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Incidence of Concha Bullosa Variations and its Association with Para-Nasal Sinusitis in Benghazi Population Using Computerized Tomography

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A B S T R A C T

Background: Sinusitis is one of the most prevalent chronic illnesses in the paranasal sinuses caused by a disruption in the process of aeration and secretion drainage, which occurs at the maxillary sinus via the osteomeatal unit. Aim of the Study: The nasal septal deviation is mentioned in most textbooks as one of the causes of sinusitis because it blocks the drainage mechanism. In the thesis, we are looking at one of the possible normal variations at the nasal cavity, which in this case concha bullosa, and its relation to the para-nasal sinuses, whether it is considered causing para-nasal sinusitis or not, using multi-slice CT scan, which is the golden modality to assist the nasal cavity anatomical variation and to detect para-nasal sinusitis. Research Design: retrospective study was conducted on adult subjects with fully developed nasal and para-nasal sinuses . Setting: The research was conducted at Aljalah hospital, Benghazi. Tools: Using multi-slice Ct scan is the golden modality to detect nasal anatomical variation and para-nasal pathology in this case we are looking for sinusitis and concha bullosa and its variations. By case series study methodology collecting CT study done to the Para-nasal sinuses. Results: Regarding the demographic and clinical data in our study, 500 participants are included in our study 43 of them are under or equal 20 years old, 222 of them are between 21-40 years old, 171 of them are between 41-60 years old and 64 participants are over than 60 years old. 304 participants of our study are male and 196 are female.. Conclusion: early accurate diagnosis of patients with sinusitis must be the major goal of the physician while facing these cases from the first second to avoid the probable dangerous sequences. We also concluded that majority of our sinusitis cases are without concha bullosa and the is no strong association detected. also found that Concha bullosa side were 11.4% in the right side, 10.6% in the left side, 21.4% bilateral and 56.6% were absent. Concha bullosa lamellar were present in 126 patients and 374 were absent. Concha bullosa bulbouse were present in 60 patients and 440 were absent. Concha bullosa extensive were present in 29 patients and 471 were absent. Sinusitis were 4.6% in the right side, 4.6% in the left side, 18% bilateral and 72.8% were absent. Recommendations: paying attention to our findings while outlining the recent guidelines for management of these patients. In addition, further studies must be done to analyze all aspects of this issue.

Keywords: Sinusitis, Concha Bullosa, Nasal cavity, Multi-slice CT scan, Anatomical variation.

INTRODUCTION:

Sinusitis is one of the most common chronic pathologies in Para nasal sinuses due to defect at the process of aeration and draining of its secretions, which is at the maxillary sinus occur through the osteomeatal unit. At this thesis we are looking for the prevalence of the anatomical variation of the nasal cavity middle turbinate (Concha Bullosa) and its effect on patency of Para-nasal sinuses. The nasal cavity is a central airway tract extending from the nasal ala to the choana, divided by the nasal septum. It is surrounded by sinuses and intricate drainage routes, connecting various sinuses and air tubes [1-4].

The ethmoturbinals, a group of folds on the lateral nasal wall that mark the beginning of the paranasal sinuses, first form around the ninth week of pregnancy. Six to seven folds appear initially, but after regression and fusion, only three to four remain [5].

- First ethmoturbinal they're rudimentary and deficient in humans. The thrusting portion forms the agger nasi descending portion forms the uncinate process.
- Alternate ethmoturbinal it forms the middle turbinate [6].

As development process on going, grooves form between these ethmoturbinals, which forming rudimentary meati and recesses. The frontal sinus developed from the pneumatization at the anterior aspect of the frontal recess into the frontal bone. The frontal sinus cannot be seen until the age of 5 to 6 years old [7].

The sphenoid sinus begins to pneumatize around the sixth or seventh year of life. The anterior clinoids and pterygoid process have fully pneumatized by the time a child reaches the age of twelve. In the tenth week of intrauterine development, the maxillary sinus begins to form. During the eleventh

week of development, the ethmoid infundibulum invaginations towards the mesenchyme combine to produce a single oval cavity with smooth walls, the primordium of the maxillary sinus [7].

