CT Scan Study of Influence of Septal Angle Deviation on Lateral Nasal Wall in Patients of Chronic Rhinosinusitis

R. K. Mundra · Yamini Gupta · Richi Sinha ·
Alaknanda Gupta

Received: 28 February 2014 / Accepted: 11 March 2014 / Published online: 25 March 2014
© Association of Otolaryngologists of India 2014

Abstract The nasal septum is an important physiological and support structure of the nose. The nasal septal deviation causes alteration in air flow, mucociliary clearance and effects structures of the lateral nasal wall causing various nasal symptoms and other sinonasal disease. A systematic analysis was performed to measure the angle of septal deviation on CT scan PNS coronal section and to evaluate the influence of increasing septal angle deviation on the severity of lateral nasal wall abnormalities. A total of 61 patients with clinical evidence of chronic rhinosinusitis refractory to medical therapy for minimum three months were included in this study. After preliminary anterior & posterior rhinoscopic examination, all patients were evaluated with nasal endoscopy & CT scan PNS coronal view. There was statistically significant increase in hypertrophy of the middle turbinates and prominence of bulla ethmoidalis with OMC impingement on the side opposite to the direction of septal deviation. No apparent statistically significant difference between ipsilateral and contra lateral side OMC disease and anterior sinus mucosal disease in relation to direction of septal deviation in various groups was seen. We concluded that there is a strong association of increasing angles of septal deviation with corresponding patterns of disease in

ostioameatal complex. The result of the present study reemphasized the fact that, obstruction at ostioameatal complex and anterior ethmoids secondary to septal deviation is the key factor for causation of chronic sinusitis.

Keywords Septal deviation · Septal angle · Lateral nasal wall · CT scan PNS

Introduction

The nasal septum is an important physiological and support structure of the nose [1]. Septal deviation occur only in human beings [2] and it is most commonly seen deformity of nose but, not necessarily be symptomatic. The deviated nasal septum (DNS) is considered secondary to trauma during intrauterine life, birth, or trauma sustained at any time in life [3]. It is of two types congenital or acquired. Septal deviation causes alteration in air flow pattern in nasal cavity, nasal cycle and mucociliary clearance. DNS has been associated with chronic sinusitis. Significant differences in middle turbinate and lateral nasal wall abnormalities were noted contra lateral to the direction of septal deviation [3]. Various studies have shown the relationship between septal deviation and sinusitis but, in very few studies the effect of increasing angle of septal deviation on lateral wall of nose has been evaluated. The intention of this study was to evaluate the different angles of nasal septal deviation by measuring angle of septal deviation on CT scan and to study the effect of increasing septal angle on the lateral nasal wall.

Materials and Methods

A total of 61 patients with clinical evidence of chronic rhinosinusitis were evaluated with nasal endoscopy & CT scan

R. K. Mundra (✉) · Y. Gupta · R. Sinha · A. Gupta
Department of Otorhinolaryngology and Head & Neck Surgery,
MGM Medical College & MY Hospitals, 2 Kanchan Vihar, 2
Kanchan Bagh, Indore 452001, Madhya Pradesh, India
e-mail: mundra.rk@gmail.com

Y. Gupta
e-mail: dryamini10@gmail.com

R. Sinha
e-mail: rich1.ost@gmail.com

A. Gupta
e-mail: alaknanda.gupta@gmail.com

PNS coronal view. Chronic rhinosinusitis was defined as a state of persistent sinus disease associated with at least one of these symptoms viz. nasal congestion, hyposima, facial pain or nasal discharge. Study included clinically and radiologically diagnosed patients of chronic rhinosinusitis who were refractory to medical therapy for minimum three months.

Study excluded patient with acute sinusitis, malignant disease or those who had undergone nasal or sinus surgery.

After preliminary anterior & posterior rhinoscopic examination, all 61 patients were evaluated with nasal endoscopy & CT scan PNS coronal view. All CT scan PNS

Fig. 1 Method of measurement of septal angle on CT scan, between the apex of the septal deviation, crista galli and anterior nasal spine

Table 1 Groups of patients on basis of degree of angle of nasal septal deviation

	Group I (0–9°)	Group II (10–15°)	Group III (>15°)	Total (all angles)
N	13	24	24	61
Percentage	21.32	39.34	39.34	100
Mean	6.84°	12.75°	21.83°	15.06°
Range	5–9°	10–15°	16–35°	5–35°

examination were performed on CT Max 64 (VIPRO-G) Scanner using 5 mm contiguous slice thickness for adults and 2–3 mm slice thickness in pediatric cases.

