Changes of Maxillary Sinus Volume and Bony Thickness of the Paranasal Sinuses in Longstanding Pediatric Chronic Rhinosinusitis

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Backgrounds and Objectives
In the previous article, sinus surgery may affect facial bone growth. Such concerns cause surgeons to think twice about a surgical solution for CRS in pediatric patients. Although some reports suggested that endoscopic sinus surgery was not related with facial growth retardation, 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, 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.

Materials and methods
Between 1995 and 2005, 15 and 16 year-old boys who had a history of longstanding CRS, over two years, and had a Lund CT score greater than 20 at the Samsung Medical Center were enrolled. Medical histories of the selected patients were reviewed retrospectively. CRS was determined clinically and was defined as the presence of a combination of symptoms. All subjects who had a history of any nasal or adenoid surgery or maxillofacial trauma were excluded from this study.

The bony thickness of the paranasal sinus was assessed based on the CT scan images at the bone setting in both groups. The evaluation of bone thickness included the following: (1) for the maxillary sinus, at the mid-point of the posterolateral bony wall, in the axial section at the greatest dimension of the maxillary sinus; (2) the ethmoid sinus, including the mean bony thickness of three randomly selected bony septa and (3) the middle turbinate, at the mid-point of the middle turbinate, in the axial section, with the longest middle turbinate (Fig. 2). Other sinuses and the inferior turbinate were not examined due to the difficulty of determining the normal ranges at these sites.

The volume of the maxillary sinus was measured in the CRS and normal groups with a 0.625 mm-slice high-resolution CT scan using the bone setting. Three-dimensional images were reconstructed on a personal computer with V-works™ 4.0 software (CyberMed, Seoul, Korea).

The volume of the maxillary sinus in the controls was 23.96 ± 4.13 ml and that in the CRS group was 21.68 ± 4.54 ml (Fig. 3). The difference between the two groups was statistically significant (P = 0.04). However, a correlation between the duration of symptoms and maxillary sinus volume was not observed.

The mean bony thicknesses of three parameters in CRS group were significantly increased more than that of normal controls (P ≤ 0.01) (Fig. 4). In addition, the bony thickness of the ethmoid sinus had a significant correlation with the duration of symptoms (r = 0.40, P = 0.03; Fig. 5). However, the maxillary sinus and the middle turbinate showed no correlation with the duration of symptoms (P > 0.05).

Conclusion
Longstanding CRS in children refractory to medical treatment results in reduced sinus volume and hyperostosis. Chronic inflammation around the bones in the sinuses may make the prognosis worse. As the duration of sinusitis increases hyperostosis of the paranasal sinus becomes more severe. Therefore, in children with CRS refractory to medical treatment, surgery should be considered.

References

Results

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Figure 1. Anterior view of left maxillary sinus reconstructed by V-works™ 4.0

Figure 2. CT scans used to measure the bony thickness of the paranasal sinus. (A) The Coronal section shows normal thickness of bone 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. (D) Bony thickness of the posterolateral wall of the maxillary sinus was measured in the axial section showing the largest dimension.

Figure 3. Comparison of maxillary sinus volume in both groups

Figure 4. The bony thickness of the paranasal sinus or turbinate in both groups. MS, maxillary sinus; ES, ethmoid sinus; MT, middle turbinate.

Figure 5. Correlation between duration of symptoms and ethmoid bony thickness

Figure 4. Longstanding CRS in children refractory to medical treatment results in reduced sinus volume and hyperostosis. Chronic inflammation around the bones in the sinuses may make the prognosis worse. As the duration of sinusitis increases hyperostosis of the paranasal sinus becomes more severe. Therefore, in children with CRS refractory to medical treatment, surgery should be considered.

References