Evaluation of Anatomic Variations of Paranasal Sinuses

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Abstract

Nowadays, CT-scan is used as a diagnostic modality for evaluating the Paranasal sinuses with extraordinary superiority in comparison with radiography.

In this study, 292 CT-scan cliché samples were collected for evaluating the anatomic variations and their prevalence. These patients were between 15-50 years old and they didn't have any pathology in their sinuses.

According to the results, the septal deviation (34.24%) was the most common and normal variation and the other cases were sequentially as follow:
1- Agger Nasi cell (36.22%), 2- Concha bullosa (15.90%), 3- Hypo plastic frontal sinus (6.24%), 4- Aerated Septum (2.62%), 5- Haller cell (1.41%), 6- Onodi cell (0.40%)

The theory was set forth for discussing the relation between septal deviation and Concha bullosa. This theory was focused on the existence of Concha bullosa in one side that increase the plausibility of Septal deviation toward the opposite side (P-value<0.001).

INTRODUCTION

The Paranasal CT-scan is used for examining the patients with sinusitis and its complications, because of the normal variations of Paranasal sinuses that have a constant role in etiology of the chronic and recurrent sinusitis. Also there are anatomic variations in CT-scan of patients that do not have any sinusitis clinical symptoms. The plausible pathogeneses prevalence and the clinical symptoms of anatomic variations are under study and investigations.

The purpose of this study was to investigate the normal variations prevalence both generally and also considering male and female cases separately .Besides, this study was underlined the importance of using the statistical information in further studies in the field of the relation between anatomic variations and chronic or recurrent sinusitis and its complications.

The hypothesis was set forth for discussing the relation between septal deviation and Concha bullosa, thus, the existence of Concha bullosa in one side, lead to septal deviation toward the opposite side. Furthermore, this research could be expand byconsidering the size of Concha bullosa in complementary studies due to that the bigger size of Concha bullosa, the more plausibility of septal deviation toward the opposite side.

METHODS

The CT-scan clichés of the paranasal sinuses were collected from patients that were referred to Imam Hospital of Tabriz university of Medical sciences, between July 2006 and April 2007.

This research was based on a cross-sectional study and after the pilot studies on 50 CT-scan cliché cases, this sample size was selected. There were 292 participants in this study, 146 male and 146 female, equally.

The average age of the participants was 31 years old. The patients who had the positive pathology such as sinusitis, polyp, tumor, fractures and those who were under 15 years old were eliminated.

CT-scan checklist was considered as the control and evaluating method. Also, the patient's age, sex and symptoms were registered in the checklist. The anatomic variations such as Agger Nasi cell, Concha bullosa, Haller cell, Onodi cell, Nasal septal deviation, aerated septum and hypoplastic frontal sinus were evaluated in the CT-scan

clichés.

SIEMENS scanner was used to prepare the coronal and axial section with 3mm thickness at 8mm spaces and in Osteomeatal complex area with 2mm thickness at 4mm spaces, from glabella to Dorsum sella.

Excel software was used to analyze the statistical data.

The theory of the simultaneous existence of Concha bullosa and Septum deviation in the opposite directions was evaluated by the Fisher exact test and the p-value considered <0.001.

RESULTS

There were 292 participants in this study, 146 male and 146 female, equally. The average age of the participants was 31 years old.

According to the results, the septal deviation (34.24%) was the most common normal variation and the other cases were sequentially as follow:

1- Agger Nasi cell (36.22%), 2- Concha bullosa (15.90%), 3- Hypoplastic frontal sinus (6.24%), 4- Aerated Septum (2.62%), 5- Haller cell (1.41%), 6- Onodi cell (0.40%).

Table 1 and 2 illustrate the result of the anatomic variations prevalence between male and female participants.

Figure 1

Table 1: The anatomic variations prevalence between male and female

Anatomic variation	Male	Female
Nasal septal deviation	39%	35.29%
Agger Nasi cell	38.22%	34.3%
Concha bullosa	14.67%	17.23%
Hypoplastic frontal sinus	3.86%	8.82%
Aerated septum	2.7%	2.52%
Haller cell	1.16%	1.68%
Onodi cell	0.39%	0.42%

Figure 2

Table 2: The anatomic variations prevalence between male and female

Anatomic variations	Male	Female	Total
Nasal septal deviation	101	84	185
Agger Nasi cell	99	81	180
Concha bullosa	38	41	79
Hypoplastic frontal sinus	10	21	31
Aerated septum	7	6	13
Haller cell	3	4	7
Onodi cell	1	1	2

In this study there were 5 cases of unilateral left-sided septal deviation and Concha bullosa, 22 cases of left-sided septal deviation and right-sided Concha bullosa and 10 cases were vise versa. So, there was the strong association between the existence of Concha bullosa and septal deviation in the opposite directions due to the P-value <0.001(P-value= 0.0000086).

