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Research Article

Septum

Correlation between the deviated nasal septum and paranasal sinuses: A Prospective study

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Introduction: Deviated nasal septal is defined as a deviation of bone or cartilage of the septum (or both) from the midline of the face. Nasal deviations play a significant role in nasal congestion, nasal cosmetic problems, increased nasal airway resistance, and sometimes snoring. Paranasal sinuses (PNS) are the air-containing cavities in the skull that surround the nasal cavity. The paranasal sinuses include maxillary, ethmoid, frontal, and sphenoid sinuses. **Material and Method:** This study is a prospective, observational study carried out on 60 patients attending the Department of ENT, Adesh Medical College, and Hospital over six months. All these patients with clinical evidence of chronic rhinosinusitis were evaluated with nasal endoscopy and C.T. scan PNS (coronal sections). **Result:** Nasal septal deviation to the left side (56.6%) was more prevalent than right (43.4%). Based on the angle of septal deviation, the patients were categorized into three groups: group I (0-7 degrees), group II (7.1- 11 degrees), group III (>11 degrees). Most of the patients were from group II constituting 38.3%, followed by the group I (35%) and group III (26.6%), respectively. **Conclusion:** C.T. scan PNS is recommended in patients with nasal obstruction to assess the severity of the nasal septal deviation, its impact on the lateral nasal wall and paranasal sinuses, which may help the surgeons in better management of the patients.

Keywords: Deviated nasal septum, Paranasal sinus, Angles of septal deviation

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Introduction

The nasal septal deviation may either cause osteomeatal obstruction or may interfere with proper airflow and result in sinusitis. Nasal septal deviation disturbs nasal physiology, not always, but together with conchal hypertrophy or other anatomical variations. [1]. It could narrow the middle meatus by pushing the concha laterally. [2]. Besides nasal obstruction, it exerts pressure on neighboring structures. This disturbs the drainage pathways, affects the mucosal ciliary function by contact, and leads to obstruction and secondary nasal infections in all sinuses by disturbing normal mucus drainage. [3].

The nasal septum divides the nasal cavity into the left and right halves, both anatomically and physiologically. It is an accepted fact that some deviation of the nasal septum is common and having a perfectly straight septum is a rarity. [4]. Various reasons have been attributed to a deviated nasal septum, including racial factors, birth moulding of septum during parturition trauma, and developmental deformities of septum. [5]. The deviated nasal septum may cause nasal obstruction and symptoms of rhinosinusitis. Usually, paranasal air sinuses drain the mucous and fluid into the nose through various openings. [6].

An increased incidence and severity of bilateral chronic sinus disease were present with increasing deviations of the septum. [7]. Nasal septal deviation is a common disorder that presents in up to 62% of the population, and its role in the pathogenesis of chronic sinusitis remains uncertain. [8]. Hippocrates in the 5th century B.C stated that "In a person having a painful spot in the head, with intense headaches, pus or fluid running from the nose removes the disease", which may be referred to as describing sinusitis. [9].

Paranasal sinuses (PNS) are the air-containing cavities in the skull that surround the nasal cavity. The paranasal sinuses include maxillary, ethmoid, frontal, and sphenoid sinuses. [10]. The main functions of paranasal sinuses include lightening of the skull, air humidification, and voice resonance. [11]. There are various imaging modalities available for the evaluation of the paranasal sinuses. Conventional radiography has a limited role in the evaluation of nasal cavity, ethmoid and sphenoid sinuses because osteomeatal complexes are not delineated by traditional radiography. [12].

Various studies have shown the relationship between the septal deviation and associated PNS pathology by C.T. scan. Still, very few studies have been reported in the literature regarding the impact of increased angle of septal deviation on the lateral nasal wall, which we wish to emphasize, and the outcome may help the surgeon in planning successful surgery and better management of patients with nasal obstruction.

Material and Methods

Setting: Department of ENT, Adesh Medical College, and Hospital.

Duration and type of study: 6 months and Prospective, observational study.
Sampling methods: Randomized into 60 Samples.

Inclusion Criteria: All patients of either sex with symptoms of DNS and chronic rhinosinusitis, e.g. headache, nasal obstruction, nasal discharge, hyposmia, or facial pain.

Exclusion Criteria: Patients with acute sinusitis, allergic sinusitis, asthma, cystic fibrosis, immune deficiency, metabolic diseases or malignant diseases or those who had previously undergone nasal or sinus surgery, maxillofacial trauma cases, and children <8 years of age were excluded from the study.

