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Korean J Otorhinolaryngol-Head Neck Surg 2014;57:27-31 / pISSN 2092-5859 / eISSN 2092-6529
http://dx.doi.org/10.3342/kjorl-hns.2014.57.1.27

Does Nasal Polyps Influence on the Location of Nasal Fontanelle?

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비용종이 비천문의 위치에 영향을 미치는가?

정용수 · 최지민 · 신동혁 · 김용운 · 정경화 · 조재훈 · 홍석찬 · 김진국

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Received August 1, 2013
Revised October 7, 2013
Accepted October 7, 2013
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Background and Objectives This study aimed to evaluate the relationship between the location of the nasal fontanelle and either the chronic rhiosinusitis with nasal polyp in middle meatus (NP) or the chronic maxillary sinusitis (CMS).

Subjects and Method We classified the subjects without any nasal septal deviation (<5°) into three groups: the normal control group, the CMS group (CMS without NP) and the NP group (CRS with NP). Both angles of nasal septum and fontanelle were measured by CT imaging and nasal cavities were counted as an individual side. We compared 96 CT scans of normal controls with 79 of CMS groups and 54 of NP groups. In case of discrepancy in the locations of both fontanelles on their CT scans, we reconstructed all the images to identify the fontanelle location. The lateral side on which the fontanelle was actually located was assigned the positive angle and the medial side the negative angle to determine the presence of fontanelle deviation. The normal range of the fontanelle deviation was established by the mean angle obtained from the normal group, which included 50% of each medial and lateral side.

Results The mean angles of the control group, the CMS group and the NP group were 1.34°, 3.47°, and 6.99°, respectively. A statistically significant relationship was noted between the control and NP group (p=0.001), but not between the control and CMS group, CMS and NP group (p=0.237 and 0.051, respectively).

Conclusion The nasal polyp in middle meatus influenced on the location of nasal fontanelle to lateral side compared to the normal controls.

Korean J Otorhinolaryngol-Head Neck Surg 2014;57:27-31

Key Words Chronic maxillary sinusitis · Fontanelle · Nasal polyp.

Introduction

The nasal fontanelle (NF), the portion without bony structures in the medial aspect of the maxillary sinus, was divided into the anterior and posterior fontanelles by the uncinate.[1] However, few anatomical studies have been conducted to depict and measure the NF because it could not be observed without removing the mucosal covering and because routine laboratory techniques for its removal often damaged the fine bony structures surrounding the NF. During middle meatal antrostomy, for instance, the uncinate process was first cut down, then the natural ostium was widened, and the nasal fontanelle was opened. In the variation such as laterally curved or flattened uncinate process, opening up of the maxillary sinus ostium became difficult, sometimes increased risk of orbital penetrations and therefore affected the outcome of the surgery and

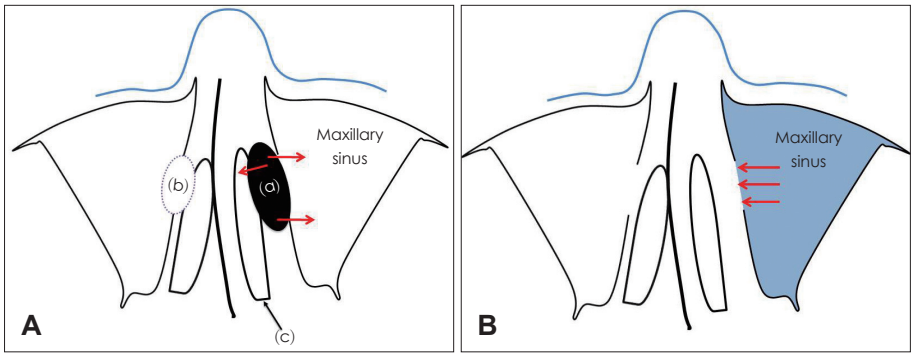

Fig. 1. How the nasal polyp (a) influenced on nasal fontanelle (b) and middle turbinate (c)(A). How the chronic maxillary sinusitis (blue color area) influenced on nasal fontanelle (B). Red arrows: direction of pressure.

could easily lead to complications.[2)]

We hypothesized that in middle meatus, there was so limited space to medial side which composed of bony structure that the nasal polyp would lateralize the fontanelle composed of mucosal structure and chronic maxillary sinusitis may influence on the medialization of fontanelle due to pressure induced by accumulation of discharge.

This study aimed to evaluate the relationship between the location of the nasal fontanelle and either the chronic rhiosinusitis with nasal polyp in middle meatus (NP) or chronic maxillary sinusitis (CMS)(Fig. 1).

