

**CLINICO-ANATOMICAL VARIATIONAL STUDY OF CHRONIC RHINOSINUSITIS**

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**ABSTRACT****BACKGROUND**

Rhinosinusitis is an infection of nose and paranasal sinuses (PNS) which is influenced by host and environmental factors and is the commonest problem encountered in ENT Clinics. Anatomical variations will affect the incidence of chronic rhinosinusitis which should be addressed in the management.

Aims and Objectives

1. To study the incidence of chronic rhinosinusitis in different sex, age and socio-economic status.
2. To study anatomical variations in direct nasal endoscopy and CT scan in chronic rhinosinusitis.

**MATERIALS AND METHODS**

This study was carried out in the Department of ENT and Head & Neck Surgery of Govt. ENT. Hospital, Andhra Medical College, Visakhapatnam from 1-07-2015 to 30-06-2016. Out of the 72000 out patients, 10800 were with Chronic Rhinosinusitis and 102 cases were included in present study.

After thorough clinical examination, direct nasal endoscopy, blood and urine routine examination, X-ray and CT PNS in coronal, sagittal and axial cuts, patients were distributed according to sex, age variation, socioeconomic status and symptoms. The anatomical variations both in direct nasal endoscopy and in CT PNS were recorded as aetiological factors.

**RESULTS**

Out of the 10800 CRS patients, 102 were included in this study. Male to female ratio was 1:0.47. The age group 21-30 yrs. (38.24%) is affected most commonly followed by 31-40 yrs. (28.45%). The low socio-economic group was affected most commonly (55%). Allergy was found in 62.8%. The most common symptom was postnasal discharge (72.94%) followed by nasal obstruction (65.17%) On endoscopic evaluation, deviated nasal septum was the most common finding (76%) followed by concha bullosa (33%). On CT evaluation, the most common variation was deviated nasal septum (78%), followed by concha bullosa (34%), agger nasi cell (33%), enlarged ethmoidal bulla (32%), uncinat process abnormalities (28%), paradoxical middle turbinate (22%), multiseptated sphenoid (14%), septal cell (12%), Onodi cell (8%) and Haller cell (4%). The least common variation was hypoplastic maxillary sinus (2%).

**CONCLUSION**

The results of this retrospective study show that some anatomical variations of the nose i.e., septum and lateral wall can play an important role in the pathogenesis of chronic rhino sinusitis, and thus may increase the risk of mucosal sinus disease. In this study, males and the age group 21-30 yrs. were most commonly suffered. CRS incidence was highest in low socioeconomic status due to poor nutrition, housing and unhygienic conditions. Allergy is a commonest predisposing and associated factor. Postnasal discharge due to excessive secretion and natural instinct of spontaneously sniffing back the secretions aided by backward movement of cilia of the nose was the commonest symptom. On direct nasal endoscopy and CT evaluation, the most common variation was deviated nasal septum followed by concha bullosa.

**KEYWORDS**

Chronic Rhino Sinusitis (CRS), Anatomical Variations in CT PNS, Direct Nasal Endoscopy, DNE.

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**BACKGROUND**

Rhinosinusitis is a complex infection which involves nasal and paranasal sinuses mucosa and produces nasal

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discharge, epistaxis, postnasal discharge and headache. The host response and surrounding atmosphere have a large role in this infective process. Rhinosinusitis is one of the commonest diseases encountered in clinical practice which has to be stressed to both ENT surgeon, pulmonary physician and also family physicians

The chronicity of the condition also renders it one of the common causes of frequent absenteeism from work and school, also affects the economic and quality of life aspects.

Extrinsic factors like bacterial, viral and fungal infections and allergy (both IgE and non-IgE mediated) and several intrinsic factors like genetic, autoimmune or

structural causes all contribute to CRS. The incidence of CRS is much more than that of acute rhinosinusitis.

Rhinosinusitis can be essentially classified into acute rhinosinusitis, recurrent acute rhinosinusitis (RARS), CRS, acute exacerbation of CRS (AECRS) and subacute rhinosinusitis,

Acute rhinosinusitis is usually bacterial in nature, is of sudden onset, and usually follows an upper respiratory tract infection (URTI). The symptoms are similar to those of URTI and last for a minimum of 5-7 days to a maximum of <4 weeks. RARS is defined by four or more episodes of rhinosinusitis every year with each episode lasting for more than 7-10 days and no symptoms or signs during the refractory period which could be indicative of any ongoing or CRS.

CRS occurs when the duration of symptoms is >12 weeks. There can be occasional worsening of symptoms suggestive of an acute exacerbation and with treatment of the acute attack the symptoms return to baseline CRS. This is termed as AECRS. Sub-acute rhinosinusitis encompasses those with rhino sinusitis lasting for 4-12 weeks. The disease in some of these patients completely resolves in due course of time while in others it progresses to CRS.

