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Changes of maxillary sinus volume and bony thickness of the paranasal sinuses in longstanding pediatric chronic rhinosinusitis

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Summary

Objectives: To evaluate the chronic bony changes in the paranasal sinuses of longstanding chronic rhinosinusitis (CRS) in pediatric patients and to compare them with normal controls.
Study design: A single-institution retrospective analysis.
Method: Thirty 15- and 16-year-old children with longstanding CRS, for more than 2 years, despite maximal medical treatment and had a Lund CT score over 20 were enrolled as the CRS group. They were compared with 45 age and gender matched randomly selected normal controls without CRS. No enrolled patient had a history of nasal or adenoid surgery. The volume of the maxillary sinus was measured using a three-dimensional CT reconstruction program (V-works^{TM} 4.0). The bony thickness of the maxillary (MS) and ethmoid sinuses (ES) and the middle turbinate (MT) was measured and compared. In addition, we evaluated the effect of disease duration on the sinus volume and bony thickness.
Results: The mean volume of the MS was $22.5 \pm 4.4\,cm^3$ in the normal group and $20.0 \pm 4.1\,cm^3$ in the CRS group; this difference was statistically significant ($p = 0.02$). However, there was no correlation found between the disease duration and maxillary sinus volume ($r = -0.07$, $p = 0.69$). The mean thicknesses of the bony walls were 1.0 ± 0.4 mm (MS), 0.8 ± 0.4 mm (ES) and 1.8 ± 0.5 mm (MT) in the normal group and 1.2 ± 0.3 mm (MS), 1.2 ± 0.4 mm (ES) and 2.4 ± 0.5 mm (MT) in the CRS group; these differences were significant ($p < 0.01$). In addition, the bony

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thickness of the ES was significantly correlated with the duration of symptoms ($r = 0.44$, $p = 0.03$).
Conclusion: The volume of the maxillary sinuses decreased and the bony thickness of the paranasal sinuses increased with longstanding pediatric CRS.

1. Introduction

The common cold is a frequent cause for medical visits in children. In about 5—10% of cases of the common cold in children, there is the additional complication of rhinosinusitis. Although most cases of acute rhinosinusitis in children spontaneously resolve, many children develop chronic rhinosinusitis despite adequate medical treatment [1].

In some cases refractory to maximal medical treatment, surgical treatment is needed. However, ENT specialists are hesitant to pursue a surgical solution. This is because of the risk for injury to normal mucosa and the development of postoperative synechiae or granulation in pediatric patients with CRS. In addition, a specific diagnosis and follow up care may be difficult. Postoperative dressing can be hard to maintain. Moreover, sinus surgery may affect facial bone growth. Such concerns cause surgeons to think twice about a surgical solution for CRS in pediatric patients [2,3]. However, Senior et al. [4] and Bothwell et al. [5] reported that there was no difference in facial bone growth between pediatric CRS patients who underwent endoscopic sinus surgery (ESS) and children who did not have this type of surgery. Due to the above concerns, many ENT clinicians and textbooks recommend adenoidectomy instead of ESS for surgical treatment of pediatric CRS. However, recent studies suggest that ESS is a more effective treatment for pediatric CRS than adenoidectomy [6,7]. On the other hand, there are few studies evaluating whether longstanding pediatric CRS, refractory to medical treatment, may affect facial bone growth without surgical treatment. If longstanding pediatric CRS itself affects facial bone growth or causes other bony change [8,9], surgery may be required when continued medical approaches are ineffective. Therefore, we evaluated the difference in sinus volume and bony thickness between patients with longstanding pediatric CRS and normal controls.

2. Materials and methods

Between 1995 and 2005, 15- and 16-year-old children who had a history of longstanding CRS, over 2 years, and had a Lund CT score greater than 20 at the

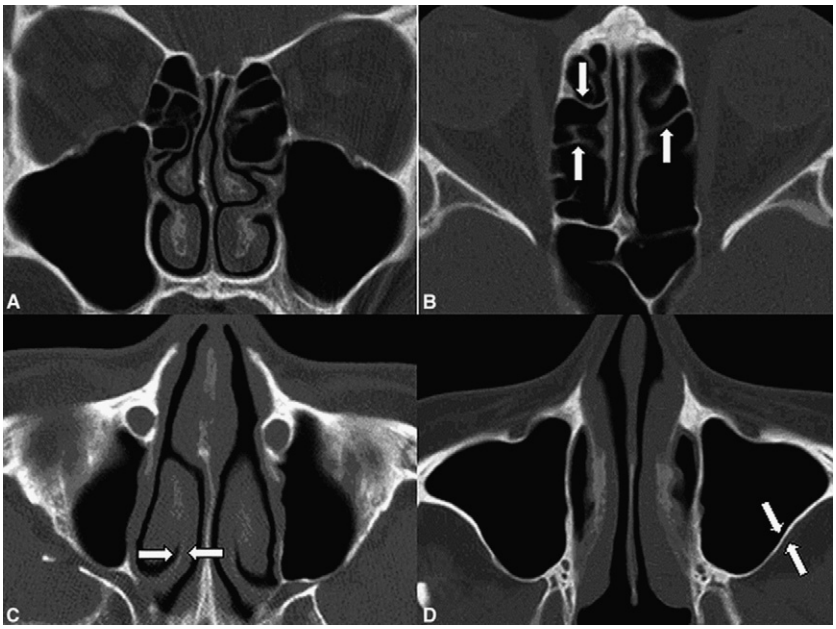

Fig. 1 CT scans used to measure the bony thickness of the paranasal sinus (A) the coronal section shows normal thickness of bones surrounding the paranasal sinuses, (B) bony thickness of three randomly selected bony septa in the ethmoid sinus was measured, (C) the bony thickness at the mid-point of the middle turbinate, and (D) bony thickness of the posterolateral wall of the maxillary sinus was measured in the axial section showing the largest dimension.