

## Association of Deviated Nasal Septum and Sinusitis: A Radiological Study

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### Abstract

**Introduction:** Deviation of nasal septum (DNS) is the most common anatomical variant in sinonasal region. It is usually asymptomatic, but it sometimes can cause different sinonasal symptoms. The severity of the symptoms is related to associate abnormalities like agger nasi cells, onodi cells, haller cells, concha bullosa and inferior turbinate hypertrophy.

**Methods:** Patients were retrospectively selected by a computer-assisted search of all the reports of CT scans performed with a clinical symptom referable to the sinonasal region, headache, nasal obstruction, recurrent sinusitis, chronic sinusitis, acute sinusitis, allergic sinusitis in S, Nijalinagppa Medical College and Hanagal Shri Kumareswar Hospital & Research Centre between December 1, 2016 and November 30, 2017 to detect the presence of deviated nasal septum. A total of 524 CT studies were identified. Of these cases, studies with malignancy, motion artifacts, Traumatic fractures, polyps, post-op status were excluded. The study design did not involve any patient contact hence no approval by the local ethics committee was required.

**Results:** The sinusitis was identified in 54 patients (10.4%). The age range was 8 to 75 years with a mean age of 33.5 years. Majority of the patients in our study belonged to 21 to 30 year age group (n=21). 36 were males, 18 were females. Midline nasal septum was seen in 31 patients, among them 14 had sinusitis and 17 showed clear sinuses. Right sided septal deviation was seen in 12 patients. Among them 11 had sinusitis and one patient showed clear sinuses. Left sided septal deviation was noted in 9 cases. Among them 6 had sinusitis and 3 showed no signs of sinusitis. S shaped septum was seen in 2 patients. Septal deviation with spur was seen in 3 patients. Sinusitis was seen in 14 patients with midline septum (45.1%). In 17 patients with midline septum there was no sinusitis (54.9%). Right sided septal deviation with associated sinusitis was seen in 11 of the total 12 cases. There was statistically significant association of septal deviation and sinusitis in our study.

**Conclusion:** The association of midline nasal septum with sinusitis is seen in 44.1% of the cases in our study. The association of deviated nasal septum with sinusitis is seen in 81% of the cases in our study. There was statistically significant association of septal deviation with sinusitis (p value <0.05) in our study.

**Keywords:** Deviated Nasal Septum, Sinusitis, turbinate hypertrophy, sinonasal region.

### 1. Introduction

The nasal cavity has many structures each with a specific set of function. The nasal septum gives support to the nasal structures whereas the lateral nasal wall takes the important function in conditioning the inspired air. The middle concha plays a very vital role as it warms and humidifies the air that is inspired. The ethmoidal fold of middle nasal wall gives rise to the middle nasal concha. A

lot of studies have discussed the relation between DNS and sinusitis. The obstruction of airflow by the presence of deviated nasal septum has been proven, but the correlation of the pathology of the paranasal sinuses and DNS are still controversial. This study therefore aimed to evaluate presence of deviated nasal septum and its association with sinusitis.

## 2. Materials and methods

Approval from Institutional Review board was obtained. Patients were retrospectively selected by a computer-assisted search of all the reports of CT scans performed with a clinical symptom referable to the sinonasal region, headache, nasal obstruction, recurrent sinusitis, chronic sinusitis, acute sinusitis, allergic sinusitis in December 1, 2016 and November 30, 2017 to detect the presence of deviated nasal septum. A total of 524 CT studies were identified. Of these cases, studies with malignancy, motion artifacts, polyps, post-op status were excluded. The study design did not involve any patient contact hence no approval by the local ethics committee was required. Informed consent was waived.

The main aim of this study was to identify the number of patients with deviated nasal septum and associated sinusitis which is controversial. A deviated nasal septum was defined as being present when there was abnormal deviation of the bony nasal septum from the midline on coronal PNS CT scans. The axial and coronal plane paranasal sinus computed tomographic scans of the patients were examined.

All CT examinations were performed with 16-slice MDCT scanner (Siemens's, SOMATOM Emotion, Germany). The imaging parameters for the scout film and the PNS scan are as follows: Scout film Kv 120, mA 10 WW/WL: 500/50. PNS Scan in axial plane kV 120, mA 90, Interval 10 mm, thickness: 2.5mm, pitch of 0.562:1/5.62, rotation time 1s with retro reconstruction of images in 0.625 mm thickness. PNS Scan in coronal plane kV 120, mA 200, Interval 10 mm, thickness: 2.5mm, pitch of 0.562:1/5.62, rotation time 1s with retro reconstruction of images in 0.625 mm thickness. Images were acquired in axial and coronal plane, analyzed in axial, coronal and sagittal on the GE advantage workstation in vertebral window with window width of 2000 HU and window level of 350 HU. The images were archived using Magnetic optic discs and external hard drives.

CT examination results were interpreted by four experienced radiologists each with more than five years of experience in interpreting PNS CT examinations. Each scan was evaluated for presence of sinusitis, underlying bony abnormalities. All scans were interpreted in bone window settings. The presence of mucosal thickening, air fluid level, and opacification of sinuses, septal deviation, presence or absence of concha, patency of osteomeatal unit was assessed. The left and right sides of each of the frontal, ethmoid, sphenoid, and maxillary sinuses were assessed separately for the presence of mucosal disease. The nasal septum was evaluated as midline, deviated to right side or left side.

## 2.1 Statistical analysis

All study data were evaluated using the SPSS version 17.0 software. The Chi-square test was used. A  $p < 0.05$  was accepted as significant. The association of deviated nasal septum with sinusitis was calculated and expressed as percentages.