All these patients with clinical evidence of chronic rhinosinusitis were evaluated with nasal endoscopy and C.T. scan PNS (coronal sections).

Data collection procedure

01. The included patients underwent detailed clinical and rhinoscopic examination, and those having evidence of DNS on rhinoscopy were evaluated further for PNS pathology. Diagnostic nasal endoscopy and non-contrast computed tomography were performed on these patients to confirm and support the diagnosis. The coronal C.T. image, which best defined the osteomeatal complex (OMC), was used for calculating the degree of septal deviation.
02. The ASD was measured as the angle between a line drawn from the crista galli to the anterior nasal spine of the maxilla and another line from the crista galli to the most deviated point of the nasal septum in the coronal plane. The patients were categorized into three groups based on the angle of septal deviation; Group I (0-7 degree), Group II (7.1- 11 degree), and Group III (>11 degrees).

03. The CT scan images were studied to analyze the effect of increasing angle of septal deviation on the ipsilateral and contralateral lateral nasal wall structures, OMC patency, and the size and pattern of mucosal abnormalities in the paranasal sinuses.

Ethical Consideration and permission: After approval from Institutional Ethics Committee for Medical Research at Adesh Medical College and Hospital, the study was initiated.

Statistical analysis: The data analysis was done using M.S. excel categorical variables were presented in number and percentage (%).

Results

In the present study, 35 were males (58.3%), and 25 were females (41.7%). The male to female ratio was 1.27: 1 (Table-1).

Table 1: Showing sex distribution

Gender	No. of patients	%
Male	35	58.3
Female	25	41.7
Total	60	100

Table 2: Showing age distribution of patients studied

Years	No. of patients	%
≤20	2	3.33
21-30	14	23.3
31-40	27	45
41-50	11	18.3
51-60	6	10
>61	-	-
Total	60	100

In table 2, only two patients were in the age group of ≤20 years (3.33%), followed by 14 of them in the age group of 21-30 years (23.3%) and 45 patients in the age group of 31-40 years (45%), 11 patients were in 41-50 years (18.3%) and six patients in 51-60 years (10%).

Table 3: Clinical symptoms

Symptoms	No. of patients	%
Nasal obstruction	43	71.6
Sneezing	7	11.6
Nasal discharge	29	48.3
Headache	33	55
Epistaxis	6	10

In table 3, among the clinical symptoms of the patients, the most common presenting symptoms were nasal obstruction (71.6 % cases), sneezing (11.6%), nasal discharge (48.3%), headache (55%), and epistaxis (10%).

Table 4: The direction of nasal septal deviation

Nasal septal deviation	No. of patients	%
Left	34	56.6
Right	26	43.4
Total	60	100

In table 4, nasal septal deviation to the left side (56.6%) was more prevalent than the right (43.4%).

Table 5: Distribution of angles of septal deviation in groups.

Group	No. of patients	%
I	21	35.0
II	23	38.3
III	16	26.6
Total	60	100

In table 5, based on the angle of septal deviation, the patients were categorized into three groups: group I (0-7 degree), group II (7.1- 11 degree), group III (>11 degrees). The majority of the patients were from group II constituting 38.3%, followed by the group I (35%) and group III (26.6%), respectively.

Table 6: Middle and inferior turbinate abnormalities and their distribution as a function of the degree of septal deviation.

Middle and inferior turbinate abnormalities	Group I		Group II		Group III	
	Ipsilateral	Contralateral	Ipsilateral	Contralateral	Ipsilateral	Contralateral
Bulbous type concha	6	5	3	7	3	5
Lamellar concha	5	4	5	6	2	4
Paradoxical middle turbinate	1	2	1	1	1	1
Hypertrophied middle turbinate	-	-	-	3	-	3
Hypertrophied inferior turbinate	3	4	3	12	3	14

In table 6, the increasing angle of septal deviation was associated with an increase in the incidence of contralateral middle turbinate hypertrophy, and there was no evidence of ipsilateral middle turbinate hypertrophy in any of the three groups.

Three patients in group II and group III showed contralateral middle turbinate hypertrophy. Similarly, the incidence of contralateral inferior turbinate hypertrophy was also associated with increasing angles of septal deviation. Also, there was a higher incidence of bulbous type concha on the contralateral side in group II and group III patients.