Subjects and Method

Patients

We classified 127 subjects who had not had any nasal septal deviation (deviation $<5°$) into three groups: normal control group, chronic maxillary sinusitis group without nasal polyp (CMS group), and chronic rhinosinusitis group with nasal polyp in middle meatus (NP group). By means of CT image, the angles of both nasal septum and fontanelle were measured; and both sides of a nasal cavity were counted individually. We had compared 96 CT scans of normal controls with 79 CT scans of CMS groups and 54 CT scans of NP groups. The cases of septal deviation $\geq 5°$, fungal sinusitis, facial trauma and previous operation history were excluded.

CT image protocol

Rapidia 3D® ver. 2.8 (INFINITT, Seoul, Korea) was employed for three dimensional (3D) reconstruction system. In case of discrepancy in the locations of both fontanelles on their CT scans, we reconstructed all the CT scans to identify the fontanelle location for further measurement of its angle. Lateral side on which the fontanelle actually was located was assigned to positive angle, while medial side was to negative angle to determine the presence of fontanelle deviation. In case of both sides

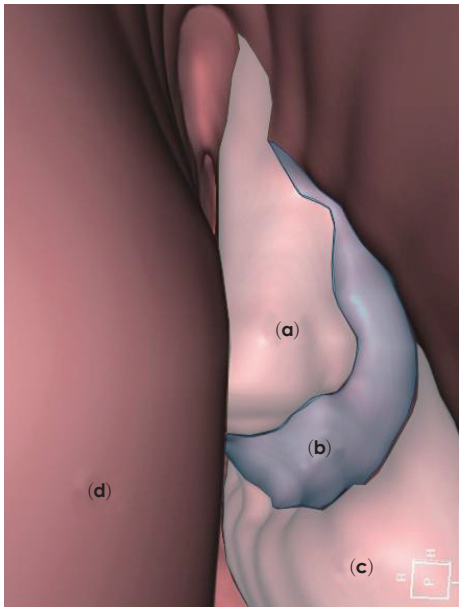

Fig. 2. Image of left nasal cavity by 3D-reconstruction. (a) was middle turbinate, (b) was nasal polyp, (c) was inferior turbinate and (d) was nasal septum. 3D: three dimensional.

of fontanelles was shown on different CT cuts, we rearranged the image by 3D reconstruction to be presented on the same view. If the borderline between a nasal polyp and fontanelle was not clear, endoscopic view of 3D reconstruction system was used to make it obvious (Fig. 2). Normal range of the fontanelle deviation was defined from the median of the range between the most medial and mean angle to the median of the range between mean and the most lateral angle (Fig. 3).

Position of fontanelle

The reference line was defined as line between midline of anterior dorsum and posterior nasal spine. The nasal fontanelle line was defined as line between anterior maxillary sinus medial bony margin and posterior medial bony margin. So the angle of nasal fontanelle composed of the reference line and the nasal fontanelle line (Fig. 4). There were no studies about clinical variation of nasal fontanelle, we defined that normal

range of nasal fontanelle angle was between 25% quartiles and 75% quartiles. And over the normal range, we defined as lateralization, below that, as medialization (Fig. 3).

Statistical analysis

Statistical analysis was performed using SPSS 17.0 (SPSS, Inc., Chicago, IL, USA). The chi-square tests with Bonferroni Post Hoc test were performed to analyze the different rate of fontanelle position among three groups. A value of $p \leq 0.05$ was considered statistically significant.

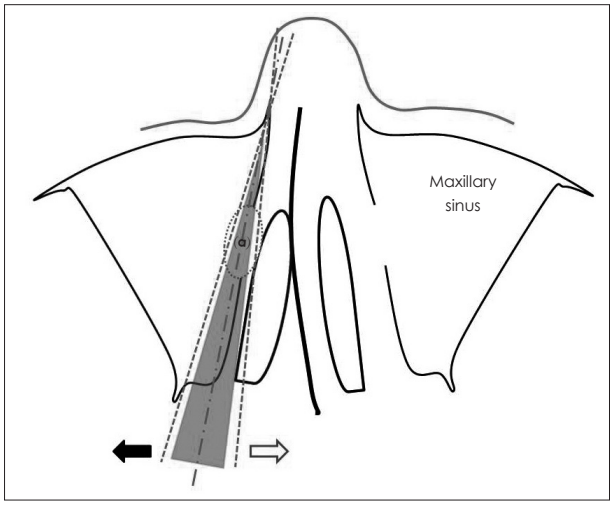

Fig. 3. The angle of fontanelle (gray triangular area) was evaluated. The lateralization was toward the black arrow above the range and the medialization was toward the white arrow below the range. (a) was imaginary area of fontanelle.