The sixteenth week is when the sinus ossification begins. At ages 3 and 7 to 18 the maxillary sinus exhibits a biphasic growth pattern. At birth, the ethmoid sinuses consist of three to four air cells. When a person reaches adulthood, they are made up of 1 to 15 aerated cells [5].

Aim of the study:

The nasal septal deviation is mentioned in most textbooks as one of the causes of sinusitis because it blocks the drainage mechanism. In the thesis, we are looking at one of the possible normal variations at the nasal cavity, which in this case concha bullosa, and its relation to the para-nasal sinuses, whether it is considered causing para-nasal sinusitis or not, using multi-slice CT scan, which is the golden modality to assist the nasal cavity anatomical variation and to detect para-nasal sinusitis.

Subjects and Methods

A- Technical Design:

1. Setting: This study was conducted at the radiological department of Aljalah hospital, Benghazi.

2. Population or Subjects: Our study was conducted on adult subjects with fully developed nasal and para-nasal sinuses in Aljalah hospital, Benghazi and their status fulfilled the inclusion and exclusion criteria.

3. Inclusion criteria / exclusion criteria:

A. Inclusion criteria:

- Age more than 18 years old.
- Both sexes.
- Patients having no history of previous nasal or para-nasal severe injury or intervention.

B. Exclusion criteria:

- Age less than 18 years old.
- Patients having with history of previous nasal or para-nasal severe injury or intervention.
- Poor image quality (Ex. Motion artifact).

4. Study Design: The study was a retrospective study.

5. Sample size: 500 cases.

B-Operational Design:

i. Process: Using multi-slice Ct scan is the golden modality to detect nasal anatomical variation and para-nasal pathology in this case we are looking for sinusitis and concha bullosa and its variations .By case series study methodology collecting CT study done to the Para-nasal sinuses in Aljalah hospital Benghazi with no history of previous nasal or para-nasal sever injury or intervention then assessing each case to detect the anatomical variation and if there associated sinusitis.CT Scan 128 slices GE Optima was considered as one of advanced machine for CT imaging thin slice thickness.The study reviewed 3D, sagittal and axial views in bony windows of all CT scan films using Picture Archiving Communication System (PACS) software and DICOM viewer radiant.

ii. The main consideration in this study were : to detect which type of conch bullosa (concha bullosa lamellar, concha bullosa bulbouse and concha bullosa extensive) and sinusitis .

iii. Time line: Over a period of 2 years (august 2017 and august 2019) .

iv. Obstacles/limitations of study: Limited image quality due motion or other causes of artifact .

C-Administrative Design:

Approval was taken from the research ethical committee. The work was carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Results:

Data collected throughout history, basic clinical examination, laboratory investigations and outcome measures coded, entered and analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 20.0) (Statistical Package for the Social Sciences) software for analysis. Qualitative data was represented as number and percentage. Data was collected and submitted to statistical analysis.

Table (1): Age distribution of the study population.

Qualitative data are represented as frequencies and relative percentages.

Age (years)	Cases (n=500)	Percentage
⩽20	43	8.6%
21-40	222	44.4%
41-60	171	34.2%
>60	64	12.8%
Total	500	100%

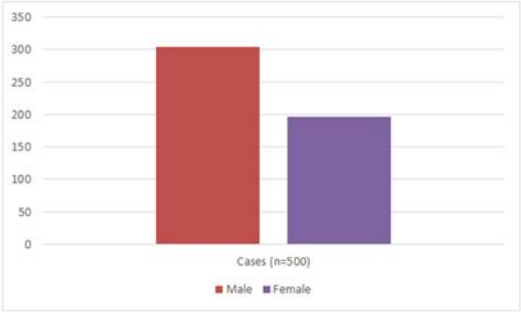

Figure (1): Sex distribution of the study population.