Table 7: OMC obstruction and distribution of paranasal sinusitis among three groups.

OMC and paranasal sinuses	No. of patients	%
OMC	21	35
Frontal sinusitis	14	23.3
Maxillary sinusitis	24	40
Ethmoid sinusitis	17	28.3
Sphenoid sinusitis	11	18.3

In table 7, the most frequently involved sinusitis area was the maxillary sinusitis (40%), followed by osteomeatal complex (35%), then ethmoid sinusitis region (28.3%). Sphenoid sinusitis was least commonly involved (18.3%).

Table 8: Pattern of sinusitis and their distribution among three groups

Pattern of sinusitis	No. of patients	%
Sinonasal polyposis pattern	15	25
Infundibular pattern	4	6.6
Osteomeatal complex pattern	9	15
Sphenoethmoidal recess pattern	3	5

In table 8, among the various sinus mucosal disease patterns, sinonasal polyposis pattern was the most common pattern (25%), followed by osteomeatal unit pattern (15%) and infundibular pattern (6.6%), and least was Sphenoethmoidal recess pattern (5%).

Discussion

Three theories explain the pathophysiological relation between the deviated nasal septal and chronic sinusitis. The first is the mechanical theory which states that secretions accumulate in the sinus due to the narrowing of the ostiomeatal complex. Thus infections ensue in the retained secretions and cause chronic rhinosinusitis. The second theory is the aerodynamic theory.

According to this theory, the mucociliary activity decreases following the nasal flow rate increase and mucosal dryness in relation with the nasal septal deviation, and consequently, chronic rhinosinusitis develops. The third theory is Bachert "s pressure theory. According to this theory, deviation of the posterior nasal septum causes chronic rhinosinusitis by creating pressure and airflow changes within the maxillary sinuses. [13]

A total of 60 patients were enrolled in the study between 15 and 60 years old. All the patients presenting with symptoms of deviated nasal septum and rhinosinusitis of more than 12 weeks duration with two significant and one minor or two minor signs were included in the study. In this present study, the incidence of nasal septal deviation was more in males than females, with 41.7% male and 58.3% female. In a study by Prasad S et al., there were 68.3% male and 31.7% female. [14]. Rosenfeld RM et al., in their study, observed that incidence was more in males than females. [15].

In our study, we have observed about 45% of cases were between the age group of 31-40 years old, followed by the affected age group of 21-30 years old, and the least was found to be 3.33% in the less than 20 years. Rosenfeld RM et al., in the year 2015, conducted a study to determine the underlying cause, clinical features, and the impact of treatment on nasal septal deviation patients. They had observed that 41.7% of patients with nasal septal deviation fell in the age group 16 - 30 years, similar to our study. [16]. Another study conducted by Kutluhan A et al. reported that the affected age group of nasal septal deviation was 21 – 40 years accounting for 65.3% of their study population. [17]. In the most published literature, the affected age group of nasal septal deviation was 20 to 40 years, similar to our study.

In our study, the most predominant clinical symptoms are nasal obstruction (71.6 % cases), followed by headache (55%), and least is epistaxis (10%). In the study conducted by Nayak DR (2001), the headache was the predominant symptom seen in 80% of patients, the nasal blockage was seen in 76.66%, nasal discharge was seen in 43.33%, facial pain in 40% of patients. [18]. While in the study by Cagici CA (2006), the commonest symptoms were nasal obstruction in 87%, nasal discharge in 70% of patients, and the other signs were posted nasal drip in 41% and abnormalities in the sensation of smell in 36% of patients. [19].