## 3. Results

Sinusitis was identified in 54 patients. The age range was 8 to 75 years with a mean age of 33.5 years. Majority of the patients in our study belonged to 21 to 30 year age group ( $n=21$ ) (Table 1). 36 were males, 18 were females.

Midline nasal septum was seen in 31 patients, among them 14 had sinusitis and 17 showed clear sinuses. Right sided septal deviation was seen in 12 patients. Among them 11 had sinusitis and one patient showed clear sinuses. Left sided septal deviation was noted in 9 cases. Among them 6 had sinusitis and 3 showed no signs of sinusitis. S shaped septum was seen in 2 patients. Septal deviation with spur was seen in 3 patients. Sinusitis was seen in 14 patients with midline septum (45.1%). In 17 patients with midline septum there was no sinusitis (54.9%). Right sided septal deviation with associated sinusitis was seen in 11 of the total 12 cases. Left sided septal deviation with associated sinusitis was seen in 6 of the total 9 cases. There was statistically significant association of septal deviation with sinusitis in our study,  $p$  value  $< 0.05$  (Table 2).

Sinusitis was more commonly seen in the maxillary sinus ( $n=32$ ) followed by ethmoid ( $n=20$ ), frontal ( $n=14$ ) and least commonly observed in the sphenoid sinus ( $n=11$ ) in our study (Table 3). Involvement of group of sinuses was more common than isolated single sinuses in our study.

**Table 1: Age distribution of patients with sinusitis**

Age group	Number
0-10	1
11-20	10
21-30	21
31-40	12
41-50	5
>50	5

**Table 2: Deviated nasal septum and sinusitis**

Septum	Sinusitis	Clear sinuses on CT scan	Percentage
Midline (n=31)	14	17	45.1
Deviated septum (n=23)	19	04	82.6
	33	21	

$p$  value  $< 0.05$

**Table 3: Distribution of Sinus involvement**

Sinuses involved	Midline septum (n=31)	Right DNS n=12	Left DNS n=09
Maxillary	11	4	5
Ethmoid	-	1	1
Sphenoid	1	1	-
Frontal	-	-	-
Maxillary, ethmoid, sphenoid & Frontal	1	-	-
Maxillary & sphenoid	-	1	1
Maxillary & Ethmoid	4	2	-
Ethmoid & sphenoid	2	-	1
Maxillary, ethmoid, frontal	-	-	1
Maxillary, ethmoid, sphenoid	-	-	2

#### 4. Discussion

Chronic rhinosinusitis is a common disease worldwide. Computed Tomography scan of the paranasal sinuses is the gold standard diagnostic radiological tool for chronic rhinosinusitis. Because CT scan is not widely available in resource poor countries, it is often indicated after failed medical treatment, when surgical treatment is planned and if there is complication [1]. CT scan has been shown to have the advantage of concurrent evaluation of the nasal cavities, osteomeatal complex and paranasal sinuses. It is also reliable, accurate and effective at demonstrating the extent of disease spread and its associated complications [2]. Studies have shown that clinical symptoms of CRS do not have good correlation with the CT scan stage [3,4] while a study has shown that preoperative CT scan stage may predict symptom improvement after endoscopic sinus surgical intervention [1,2,5]. Rhinosinusitis is a significant health problem with its rising prevalence corresponding with the increasing frequency of allergic rhinosinusitis worldwide. There were more males with the disease in this study. This agrees with the findings from other similar studies on chronic rhinosinusitis where the disease has been reported to have a higher male sex predilection [6,7].

The maxillary sinus was identified as the most involved paranasal sinus by the disease. This finding is similar to what had been reported in other previous studies [8, 9]. The role of maxillary sinus in chronic rhinosinusitis is very important and the sinus should be considered while managing the disease.

Normal nasal physiology is dependent on the healthy condition of sinus ostia for proper drainage and ventilation of the paranasal sinuses [10,11]. These ostia are located in an area on the lateral wall of the nose called ostiomeatal complex. Ostiomeatal complex receives the drainage of most paranasal sinuses and when occluded, it is an important factor in the pathogenesis of chronic rhinosinusitis [12,13].

Specifically, anatomical variations which redirect nasal airflow or narrow the ostiomeatal complex have been considered important factors in the pathogenesis of chronic rhinosinusitis [14]. Different studies have reported on the association of anatomic variations with the pathogenesis of chronic rhinosinusitis. This present study also found no association between anatomic variations and severity of the disease ( $p>0.05$ ). It was also observed that there was no difference in the presence of septal deviation between patients with sinusitis.

CT scan has been used by clinicians to make diagnose, delineate disease extent and identify the involved paranasal sinus as well as any anatomical abnormalities [15]. In addition, it serves as a road map for the surgeons during endoscopic sinus and base of skull surgeries [16].

Although our overall prevalence of nasal septal deviation is much higher than that reported in the literature, the prevalence of more than minimal nasal septal deviation falls within the previously reported range of 19.4–79% [17 18 19 20 21].

Like our study, a number of other studies did not show a significant association between the presence of anatomic variants and imaging evidence of rhinosinusitis. Two studies [18, 21] showed no increased incidence of paranasal sinus disease in patients with concha bullosa or nasal septal deviation.

Few authors have suggested relationship between the presence of a deviated nasal septum and sinusitis [22, 23], but other reports have found no direct relationship [24, 25]. We found significant correlation between the presence of a deviated septum and sinus disease. Eighty percent of patients with deviated septum had sinus disease in our study.

The main limitations of our study are its retrospective design, small cohort numbers, and no characterization of other associated sinonasal anatomical variants.

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