Qualitative data are represented as frequencies and relative percentages.

As shown in figure (1), 304 participants of our study are male and 196 are female.

Table (2): Distribution of Concha bullosa side of our participants.

	Concha bullosa side	Percentage
Right side	57	11.4%
Left side	53	10.6%
Bilateral	107	21.4%
No	283	56.6%
Total	500	100%

Regarding table (2) we found that Concha bullosa side were 11.4% in the right side, 10.6% in the left side, 21.4% bilateral and 56.6% were absent.

Table (3): Distribution of Concha bullosa types of our participants.

Type	number of cases	percentage
Concha bullosa lamellar	126	25.2%
Concha bullosa bulbouse	60	12%
Concha bullosa extensive	29	5.8%
No concha bullosa	285	57%

Table (3) : The most common type was lamellar , bulbous then extensive with 285 case have no concha bullosa .

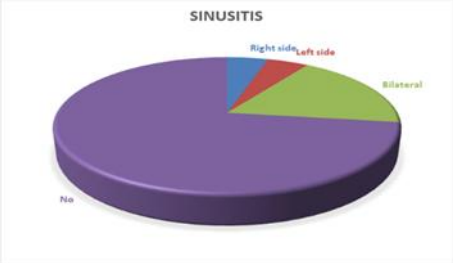

Figure (2): Distribution of Sinusitis of our participants.

Figure (3): Correlation between sinusitis and concha bullosa.

figure (2) we found that Sinusitis were 4.6% in the right side, 4.6% in the left side, 18% bilateral and 72.8% were absent , According to Figure (3), we found that the majority of our cases of sinusitis (53.7%) are without concha bullosa. The rest of cases of sinusitis had concha bullosa lamellar, concha bullosa bulbous and concha bullosa extensive with percentages of (27.9%), (14.7%) and (3.7%) respectively.

Discussion

Our retrospective study was conducted on adult subjects with fully developed nasal and para-nasal sinuses in Aljalah hospital, Benghazi and their status fulfilled the inclusion and exclusion criteria over a period of 2 years (august 2017 to august 2019).

Using multi-slice Ct scan is the golden modality to detect nasal anatomical variation and para-nasal pathology in this case we are looking for sinusitis and concha bullosa and its variations. By case series study methodology collecting CT study done to the Para-nasal sinuses in Aljalah hospital Benghazi with no history of previous nasal or para-nasal sever injury or intervention then assessing each case to detect the anatomical variation and if there associated sinusitis.

Regarding the demographic and clinical data in our study, 500 participants are included in our study 43 of them are under or equal 20 years old, 222 of them are between 21-40 years old, 171 of them are between 41-60 years old and 64 participants are over than 60 years old. 304 participants of our study are male and 196 are female.

We also found that Concha bullosa side were 11.4% in the right side, 10.6% in the left side, 21.4% bilateral and 56.6% were absent. Concha bullosa lamellar were present in 126 patients and 374 were absent. Concha bullosa bulbouse were present in 60 patients and 440 were absent. Concha bullosa extensive were present in 29 patients and 471 were absent. Sinusitis were 4.6% in the right side, 4.6% in the left side, 18% bilateral and 72.8% were absent.

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In many studies, 37.3% of patients had concha bullosa [9,13,22]. half of CTs had both sides CB (55.6%). However, the frequency of CB is varied, ranging from 15%, to 80% [10,14,16].This wide range of CB prevalence might be due in part to different criteria of diagnosis.

Stallman defined concha bullosa as being present when more than 50% of the vertical height (measured from superior to inferior in the coronal plane) of the middle turbinate is aerated while Smith et al defined CB as the existence of any pneumatization within the superior, middle or inferior conchae [8,13].

However, Hatipoğlu et al. categorize concha bullosa depending on the site of the pneumatization as bulbous , lamellarand extensive [14].

