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Original article

Brain anomalies in 121 children with non-syndromic single suture craniosynostosis by MR imaging

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ABSTRACT

Introduction: The aim of this study was to evaluate prevalence of intracranial abnormalities in children with non-syndromic single suture craniosynostosis scheduled for cranial vault remodelling surgery using pre-operative magnetic resonance imaging.

Patients and methods: A retrospective analysis of brain magnetic resonance imaging studies of 129 non-syndromic single suture craniosynostosis children undergoing craniofacial surgery between January, 2004–October, 2010 was conducted. Statistical analysis was performed for child, maternal and sibling related predisposing factors for abnormal brain magnetic resonance imaging findings.

The mean age of these 121 patients at the time of imaging was 21.6 months. The majority, 78% were males and 74% of the patients were scaphocephalic.

Results: In 18 (15%) patients abnormal brain findings were noted. The most common finding was Chiari 1 malformation in 11 (9%). Chiari 1 malformation comprised over half (61%) of the brain anomalies identified. None of these findings required any additional surgical procedures. None of the statistical analysis reached statistical significance.

Conclusions: Brain anomalies in connection with non-syndromic single suture craniosynostosis patients seem to be a coincidental event. We did not establish any specific craniosynostosis form to be regularly associated with abnormal brain magnetic resonance imaging findings. The routine use of pre-operative magnetic resonance imaging in non-syndromic single suture craniosynostosis patients seems to be of limited value in the search for associated intracranial malformations necessitating additional interventions.

1. Introduction

Craniofacial anomalies can occur in association with malformations of the central nervous system.[1] Since the introduction of magnetic resonance imaging (MRI) the neuroradiological diagnosis of associated intracranial abnormal findings in patients with craniosynostosis has evolved. Unlike in syndromic craniosynostosis MRI is rarely

Abbreviations: MRI, Magnetic resonance imaging; CMI, Chiari I malformation; N-SSSC, Non-syndromic single suture craniosynostosis.

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performed in the examination of patients with non-syndromic single suture craniosynostosis (N-SSSC). So far, there is little information in the literature on the MRI findings in association with N-SSSC. We have previously recognized a 5.6%prevelence of Chiari type I malformation (CMI) among N-SSSC patients.[2]

The aim of this study was to evaluate the pre-operative MRI findings in patients with N-SSSC scheduled for cranial vault remodelling surgery to find out the prevalence of co-existing intracranial abnormalities. A further aim was to assess the usefulness of pre-operative MRI examination within this patient group.

2. Patients and methods

A retrospective analysis of the brain magnetic resonance imaging (MRI) studies of children undergoing craniofacial surgery in Cleft Palate and Craniofacial Centre, Department of Plastic Surgery, Helsinki University Hospital, Finland, was conducted. During the study period, January 2004 to October 2010, a total of 145 non-syndromic patients with single suture craniosynostosis were examined using brain MRI and operated on in our department. Due to missing data or missing brain MRI, 24 patients were excluded leaving the final study population of 121 patients. The mean age of these 121 patients was 21.6 months at the time of imaging. All were Caucasian. The detailed demographic and clinical data of 121 N-SSSC patients is given in Tables 2 and 3.

Brain-MRI has been included in our routine clinical protocol since 2004. All N-SSC patients are subjected to MRI, none is deliberately left without imaging. The reason for the possible cases of omitting pre-operative MRI is mainly due to hospital logistics.

The additional information pro-vided by MRI, especially concerning vascular anatomy and intracranial anomalies are better detect-ed from MRIs than CTs. With the current number of 40–50 cranioplasties performed in our unit annually we have managed to provide pre-operative MRI to each patient undergoing cranioplasty a day before the operation. All parents have so far complied with this protocol. Our current study is based on those brain-MRI images obtained through our routine clinical protocol.

The MRI studies were performed with a GE Signa HDx 1.5 T MR unit. We obtained T1-weighted spin echo (SE) images in sagittal and axial planes and T2-weighted SE images in axial

Table 1 – Factors analysed in statistical analysis and respective *p*-values.

Factor	In detail	*p*-values
Craniosynostoses related factors	Sagittal	1.0
	Coronal	
	Metopic	
	Lambda	
Maternal factors	Mother using epilepsy drug	1.0
	Mother using antidepressants	1.0
	Mother using alcohol and or drugs	1.0
	Maternal diabetes mellitus	0.37
	Gestational diabetes mellitus	0.59
	Pre-ecklampsy	1.0
Child related factors	Gender	0.35
	Prematurity (<32 weeks ≤ 1500 g)	1.0
	Childs ricketsia	0.26
	Twin	0.59
Sibling related factors	Family history of craniosynostoses	0.26
	Siblings with craniosynoatoses	1.0

Table 2 – Clinical characteristics of 121 non-syndromic single suture craniosynostosis patients.

	Number (%)
Gender	
Male	94 (78)
Female	27 (22)
Age[a]	
Mean	21.6 months
Range	1 months–127 months
Craniosynostosis	
Sagittal	89 (74)
Coronal	11 (9)
Metopic	14 (11)
Lambdoid	7 (6)
Gestational problems	
Gestational diabetes	9 (7)
Twins	7 (6)
Maternal diabetes	2 (2)
Pre-eclampsy	3 (2)
Premature	3 (2)
IVF	2 (2)
Family history of N-SSSC	2 (2)
Rickets	2 (2)
Chromosomal changes	2 (2)

Abbreviations: IVF – in vitro fertilisation; N-SSSC – non-syndromic single suture craniosynostosis.
a At the time of MRI imaging.

Table 3 – Clinical characteristics of 18 non-syndromic single suture craniosynostosis patients with brain MRI findings.

	Number (%)
Gender	
Male	16 (89)
Female	2 (11)
Age[a]	
Mean	33.5 months
Range	2–116 months
Craniosynostosis	
Sagittal	12 (67)
Coronal	3 (17)
Metopic	1 (5)
Lambdoid	2 (11)
Gestational problems	
Maternal diabetes	1 (5)
Papilla edema[b]	1 (5)
Rickets	1 (5)
Chromosomal changes	1 (5)

a At the time of MRI imaging.
b Optic disc swelling caused by elevated intracranial pressure.