



Quantitative evaluation of facial growth in children after unilateral ESS for subperiosteal orbital abscess drainage[☆]



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ARTICLE INFO

Article history:

Received 7 January 2015

Received in revised form 16 February 2015

Accepted 17 February 2015

Available online 24 February 2015

Keywords:

Endoscopic sinus surgery

Subperiosteal orbital abscess

Mid face

Change

Children

ABSTRACT

Objective: To determine the effects of unilateral endoscopic sinus surgery (ESS) on facial skeletal growth in children.

Design: Retrospective controlled study.

Setting: Academic tertiary referral medical center.

Materials and methods: Included were children who underwent a unilateral ESS procedure between 1995 and 2006 to evacuate a subperiosteal orbital abscess (SPOA) and several years later went through cephalometric measurements comparing their facial development between the surgical and nonsurgical sides.

Results: A total of 6 children were recruited for this study (3 girls and 3 boys), between the ages 3 to 10 at time of surgery, and from 9.5 to 23 years of age today. Four of the children had surgery on the right side and 2 on the left. No statistically significant difference was found when evaluating all planes in the cephalometric radiographs according to age at surgery, age today and years from surgery.

Conclusion: In our study, no significant differences were found in craniofacial growth between the sides of the face in children who underwent ESS for the same medical indication on one side of the face, suggesting that ESS might be safely performed even in young children.

Level of evidence: –2c

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1. Introduction

Insufficient reports and animal studies have raised concerns and debate regarding the impact of surgical intervention of the nasal sinuses on facial development in the pediatric population [1–8]. Most of these studies were conducted on piglets, showing interruption of facial growth on the side of the endoscopic surgery. However, the animals did not show any clinical evidence of abnormal growth [9,10]. The effects of sinus surgery on facial growth in human beings has been even less frequently reported due to the significant quantity of parameters to be evaluated

including patient age, the various pathologies treated, the surgical procedure performed and the need for further imaging for accurate evaluation of the facial skeleton post-surgery. For example, Kosko et al. reported maxillary sinus hypoplasia on CT scan after endoscopic sinus surgery (ESS), but with no apparent clinical facial asymmetry [11]. In addition to this, very aggressive surgical management of mid-face lesions was not associated with interruption of facial growth as was suggested by Lund et al. [12]. In another study conducted by Wolf et al., no evidence of facial growth interruption was reported; however, these two latter studies did not perform accurate measurements of the facial skeleton.

The purpose of this study is to evaluate the effect of extensive unilateral removal of the ethmoid cells and the lamina papyracea by ESS on mid-facial growth in a unique group of children having a subperiosteal orbital abscess (SPOA), and compare this to the non-operated side using antero-posterior (AP) cephalometric radiographs (soft tissue and bone intensity).

2. Materials and methods

The study was approved by the IRB.

[☆] There is no direct or indirect commercial financial incentive associated with publishing the article; there is no extra-institutional funding; there are no possible conflicts of interest; there are no sources of financial support, corporate involvement, patent holdings, etc. for our research/study; and there is no ethical problem.

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The study population consisted of children who underwent ESS for drainage of an SPOA between the years 1995 and 2006. Children with significant congenital syndromes such as Down's syndrome and cystic fibrosis [13], a history of significant maxillofacial trauma, nasal fractures, or previous nasoseptal surgery were excluded. All children underwent a CT scan demonstrating sinusitis and an SPOA. All ESS procedures for drainage of the abscess were performed by the same surgeon, using the same approach and technique.

2.1. Surgical procedure

ESS was performed using 4-mm 0° and 30° telescopes under general anesthesia. The lamina papyracea was completely exposed and removed after removal of the uncinate process, bulla ethmoidalis and anterior and posterior ethmoid cells. A small pack was left in the middle meatus until the following morning [14].

2.2. Patient evaluation

All patients were contacted for initial assessment by phone for collecting epidemiologic data, including queries regarding any imaging modality of the head region performed since the ESS procedure.

The next step was to invite the child (and his parents when appropriate) for medical history, including nasal history, face trauma and additional surgery in the sinuses and nose along the years, and a complete head and neck examination at the outpatient clinic. An informed consent was provided by the patient (or his parents when appropriate).

2.3. Cephalometric radiography and measurement

All patients had an AP cephalometric radiograph for evaluation of any asymmetry between the two sides of the face.