The method used for measuring the angle of septal deviation is as follows —

A coronal CT image best defined the OMC was utilized for calculation of direction and degree of septal deviation. The superior insertion of the nasal septum at the crista galli, its inferior insertion at the level of the anterior nasal spine, and apex of nasal septal deviation were identified and clearly marked on the respective film (Fig. 1). The angle was calculated using a standard protractor, and direction of the septal deviation noted. The data from each of the patient CT scans were analyzed, comparing ipsilateral and contra lateral structural and pathologic processes as a function of septal deviation. Statistical analysis was performed using the Chi square test.

Results

On CT analysis angle of nasal septal deviation was measured and its effect was noted on lateral nasal wall both ipsilaterally and contralaterally. Anatomic variants of the ostiomeatal complex and mucosal abnormalities of the paranasal sinuses were also evaluated.

Out of total 61 patients 34 were male and 27 were female. Majority of patients (57.38 %) were in the age group of 21–40 years.

Clinically, nasal discharge seen in 80.33 % cases was predominantly bilateral and mucoid in nature. Nasal obstruction was seen in 78.69 % cases and DNS was predominantly on left (59.01 %) side.

On CT evaluation of 61 patients mean septal angulation was found to be 15.06° (range 5–35°). Depending on degree of septal angle patients were divided into 3 categories. Group I (0°–9°), Group II (10°–15°), Group III (>15°) (Table 1) In, both group I and II equal number (24) of patients were there.

In this study we found a significant increased incidence of hypertrophy of the contra lateral middle turbinate.

Table 2 Middle turbinate and lateral nasal wall abnormalities (percentage)

	Group I (0–9°)		Group II (10–15°)		Group III (>15°)	
	Ipsi lateral	Contra lateral	Ipsi lateral	Contra lateral	Ipsi lateral	Contra lateral
Hypertrophy	7.69	30.77	4.16	20.83	0	12.5
Concha bullosa	38.46	46.15	33.34	29.17	20.83	50.0
Paradoxical deviation	0	7.69	4.16	4.16	4.16	8.33
Prominent bulla	7.69	15.38	8.33	25.00	16.67	33.34
Unicinate deviation	7.69	15.38	12.5	16.67	16.67	25.00
Haller cell	7.69	0	20.84	12.5	16.67	16.67

(Table 2) In group III patients, significantly increased incidence of contra lateral concha bullosa (Fig. 2) was noticed. Also, statistically significant increase in prominent bulla ethmoidalis with OMC impingement of ethmoid bulla was observed on the side of opposite to the direction of septal deviation (Table 2).

No apparent statistically significant difference between ipsilateral and contralateral side OMC disease and prevalence of anterior sinus mucosal disease in relation to each of the various groups as a function of degree of septal deviation (Table 3).

On CT evaluation of various variants middle turbinate variants like paradoxical middle turbinate and concha bullosa were seen in 8.19 and 49.18 % respectively. More than 75 % of the patients showed presence of Agger Nasi cells and over pneumatized ethmoidal bulla was seen in 27.86 % patients. Over all the abnormal uncinate process was found in 47.5 %.

On CT analysis of mucosal abnormalities, most frequently involved sinus area was anterior ethmoids (68.85 %), followed by maxillary sinus involvement (62.29 %). Sphenoid sinus was the least commonly involved (6.56 %).

Discussion

There was a significantly increased incidence of hypertrophy of the contra lateral middle turbinates, contra lateral concha bullosa in group III patients. A statistically significant increase in prominent of ethmoid bulla with OMC impingement was observed on the side of opposite to the direction of septal deviation. No apparent statistically

significant difference between ipsilateral and contralateral side OMC disease in relation to direction of septal deviation was seen. No statistically significant difference of prevalence of anterior sinus mucosal disease in relation to each of the various groups, both ipsilaterally and contralaterally was seen. It was found that findings of nasal endoscopy and CT scan were complimentary to each other. On comparison of anatomical variations and frequency of mucosal sinus abnormalities with other studies our results were in consistent with them (Tables 4, 5).

Yousem et al. [9] concluded that patients with evidence of sinusitis on CT scanning had a higher degree of septal deviation. Calhoun et al. [10] showed a strong correlation between septal deviation and sinus disease, although the degree of septal deviation was never qualified. Elahi et al. [11] showed ipsilaterally that is in the direction of septal deviation, OMC and sinus disease is directly attributable to the septum in the absence of any other discernible factor.

