EPIDEMIOLOGICAL ANALYSIS OF THE FACTORS ASSOCIATED WITH CHRONIC SINUSITIS BY USING COMPUTED TOMOGRAPHY

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ABSTRACT

Aim: Anatomical differences in the nasal cavity and paranasal sinuses can result in sinusitis, an inflammation of the sinuses. We investigated the association between sinusitis severity and septal deviation, as well as between sinusitis severity and concha bullosa.

Method: This retrospective cohort study included patients with chronic sinusitis symptoms or nasal blockage. The CT scans of the patients were rechecked to determine the presence of conchae bullosa and the degree of septal deviation. Sinusitis severity was evaluated using the Lund- Mackay criteria. The number of patients with nasal septal deviation with different degrees and concha bullosa was studied.

Results: Of 150 cases, 82.7% had septal deviation. Concha bullosa was identified in 14.7% of the patients on the left side and 11.3% of them on the right side. A significant relationship between the absence of concha bullosa and sinusitis severity was observed. Moreover, a nonsignificant association was observed between the severity of sinusitis with ostiomeatal involvement and the presence and degree of septal deviation.

Conclusion: The absence of concha bullosa was associated with mild chronic sinusitis and ostiomeatal involvement.

Keywords: chronic sinusitis, nasal septal deviation, concha bullosa, septal deviation degree, chronic sinusitis severity

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INTRODUCTION

Infections, allergies, and problems with mucociliary transport can lead to sinusitis and blockage of the ostiomeatal complex (OMC) [(1)]. The anatomical differences in the paranasal sinuses and nasal cavities are additional potential blockage-causing factors [(2)].

The sinonasal cavity has anatomical variations that impair proper sinus airflow and mucociliary clearance by narrowing or obstructing the ostiomeatal channels. Some studies have claimed that these variations play a role in the development of chronic sinusitis (CS) according to the size, location, or amount of mucosal contact generated by the variation [(3)].

A deviated nasal septum (DNS) may cause CS through mechanical outflow obstruction and compromised mucociliary function, and 16% to 54% of patients with CS have DNS. A study demonstrated a relationship between DNS and CS [(4)]. A pneumatized turbinate in the nose is known as concha bullosa (CB). Middle turbinate CB is the most prevalent anatomical variant of the OMC and is a potential etiological component in CS with frequent recurrence. The cause of nasal turbinate pneumatization remains unclear [(5)].

This study investigated the association between the presence and degree of nasal

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septal deviation (NSD) with sinusitis severity, as well as the relationship between CB and sinusitis severity. The study outcomes may support the development of treatment methods. If an association between NSD and CS is detected, surgery (septoplasty) for NSD correction can reduce the incidence of CS and, therefore, its problems.

METHODS

Ethical Approval

This retrospective cohort study was performed from July 2021 to January 2022 in collaboration with otolaryngologists and radiologists at the Royal Medical Services in Jordan. This study was approved by the Ethics Committee of Royal Medical Services, Jordan.

Design

Regardless of age or gender, the study included patients who visited an ENT clinic between July 2021 and January 2022 with nasal obstruction or CS symptoms for > 3 months, who were not responding to medical treatment, and who underwent a sinus computed tomography (CT) scan. The presence of CB and the degree of NSD were also examined using CT images. Patients with a history of nasal trauma in the last year and heavy smoking (>10 pack-year) were excluded. Data were collected by referring to the "Hakeem" and "AQFA" applications and applying the patients' national numbers.

The Lund-Mackay staging system (6) was used to categorize sinusitis severity. A fully engaged sinus was assigned a score of 2 represented severe sinusitis, a partially engaged sinus 1 represented moderate sinusitis, and a totally intact sinus 0 represented mild sinusitis, see **Figure (1)**.

The patients were divided into four groups on the basis of NSD degree: the normal (0 < NSD < 5 [degree of the center]), mild (5 < NSD < 10), moderate (10 < NSD < 15), and severe (NSD > 15) groups [7], see Figure (2). The most distorted angle to the right or left with an S-shaped deviation was considered an NSD. Patients whose CT scans revealed no signs of persistent sinus inflammation were excluded.

Statistical Analysis

Statistical analysis was performed using SPSS software. The percentage was used as the descriptive index to describe the qualitative factors.

Ordinal logistic regression was used to determine the association between the presence and degree of NSD with CS severity, as well as the association between CB and CS severity.

RESULTS

A total of 150 patients were enrolled in the study, with an average age of 34.4 + 13.9 years old, and males formed 59.3% of the sample.

The prevalence of NSD was high at 82.7%. CB was detected in 51.3% of the patients, with 25.3% of them having bilateral CB, 14.7% of them having left-sided CB, and 11.3% of them having right-sided CB. The most common NSD degree was moderate (10 < NSD < 15), with 15.3% of the patients having a normal NSD degree **(Table 1)**.