The prevalence of sinusitis in USA population was estimated to be around 14%. In another study, the prevalence of sinus disease was 80.1%; moderate was the most common and the maxillary and ethmoid sinuses are the most affected [8].

Maxillary and ethmoid sinus involvement has been reported in asymptomatic patients using MRIs in many studies. These studies also noted that season affected sinus abnormalities, mainly in late fall and winter [16-18].

A study of incidental paranasal sinus inflammatory changes in a Jordanian population found that 64.3% of patients had one or more abnormalities when MRIs were utilized. The maxillary and ethmoid sinuses were the most commonly involved [19].

It was introduced by few that abnormalities of the concha could predispose patients to chronic sinusitis; others concluded that there is no correlation between the presence of middle turbinate pneumatization and sinusitis. Previous studies, which supported the validity of a relationship, have typically included a majority of patients with pre-existing chronic sinusitis [23, 8, 9,22,20,21].

While other studies have presumed an association between NSD and the presence of concha bullosa, the presence of NSDs was usually associated with the presence of dominant or large concha bullosa [23,24,25,8].However, in a study, no association was found between a unilateral or dominant CB and ipsilateral or contralateral DNS [15].

Hatipoglu et al conclude that there was an association between the severity of deviation and the presence of sinusitis [21].

Nevertheless, a meta-analysis failed to confirm a definite relationship between these two factors, which is similar to the current study [27].

The osteomeatal complex is defined as a functional unit of the anterior ethmoid complex; it is the final common pathway for drainage and ventilation of the frontal, maxillary and anterior ethmoid sinuses [28].

Endoscopic surgery goal is removing the obstruction of the primary drainage pathway, usually the osteomeatal complex, based on that such obstructions can cause the sinus disease [29,31].

In another study, 38.3% of patients with CB had an obstructed OMC, of whom 75.8% had chronic rhinosinusitis and 24.2% did not have. The patients whose OMC was not obstructed, 20.2% had chronic rhinosinusitis. Patients with both side OMC occlusion had a significantly higher incidence of chronic rhinosinusitis (88%) compared to patients with one side OMC occlusion (60%) [8].

Lee et al. in a review by CT about patients with rhino sinusitis found that occluded OMC was an solitary risk factor for the disease, not dependent on CB[21].

On the other hand, Caughey et al. concluded that PNS variants contributed to the narrowing of the OMC including CB, as well as septal deviations and infraorbital ethmoid cells, and therefore were associated with rhino sinusitis [32].

In a comparative investigation of patients with and without sinus disease using CT scans, the findings of Calhoun et al. were indicative of an association of CB and sinus disease [33].

In contrast, Unlü et al. studied both the effects of CB on the distribution of opacification within the paranasal sinuses as well as the relationships between CB and osteomeatal complex disease; their results showed that CB does not necessarily have influence on the distribution of mucosal changes in paranasal sinuses [34].

Furthermore, in the presence of sinusitis, no statistically difference was detected between patients with CB and those without. However, when the types of CB were considered, OMC disease was found to be more frequent if the pneumatization was localized to the inferior half of the middle turbinate, such as in bulbous and extensive types of CB [15].

The study on the prevalence of concha bullosa and its impact on paranasal sinusitis reveals critical insights. Our findings show that the majority of sinusitis cases did not correlate with the presence of concha bullosa. Among those that did, lamellar concha bullosa was the most common type, followed by bulbous and extensive types. This is consistent with previous studies reporting variability in concha bullosa prevalence and its debated role in sinusitis[15].

Conclusion:

The study findings that early accurate diagnosis of patients with sinusitis must be the major goal of the physician while facing these cases from the first second to avoid the probable dangerous sequences. We also concluded that there is no strong association between concha bullosa and para-nasal sinusitis.

Recommendations

Based on the findings, the investigator suggests:

1. Paying attention to our findings while outlining the recent guidelines for management of these patients.

2. In addition, further studies must be done to analyze all aspects of this issue.

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