In another study by Oudinet JP et al. (2006), nasal discharge was the commonest complaint seen in 78.2%, while nasal blockage and headache were seen in 75.6% of patients. [20]. In our study, deviated nasal septum to the left was more common than to the right side, accounting for 56.6% on the left side and 43.4% on the right side. Similar to our study, the study done by Moorthy P et al. in 2014 showed a deviation of the nasal septum to the left side (54%) more common than the right side (36.5%). [21]. This is similar to the study conducted by Uthman AT et al. The author studied the relation between the deviated nasal septum and paranasal sinus pathology. The study concluded that there is no significant association between deviated nasal and paranasal sinusitis. [22]. The maximum number of patients, 23 (38.3%), are group II angle of septal deviation, followed by the group I with 21 (35%) cases. The least number of patients, 16 (26.6%), are group III. These findings were following the study of Demir U.L., who reported a maximum number of cases 205 (34.8 %) to be of group I, followed by group II with 181 (30.7 %) cases and the least number of cases 4 (0.6 %) to be of group III angle of septal deviation. [23]. This suggests that people with horizontal spurs have a significantly increased probability of developing osteomeatal disease. These findings can be explained by the fact that due to the involvement of the nasal valve area, normal ventilation of the nose was hampered, leading to a high incidence of septal deviation in these groups. Our study shows a higher incidence of bulbous type concha on the contralateral side than the ipsilateral side among the three groups, parallel to the study results of Stallman et al. [24]. Aktas D et al. evaluated the association of septal deviation and chronic sinus disease. They concluded that the increasing angle of septal deviation is associated with bilateral sinus disease, contralateral middle turbinate abnormalities, and prominent ethmoidal bulla. [25]. However, in our study, this relationship was not observed. There was an increased incidence of bulbous type concha in group I patients compared to group II and III patients. There was no evidence of ipsilateral middle turbinate hypertrophy in any of the three groups; instead, the increasing angle of septal deviation was associated with an increase in the incidence of contralateral middle turbinate hypertrophy, which agrees with the study results of Kucybala I et al., who found that the measurements of the bony and mucosal structure of the contralateral middle turbinate were greater and statistically significant. [26].

The sizes of the bony and mucosal thickness of inferior turbinate by Kapusuz Gencer Z al; revealed a statistically significant difference between the ipsilateral and contralateral side in patients of the deviated nasal septum, which is following our study results. [27].

In our study, most patients had maxillary sinusitis in 24 patients (40%). At the same time, OMC was 35%, frontal sinusitis was seen in 14 patients (35%), while ethmoidal sinusitis was presented in 17 patients (28.3%), and sphenoidal sinusitis was seen in 11 patients (18.3%). In a study by Mohebbi et al., maxillary sinusitis presentation was seen in 45% of patients. Similarly, frontal sinus involvement was seen in 23.5%, and ethmoidal sinusitis was seen in 36.1%, sphenoidal sinusitis was seen in 25.3%. [28]. Rao et al. in their study found horizontal spur was most commonly associated in sinus pathology, 43.4% of patients spurs were accounted for sinus pathology, similarly type III (posterior vertical deviation) was seen having osteo meatal complex (OMC) block in 62.5% of cases, S-shaped variation was associated with OMC block in 50% of cases. [29].

Considering the various patterns of sinonasal inflammatory disease, we observed that the sinonasal polyposis pattern was the most common, followed by osteomeatal unit pattern and infundibular pattern, respectively, which was similar to the study results of Hastan D et al. [30]. In contradiction, Collet S et al. found that infundibular pattern was the most common, followed by osteomeatal unit and sinonasal polyposis pattern, respectively. [31]. Broad-spectrum antibiotic usage could be a possible source of bias in these results, and the effect of such therapies on C.T. scan outcome is still unknown. We assume that antibiotic treatment would reduce the prevalence of mucosal sinus disease, and the limitation that actual prevalence might be even higher still stands.

C.T. scan PNS stands the gold standard in evaluating patients with chronic sinusitis with its ability to map out the bony and soft tissue anatomy accurately. [32]. C.T. scan in conjunction with nasal endoscopic examination is the ideal combination for evaluation of the sinonasal region. Analyzing anatomy and abnormalities of the nasal septum, lateral nasal wall, and paranasal sinus abnormalities is a prerequisite to safe and effective surgical treatment of sinonasal disease.

Conclusion

This perspective and observational study were conducted to evaluate the septal angle and its effect on the lateral wall of the nasal cavity by C.T. scan, thus highlighting the ancillary pathologies which can lead to an increase in the success rate of surgical procedures. Hence, CT scan PNS is recommended in patients with nasal obstruction to assess the severity of the nasal septal deviation, its impact on the lateral nasal wall and paranasal sinuses, which may help the surgeons in better management of the patients.

What does the study add to existing knowledge?

This study brings to various light presentations of DNS implicated in the causation of chronic sinusitis, which will influence the treatment decisions and also reduce the morbidity caused by it. There is a need to educate the general masses about the symptoms of chronic sinusitis and its effect on the quality of life to increase its prevention, diagnosis, treatment, and control. Patients should be made aware of the possible sequelae of it if left untreated.

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