Regression analysis revealed that in the majority of paranasal sinuses, the severity of sinusitis was not impacted by the absence of NSD, with the exception of the right middle meatus cavity (R.OMC), where the presence of NSD was found to decrease the likelihood of experiencing mild sinusitis by 79%, whereas the presence of CB increased the odds ratio of mild sinusitis from 1.61 in the left maxillary sinus to 10.81 in the left sphenoid sinus. **(Table 2).**

No association between the degree of NSD and CS severity was observed in general except for mild R.S odds ratio was 3.6 in association between mild degree of NSD. **(Table 3).**

Table 1 : Prevalence of nasal septal deviation, conch bullosa, and nasal septal deviation degree (n= 150)

Category	Frequency	Percentage (%)
Concha Bullosa		
Both	38	25.5
Left	22	14.7
Right	17	11.3
No	73	48.7
Total	150	100
Nasal septal Deviation		
Left	56	37.3
Right	68	45.3
No	26	17.3
Total	150	100
Nasal Septal Deviation Degree		
Severe	40	26.7
Moderate	48	32.0
Mild	39	26.0
Normal	23	15.3

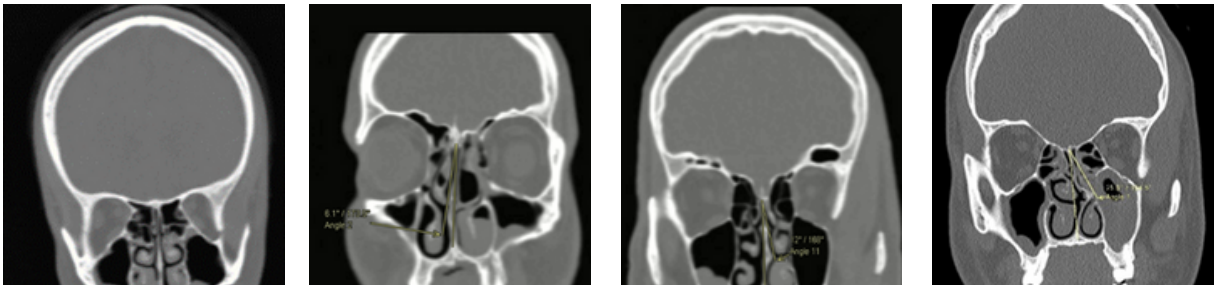

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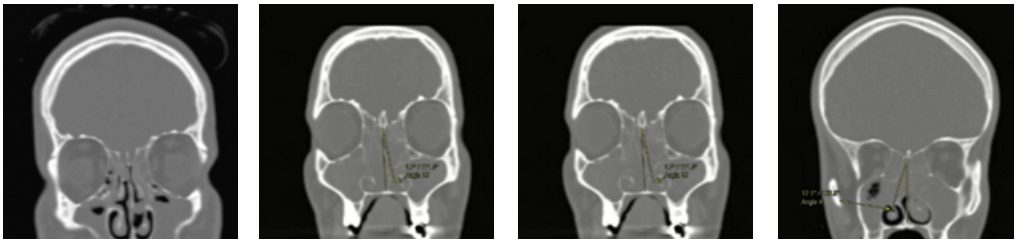
Figure (1): coronal CT images bone window for different patients, demonstrate partial opacification of paranasal sinuses with different degrees of nasal septal deviation, (A) Normal. (B) Mild. (C) Moderate. (D) severe.

Table 2 : Association between the severity of chronic sinusitis with ostiomeatal involvement and presence of nasal septal deviation and concha bullosa (n= 150)

Sinus severity	P-value	OR
Mild R.M	**0.39**	**0.58**
CB	0.00	3.01
Mild L.M	**0.56**	**0.70**
CB	**0.00**	**1.61**
Mild R.A.E	**0.21**	**0.46**
	0.00	**4.45**
Mild L.A.E	**0.22**	**0.47**
	0.00	**4.46**
Mild R.P.E	**0.97**	**0.34**
	0.00	**7.35**
Mild L.P.E	**015**	**0.41**
	0.00	**4.34**
Mild R.F	**0.74**	**0.80**
	0.00	**3.97**
Mild L.F	**0.34**	**0.54**
	0.00	**5.53**
Mild R.S	**020**	**0.40**
	0.00	**7.13**
Mild L.S	**0.13**	**0.31**
	0.00	**10.81**
Mild R.OMC	**0.03**	**0.21**
	0.00	**3.76**
Mild L.OMC	**0.20**	**0.44**
	0.00	**4.75**

R: right, L: left, A: anterior, P: posterior, M: maxillary sinus, E: ethmoid sinus, F: frontal sinus, S: sphenoid sinus, OMC: ostiomeatal complex, NSD: nasal septal deviation, CB: concha bullosa, OR: odds ratio



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figure(2): coronal CT images bone window for different patients, demonstrate extensive mucosal thickening in all paranasal sinuses with different degrees of nasalseptal deviation, (A) Normal. (B) Mild. (C) Moderate. (D) severe.