DISCUSSION

The statistics of anatomic variations prevalence were presented differently in various studies that it could be the result of discrepancies in analyzing and studying methods, definitions, racial varieties and the accuracy of studies according to CT-scan cut offs .

Table 3 illustrates different percentages of the Agger Nasi cell prevalence in several researches.

Figure 3

Table 3: The prevalence of Agger Nasi cell in different papers

Papers	Agger Nasi cell
Messerklinger (3)	10%-15%
Mosher (3)	40%
Davis (6)	65%
Van Alyea (3)	89%
Khon Kaen University (7)	95%
Zinreich (8)	98.5%

In addition to mentioned factors to understand them clearly we should consider that the Agger Nasi cell is near the 5 separate skull bone ([3]):

1- Lacrimal bone, 2- Maxillary bone, 3- Ethmoid bone, 4- Frontal bone, 5- Nasal bone.

Table 4 illustrates different percentages of the Concha bullosa prevalence in several researches.

Figure 4

Table 4: The prevalence of Concha bullosa in various papers.

Papers	Cocha bullosa
Lothrop (3)	9%
Davis (6)	8%
Schaeffer (3)	11%
Turner (3)	20%
Tan (10)	34%
Khon Kaen University (7)	29.1%

According to Lothrop's researches ([3]), the Concha aeration could be because of three reasons:

1- The anterior ethmoid cell originated from middle meatus

(55%)

2- The posterior ethmoid cell originated from upper meatus (45%)

3- The anterior ethmoid cell originated from frontal recess (5%)

Also, in some other CT-scan studies the Concha bullosa was reported in 33%-36% of patients that had chronic sinusitis. Another important point was that in high percentage of aerated Concha bullosa was as a result of considering any degree of aerated Concha and in lower percentages they just considered the bigger ones.

The Haller cells are diagnosed as a plausible etiologic factor in recurrent maxillary sinusitis as a result of the negative effects of ventilation. According to researches the Haller cell was reported:

- 45.9% in patients with chronic sinusitis complications (3)
- 41.6% in patients without any sinusitis symptoms (3)
- 30.9% in other cases (9)

These statistics do not have any significant discrepancy, so we should consider the pathogeneses of Haller cell by case-case method in maxillary sinusitis. For example the factors that should be consider are the presence of inflammation, the size of the Haller cell and its distance from maxillary sinus in pathogenesis cases.

Hypoplastic frontal sinus was detected in 18.5% of patients by Zinreich's study ($_{9}$). Also, in another study in Germany the hypoplastic

frontal sinus was seen in 2.9% of male and 5.6% of female patients($_{11}$) and in this study it was detected in 10.6% of patients (3.4% male and 7.2% of female.)

According to two studies, one in Fatih University in Turkey ($_{12}$) at 2003 (p-value <0.01) and also in Radiology department of New York University ($_{13}$) (p-value <0.001), the theory of the relation between unilateral Concha bullosa and contra lateral nasal septal deviation was plausible and in this study there was a strong relation, too (p-value = 0.0000086).

CONCLUSION

According to the results, nasal septal deviation was the most common anatomic variation and the Onodi cell was the rarest one, considering the male and female patients separately. Also, there was a strong correlation between the unilateral Concha bullosa and contra lateral septal deviation, which was meaningful based on the statistical studies.

The prevalence of septal deviation is more widespread in males than females, but in clinics it is conversely. So, it could be because of the high number of females with septal deviation that refer for septorhinoplasty.

Most of the anatomic variations were originated from aerial cells of ethmoid sinus.

Moreover, 90% of anatomic variations are septal deviation, Agger nasi cell and Concha bullosa.

Our results suggest that it could be detect a special relation between these variations and the specific pathologies by evaluating the prevalence of each of these anatomic variations in patients with specific pathologies like sinusitis. Furthermore, it could be mention that doctors should pay more attention to diagnose the existence of Concha bullosa and septal deviation in CT-scans, because of the high prevalence and accompaniment of these factors that could be consider as an etiology of chronic and recurrent sinusitis.

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