	13.8	Headache	ESC
Patient 4	7.67	24.4	16.7	Headache, papilledema,	CVR
Patient 5	4.90	55.6	50.7	Headache	CVR
Mean	5.46	31.9	26.5		

Characteristics of Patients With Symptomatic Cranial Growth Restriction