Results

Clinical presentations

Gender ratio of a normal control group was 22 : 74 (M : F) and mean age was 41.4 (18−75) years. The ratio was 38 : 41 and the mean age was 48.5 (18−73) years for CMS group, while the ratio was 36 : 18 and the age was 45.3 (18−77) years for NP group respectively (Table 1).

Angle of fontanelle

The mean angle was 1.34° (−9.31−13.69°) in normal control group, 3.47° (−27.05−41.33°) in CMS, and 6.99° (−12.98−27.79°) in NP group respectively (Table 2).

Set-up normal range of fontanelle position

Normal range of angle between nasal fontanelle and nasal septum has not been reported yet, thus we have set it from the

Table 2. The comparison of mean angle between groups

Groups	Angle ranges (°)	Mean angle (°)*
Normal (n=96)	−9.31−13.69	1.34±5.67
CMS (n=79)	−27.05−41.33	3.47±9.96
NP (n=54)	−12.98−27.79	6.99±9.53

*mean±SD. CMS: chronic maxillary sinusitis, NP: chronic rhinosinusitis with nasal polyp in middle meatus

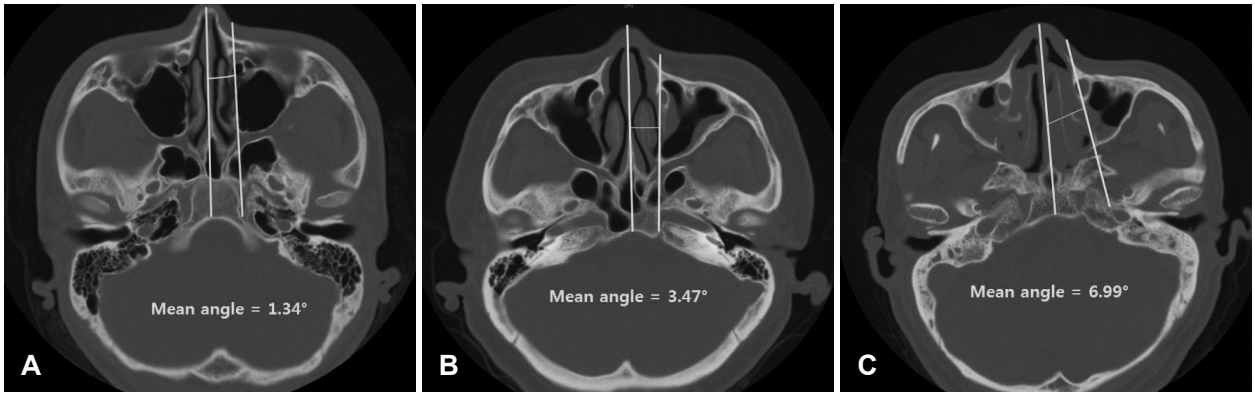

Fig. 4. Representative image of each group was shown for evaluation of angle between reference line and fontanelle line. The mean angle of each group was presented. Normal group (A). CMS group (B). NP group (C). CMS: chronic maxillary sinusitis, NP: chronic rhiosinusitis with nasal polyp in middle meatus.

Table 1. Characteristics of subjects

Groups	Age ranges (y)	Mean age (y)*	Gender	
			M	F
Normal (n=96)	18−75	41.4±17.10	22/96 (22.9%)	74/96 (77.1%)
CMS (n=79)	18−73	48.5±16.93	38/79 (48.1%)	41/79 (51.9%)
NP (n=54)	18−77	45.3±13.57	36/54 (66.7%)	18/54 (33.3%)

*mean±SD. CMS: chronic maxillary sinusitis, NP: chronic rhiosinusitis with nasal polyp in middle meatus

Table 3. The comparison of fontanelle-positions between groups

	Normal	CMS	NP	Total
Lateralization	23 (24.0%)	28 (35.4%)	30 (55.6%)	81 (35.4%)
Normal	48 (50.0%)	35 (44.3%)	14 (25.9%)	97 (42.3%)
Medialization	25 (26.0%)	16 (20.3%)	10 (18.5%)	51 (22.3%)
Total (n)	96	79	54	229

Post-Hoc test *p*-value: Normal-NP: 0.001, Normal-CMS: 0.237, CMS-NP: 0.051. CMS: chronic maxillary sinusitis, NP: chronic rhinosinusitis with nasal polyp in middle meatus

data obtained in normal control group. It has been set up from −2.43° to 5.90°, which was assumed by 50% of both medial and lateral side laying stress on the point of 2.06°, a mean angle of normal control group (−9.31° to 13.69°). We also classified the data into lateralization, normal and medialization group by means of the standard angle we had obtained (Table 3).

