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Relationship between pediatric sinusitis and middle turbinate pneumatization—ethmoidal sinus pyocele thought to be caused by middle turbinate pneumatization

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Summary

Objective: To investigate whether the presence of pediatric middle turbinate pneumatization causes narrowing of the ostiomeatal complex (OMC) and is associated with the development of paranasal sinusitis.
Methods: CT scans of 190 nasal sides of 95 children (1—15 years old) were analyzed for the presence of middle turbinate pneumatization and mucosal thickness in the paranasal sinus.
Results: Middle turbinate pneumatization was detected in nine (4.6%) of the nasal cavities. Only one of these sides was in a patient younger than 10 years of age, while the other eight sides were in patients at least 13 years old. In six of those nine sides with pneumatization, paranasal sinusitis was also found. However, the images showed that in five sides the middle turbinate pneumatization itself did not obstruct the OMC. In addition, the mean $\pm$ standard deviation (S.D.) of the total score for the paranasal sinus opacification on the side which had the middle turbinate pneumatization was 5.67 ± 2.95. The corresponding value for the 76 sides without pneumatization was 5.29 ± 2.53, and the difference between these mean total scores was not statistically significant. However, in one side, the OMC was obstructed or narrowed due to the middle turbinate pneumatization, and an ethmoidal sinus pyocele formed on this side.
Conclusion: A causal relationship was not found between middle turbinate pneumatization and the mechanism of development of paranasal sinusitis in children. However, in the event that the OMU becomes obstructed at some time, frequent cycles of improvement and aggravation of pediatric paranasal sinusitis may occur and lead to the development of a serious condition.

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1. Introduction

Middle turbinate pneumatization develops as an air space extending from the middle turbinate basal plate to the curl on its free edge. Approximately 80% of cases of pneumatization occur in the superior nasal meatus, while the remaining roughly 20% occur in the middle nasal meatus. When middle turbinate pneumatization becomes large, it can cause narrowing or even obstruction of the natural opening of the middle nasal meatus, and it is thought that this can lead to the development of paranasal sinusitis or that the pneumatization itself can become an inflammatory lesion. It has been reported by Bolger et al. [1] that CT scan studies of the paranasal sinuses have found middle turbinate pneumatization in 50% of nasal sides. In addition, the rates of middle turbinate pneumatization were 53.6% in sides with chronic paranasal sinusitis and 53.0% in sides without any abnormality in the paranasal sinus, and the difference in these rates was not statistically significant. It has thus been argued that there is no clear involvement of middle turbinate pneumatization as a cause of the development of paranasal sinusitis. On the other hand, there have been no reports regarding investigation of the incidence of middle turbinate pneumatization and its relationship with chronic paranasal sinusitis in children. It has been reported that the overall incidence of middle turbinate pneumatization in children is 5—19%, which is lower compared with in adults [2—4]. However, the pathology of paranasal sinusitis in children differs from that in adults: it is characterized by repeated cycles of improvement and aggravation of the acute or subacute inflammation, and morphologically, as well, the paranasal sinus is in the developmental stage. Accordingly, compared with in adults, it is easy for the ostiomeatal complex (OMC) of children to be obstructed by the presence of middle turbinate pneumatization, and there have been reports that this is the cause of paranasal sinusitis [5,6]. Moreover, we have diagnosed cases of ethmoidal pyocele that we thought had been caused by middle turbinate pneumatization. This paper reports our investigation of the incidence of pediatric middle turbinate pneumatization and discusses the development of this pyocele.

2. Methods

The experimental subjects were 95 patients between 1 and 15 years of age. The sex ratio was 54:41 (male:female). Computed tomography (CT) scans were used to diagnose the presence of pediatric middle turbinate pneumatization. All paranasal sinus anomalies were identified and confirmed by a neuroradiologist. Most CT scans were performed at The Jikei University Hospital, and all were noncontrast studies. At The Jikei University Hospital the CT scans were performed with an Emotion Duo VA40C scanner using an algorithm for bone window imaging of 1.25-mm direct horizontal cuts. Coronal cuts were reconstructed with a Somaris/53D postprocessing VA40C. The side of interest in the middle turbinate was centered on the region around the natural opening to the maxillary sinus, which was observed for the presence or absence of pneumatization. In addition, at the same time CT images were analyzed for the presence or absence of paranasal sinus lesions. The diagnosis of paranasal sinusitis was based on the staging method of Lund and Mackay [7]. That is, each sinus group was graded between 0 and 2 (0: no abnormality; 1: partial opacification; 2: total opacification). The OMC was scored as 0 (not obstructed) or 2 (obstructed). The total score of each side was considered separately (0—12).

Statistical significance was performed by nonparametric Kruskal—Wallis one-way analysis of variance because the groups were unmatched. A p-value of less than 0.05 was considered statistically significant.

We informed a patient and her parents to publish this paper and obtained their consent.

3. Results

Paranasal sinusitis was detected in 82 of 190 sides of the 95 children. In all cases, the paranasal sinusitis appeared primarily as bilateral anterior ethmoidal sinus and maxillary sinus opacification. Middle turbinate pneumatization was detected in nine (4.6%) of those nasal cavities. One of these sides with pneumatization was in a patient who was 8 years old and is described in detail below, whereas the other eight sides were in teenage patients who were at least 13 years of age (Fig. 1). Three sides showed no paranasal sinus abnormality, while the opacification in paranasal sinus was observed in six sides of five patients. Staging of the paranasal sinus opacification on the side which had the middle turbinate pneumatization resulted in a mean total score of 5.67 ± 2.95. The CT images showed that in all eight sides the middle turbinate pneumatization did not obstruct the OMC. On the other hand, for the 181 sides which had no middle turbinate pneumatization, staging of the paranasal sinus opacification detected on 76 sides resulted in a mean total score of 5.29 ± 2.53. These data did not reveal a statistically significant correlation between the presence