Table 3 : Association between the severity of chronic sinusitis with ostiomeatal involvement and nasal septal deviation degree (n= 150)

Sinus severity	NDS degree	P- Value	OR
Mild R.M	Severe	0.67	1.32
	Moderate	0.65	0.80
	Mild	0.75	1.18
Mild L.M	Severe	0.39	1.72
	Moderate	0.72	1.13
	Mild	0.22	1.64
Mild R.A.E	Severe	0.95	0.96
	Moderate	0.77	1.16
	Mild	0.55	1.37
Mild L.A.E	Severe	0.94	0.95
	Moderate	0.18	1.98
	Mild	0.21	1.94
Mild R.P.E	Severe	0.55	0.67
	Moderate	0.78	1.16
	Mild	0.47	1.50
Mild L.P.E	Severe	0.48	0.64
	Moderate	0.22	1.88
	Mild	0.24	1.89
Mild R.F	Severe	0.38	1.84
	Moderate	0.14	2.20
	Mild	0.07	2.82
Mild L.F	Severe	0.63	0.72
	Moderate	0.56	1.37
	Mild	0.39	1.63
Mild R.S	Severe	0.70	1.31
	Moderate	0.16	2.24
	Mild	0.04	3.60
Mild L.S	Severe	0.49	1.71
	Moderate	0.13	2.49
	Mild	0.06	3.25
Mild R.OMC	Severe	0.41	0.58
	Moderate	0.94	1.04
	Mild	0.86	1.11
Mild L.OMC	Severe	0.57	.69
	Moderate	0.35	1.65
	Mild	0.48	1.48

DISCUSSION

The prevalence of NSD varies, and the explanation for this variation is most likely due to the classification criteria utilized [8]. According to the findings in this study, we found that NSD was quite common in patients, with moderate NSD degree being the most prevalent.

The relationship between NSD and CS has been evaluated by several studies; however, the results remained controversial and uncertain. In 2001, a review article based on 25 publications could not conclusively prove that the nasal septum plays a role in either the pathophysiology or etiology of CS [9]. However, an analysis of five publications from 2010 revealed a strong link between sinusitis and NSD. Bilateral inflammation was observed in many studies that investigated the laterality of sinusitis and septal deviation [10]. A 2022 systematic review concluded that NSD is common but is not associated with CS [11]. Previous research has not found a link between the location of chronic sinusitis and the degree of nasal septum deviation [12]. We observed that neither the NSD degree nor the presence of NSD had an association between sinusitis severity and OMC involvement in general.

Between 13.6% and 33.6% of people have CB. The prevalence of CB, as determined using CT, ranges from 14% to 53%, and the connection between CB and paranasal sinus illness remains debatable [13]. In this study, the CT-determined prevalence of CB was as high as 51.3%.

CB is a typical anatomical variation detected in patients with CS. Patients with CB may develop OMC blockage more frequently. CB is crucial to the progress of CS [14] and may be a predisposing factor for CS; therefore, surgical manipulation is crucial for sinusitis prevention [15].

(A study reported no direct relationship between CB and CS [16]. However, our results suggested a relationship between CB and CS with OMC involvement; the presence of CB increased the likelihood of mild sinusitis.

In line with the results and conclusions of our study, it was noted by the authors of a 2019 study in the United Arab Emirates that despite NSD being present in over two-thirds of the sample, and CB being detected in over one-third of the sample, only CB had a significant impact on the severity of sinusitis [17].

Our study investigated the association between sinusitis severity and the presence and degree of NSD, as well as the presence of CB. The presence of CB was associated with mild sinusitis and OMC involvement. Moreover, neither the presence of NSD nor the degree of NSD affected sinusitis severity generally. More research is required to validate these findings.

LIMITATIONS

This study has the following three limitations:

- Our results reflected the patients' findings during the investigation.
- No comparative group was included.

This study was conducted for a limited duration.

CONCLUSION

A high prevalence of NSD was found, with the most common degree of deviation being moderate, while CB was observed to be fairly prevalent. Surprisingly, no correlation was found between the severity of sinusitis and the presence or degree of NSD in OMC involvement, which contrasts with some studies but is in agreement with others. Additionally, the occurrence of CB was linked to mild sinusitis severity and OMC involvement.

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