The cephalometric images are the 2D interpretation of 3D structures. In cephalometry, the X-ray source was fixed at a distance of 152.4 cm from the mid sagittal plane, and the film was placed at a distance of 15 cm from the mid sagittal plane. The ear rods were inserted into the external auditory canals, while the Frankfort plane was parallel to the floor. The central X-ray beam penetrated the patient's skull in an AP direction and bisected the trans-meatal axis perpendicularly. In lateral and frontal cephalograms, many structures overlap as complex 3D structures are projected on a 2D plane. The magnification and distortion inherent in conventional radiography make it difficult to accurately assess the patient's anatomy [15]. The properly adjusted cephalostat cannot prevent a slight translation or rotation of the mid-sagittal plane. These variations in skull position may lead to variations in cephalometric measurements.

One investigator (blinded to the side of operation) evaluated 7 reference points on the cephalometric radiograph and compared the two sides of the face. Cephalograms were traced and measured by hand, and all measurements made by one investigator. Five transverse linear measurements were measured on each radiograph. These are shown in Fig. 1 (see legend for definitions of abbreviations).

The linear transverse measurements used in the study were as follows:

Our 4 anatomic landmark reference points used for the measurements (Fig. 1):

1. MO – medio-orbitale – the point on the medial orbital margin that is closest to the median lane (left and right);

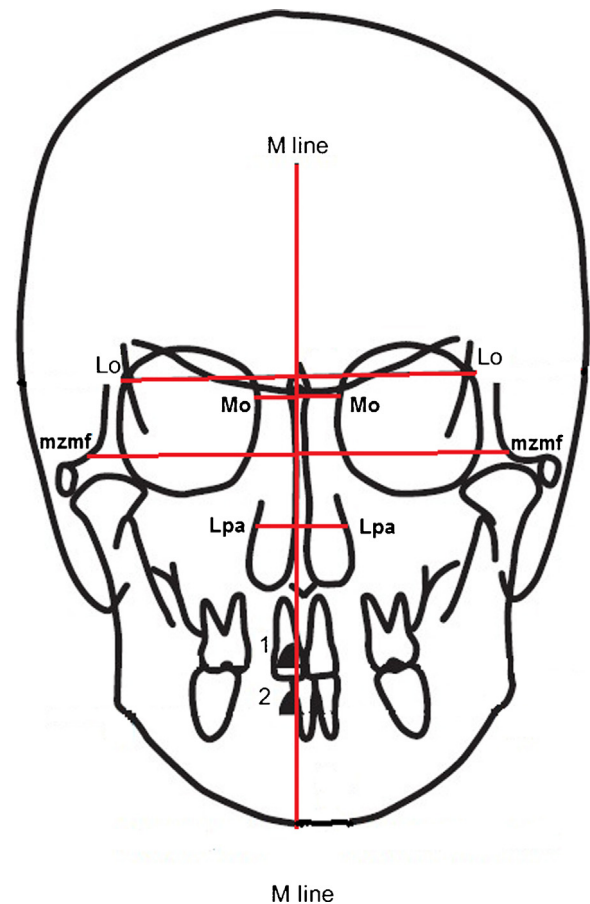


Fig. 1. Illustration of the five transverse linear measurements.

2. LO – latero-orbitale – the intersection of the lateral orbital contour with the innominate line (left and right);
3. LPA – lateral piriform aperture – the most lateral aspect of the piriform aperture (left and right);
4. ZFMA – zygomatico-frontal medial suture point – point at the medial margin of the zygomatico-frontal suture (left and right).

The midsagittal plane (the 5th plane), from which all other planes were calculated was drawn through:

Top: OM – orbital midpoint – the projection on the line LO–LO of the top of the nasal septum at the base of the crista galli;
TNS – top nasal septum – the highest point on the superior aspect of the nasal septum;
Bottom: ANS – anterior nasal spine.

2.4. Statistical evaluation

Categorical variables were reported as frequency and percentages, and continuous variables as medians and inter-quartile ranges (IQR). We used the Wilcoxon test to study the difference between the two sides of the face, using the four variables measured. Spearman Correlation Coefficient was used to assess the correlation between age at surgery, age at evaluation, time of follow up and the difference between the measurements of the two facial sides. A two-tailed $p < 0.05$ were considered statistically significant. Analyses were performed with SPSS version 21.

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