Table 3 Ostiomeatal complex obstruction and anterior sinus disease as a function of degree of septal deviation

	Group I (0–9°)		Group II (10–15°)		Group III (>15°)	
	Ipsi lateral	Contra lateral	Ipsi lateral	Contra lateral	Ipsi lateral	Contra lateral
OMC obstruction	30.77	69.24	50.00	70.84	20.89	66.67
Ethmoid	15.38	61.54	50.00	66.67	16.66	58.33
Maxillary	15.38	69.23	33.34	37.50	20.84	54.17
Frontal	7.69	15.38	12.5	12.5	4.16	8.33

Table 4 Comparison of anatomical variations with other studies

Anatomical variant	Zinreich [4] (%)	Bolger [5] (%)	Our study (%)
Paradoxical MT	NA	27.1	8.19
Concha bullosa	34	53.6	49.18
Agger nasi cell	NA	98.5	77.05
Haller's cells	10	45.9	18.03

Table 5 CT demonstrated frequency of mucosal sinus abnormalities

	Maxillary	Anterior ethmoid	Posterior ethmoid	Sphenoid	Frontal
Havas et al. [6]	24.4	28.4	NA	11	4.8
Kennedy & Zinrich [7]	66	78	31	16	34
Calhoun et al. [8]	43	34	NA	19	13
Our study	62.29	68.85	13.11	6.56	14.75

Fig. 2 Septal deviation on right side with huge true concha bullosa and Haller cell on contra lateral side

On the side opposite the direction of septal deviation, a prominent bulla ethmoidalis and various middle turbinate abnormalities have been shown to be the cause of OMC obstruction. They also showed increasing OMC disease bilaterally with increasing septal deviation.

Conclusion

From this study we conclude that —

- Nasal endoscopy and CT scan PNS coronal view are complimentary methods for examination of septum and lateral nasal wall.
- Deviated septum was most common anatomic variation found on CT scan PNS and left side deviation was more common. This results in compensatory structural changes in the middle turbinate and other lateral nasal wall structures.
- There has been a strong association linking increasing angles of septal deviation with corresponding patterns of disease within the ostiomeatal complex. Increasing angles of septal deviation are associated with bilateral sinus disease and contra lateral middle turbinate abnormalities and ethmoid bulla prominence.
- The anatomical changes of lateral wall of nose are secondary to septal deviation as the shape of anatomical abnormality usually corresponded to the shape of septal deviation.
- Septal deviation is associated with middle turbinate and lateral nasal wall abnormalities which causes OMC obstruction resulting in sinusitis. The result of the present study reemphasized the concept that obstruction at ostiomeatal complex and anterior ethmoids is the key factor for causation of chronic sinusitis, which is secondary to septal deviation.

Conflict of interest The authors declare that they have no conflict of interest.

References

1. Keleş Bahar, Öztürk Kayhan, Ünal Deniz (2010) Is there any relationship between nasal septal deviation and concha bullosa. *Eur J Gen Med* 7(4):359–364
2. Negus V. 1958, Comparative anatomy and physiology of nose and paranasal sinuses, E & S, livingstone, Ed. Edinberg & London
3. Daghistani KJ (2002) Nasal septal deviation in Saudi patients: a hospital based study. *J KAU Med Sci* 10:39–46
4. Zinreich SJ, Mattox DE, Kennedy DW, Chisholm HL, Diffly DM, Rosenbaum AE (1988) Concha bullosa: CT evaluation. *J Comput Assist Tomogr* 12(5):778–784
5. Bolger WE, Butzin CA, Parson DS (1991) Paranasal sinus bony anatomic variations and mucosal abnormalities; CT analysis for endoscopic sinus surgery. *Laryngoscope* 101:56–64
6. Havas TE, Motbey JA, Gullane PJ (1988) Prevalence of incidental abnormalities on CT scan of PNS. *Arch Otolaryngol Head Neck Surg* 114(8):856–859
7. Kennedy DW, Zinreich SJ, Rosenbaum AE, Johns ME (1985) Functional endoscopic sinus surgery. Theory and diagnostic evaluation. *Arch Otolaryngol* 111(9):576–582
8. Calhoun KH, Waggenpack GA, Simpson CB, Hokanson JA, Baily BJ (1991) CT evaluation of Paranasal sinuses in symptomatic and asymptomatic populations. *Otolaryngol Head Neck Surg* 104:480–483
9. Yousem DM, Kenedy DW, Rosenberg S (1991) Ostiomeatal complex risk factor for sinusitis: CT evaluation. *J Otolaryngol* 20(6):419–424
10. Calhoun KH, Rotzler WH, Stiernberg CM (1990) Surgical anatomy of lateral nasal wall. *Otolaryngol Head Neck Surg* 102(2):156–160
11. Elahi MM, Frenkiel S (2000) Septal deviation and chronic sinus disease. *Am J Rhinol* 14(3):175–179