Position of fontanelle

In control group, lateralization, normal and medialization group showed 23, 48 and 25 sides respectively. Also 28, 35 and 16 sides respectively in CMS group and 30, 14 and 10 sides in NP group were obtained from the data. The lateralization of NP group was 55.6%, which indicated statistically significant gap with 24.0% in normal control group, and medialization of CMS group was 20.3% which did not have statistical significance comparing with normal control group, 26.0%. Other data did not have any statistical significance (Fig. 5).

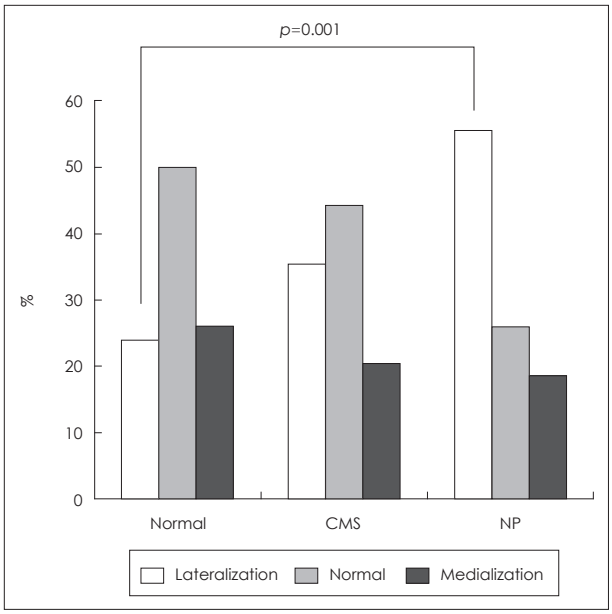

Fig. 5. A statistically significant relationship was noted between the control and NP group (p=0.002) that the nasal polyp in middle meatus influenced on the location of nasal fontanelle to lateral side compared to the normal controls. CMS: chronic maxillary sinusitis, NP: chronic sinusitis with nasal polyp in middle meatus.

Discussion

The first advantage of this study was the first trial that evaluated the location change of fontanelle in nasal polyp and CMS. We have figured out that nasal polyp would significantly lateralize the position of fontanelle by mass effect in comparison with normal group (p=0.001). We hypothesized that chronic maxillary sinusitis may influence on the medialization of fontanelle due to pressure induced by accumulation of discharge. Making a comparative study of CMS and normal control group, there were no difference of fontanelle position between CMS and normal control group (p=0.237), so was between CMS and NP group (p=0.051). In the result, it is considered that maxillary sinusitis does not have much influence on the medialization of fontanelle.

The second advantage of this study was the information of surgical anatomy. There were so many methods introduced about uncinectomy and middle meatal antrostomy.[2-4] It is explained for the purpose making less complication such as orbital complication,[5] it is indirect expression of variety of anatomic locations proceeding uncinectomy and middle meatal antrostomy.[6,7] The present study suggested that the change of fontanelle location is a certain cause making surgery difficulty such as anatomic variants. For example, when the nasal fontanelle was lateralized after removing middle meatal polyp, the uncinectomy was more trouble due to nearby lamina papyracea and the short range of backtbiter. Thus more attention is required when middle meatal antrostomy would be performed to the patients with NP, since there is quite a possibility that fontanelle may be located laterally.

There are some limitations to this study. First, to analyze the influence of nasal polyp on the position of fontanelle, it is appropriate to analyze patients with nasal polyp who do not have sinusitis. However, because there were few who fit them, we chose chronic rhinosinusitis group with nasal polyp to analyze the tendency of effect of nasal polyp on the position of fontanelle. Second, in NP group, rhinosinusitis included a maxillary sinus or other sinuses. Because it was reported that osteomeatal complex obstruction is not associated with adjacent sinus disease in chronic rhinosinusitis with polyps,[8] it is considered that other sinusitis except maxillary sinusitis may not have influence on the position of fontanelle. Further study is necessary to this subject.

Acknowledgments

This research was supported by the Small and Medium Enterprises (SME) Convergence Technology Development Program of the Small and Medium Business Administration of Korea (S2098563).

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