The classification of CRS was done with molecular, cellular, and histological markers to identify the characteristics which affect objective measurements like Eosinophilic chronic hyper plastic rhinosinusitis, patients with polyps and sinus tissue eosinophilia.

1. Non-eosinophilic chronic hyper plastic rhinosinusitis: patients with polyps without sinus tissue eosinophilia.
2. Eosinophilic chronic rhino sinusitis: patients without polyps but with sinus tissue eosinophilia.
3. Non-eosinophilic chronic rhinosinusitis: patients without polyps or sinus tissue eosinophilia.

The upper end of attachment of uncinate process may give clue to nature of spread of infection from ethmoid to maxillary and frontal sinuses. If the uncinate process is attached to the middle turbinate, then infection may spread from the frontal to the maxillary sinus. Conversely, if it is attached to the lamina papyracea, then the outflow track from the frontal recess would be isolated from the maxillary sinus, not allowing for spread of infection.

A deviated nasal septum may potentially cause narrowing of the meatus on the side of the convexity/angulations of the deviation. This may not, however, necessarily cause ipsilateral sinusitis. In fact, may a time, the sinusitis has been seen to occur on the opposite side. An pneumatized uncinate process, concha bullosa, paradoxical middle turbinate and a well pneumatized bulla ethmoidalis and accessory ostia with anterior and posterior fontanelles with recirculation of mucus and Haller cell, are also may lead to maxillary sinusitis.

The OMC<sup>1,2</sup> is a functional entity of the anterior ethmoid complex that represents the final common pathway for drainage and ventilation of the frontal, maxillary and anterior ethmoid cells. Thus, anatomical variations<sup>3,4,5</sup> that redirect nasal airflow or narrow the OMC have been implicated in the development of chronic rhinosinusitis.

The CT plays a central role in the modern management of chronic rhinosinusitis due to its ability to delineate mucosal disease<sup>6</sup>, to demonstrate a primary obstructive pathology and to image distal structures such as the posterior ethmoid sinus.

Surgery is reserved for those not responding to medical therapy. The aim of surgery is to remove presumably irreversibly diseased tissue obstructing sinus drainage passages harboring infection, consequently restoring normal sinus function. Endoscopic sinus surgery (ESS) been shown to improve the signs, symptoms and quality of life in individuals with chronic rhinosinusitis.

### Aims and Objectives

1. To study the incidence of chronic rhinosinusitis in various groups i.e. according to sex, age, socio-economic status and symptoms
2. To study the anatomical variations in direct nasal endoscopy and CT scan in chronic rhinosinusitis.

### Study Design

The study is conducted in retrospectively.

### Setting

Government ENT Hospital, Andhra medical college, Visakhapatnam

### MATERIALS AND METHODS

The present study, observations on both clinical and anatomical variations in chronic Rhinosinusitis was carried out in the Department of Ear, Nose and Throat and Head & Neck Surgery of Govt. ENT. Hospital, Andhra medical college, Visakhapatnam for a period of 1-year i.e. from 1-7-2015 to 30-6-2016. During the above period the total no. of patients attended to OPD are 72000, out of which CRS patients were 10800. The total no. of patients admitted in our hospital are 1687 out of which 102 patients with CRS were taken into this study group.

All the patients were examined thoroughly, the nose, ear, oral cavity and throat with headlight both by anterior rhinoscopy & posterior rhinoscopy. Later those who are suspected were subjected to direct nasal endoscopy with both 0° and 30° endoscopes. All the patents in the study group were investigated for blood and urine routine. X-ray PNS and CT PNS in coronal, sagittal and axial cuts were carried out in all. With referral to this the study was conducted in sex distribution, gender variation, socioeconomic status and symptomatology. The anatomical variations both in direct nasal endoscopy and in CT PNS were identified as possible predisposing etiological factors.

### Inclusion Criteria

1. CRS symptoms present for greater than 12 weeks.
2. Two or more of the following symptoms.
  - Anterior or posterior mucopurulent nasal discharge
  - Nasal obstruction, headache
  - Facial pain, pressure or fullness.
3. Evidence of rhinosinusitis on CT scan within 1 year of study entry.

**Exclusion Criteria**

1. Sino nasal polyposis
2. Allergic fungal sinusitis.
3. Sino-nasal malignancy, osteomyelitis, Abscess etc.
4. Facial trauma.
5. Patients with history of previous sinus surgery.

The clinical material for the present study comprises of 102 cases of chronic rhinosinusitis. The patients were examined clinically and further investigated given treatment and follow up. A detailed history of the patient and the thorough clinical examination were conducted as per the following format.

**RESULTS**

Period of Study	Total Cases Attended ENT OPD	Total Cases Attended OPD (Ars)	Total Cases Attended OPD (Crs)	No. of Cases Admitted to IPD	Admitted to IP (Crs)
1/7/2015 to 31/6/2016	72000	2118(2.94%)	10800(15%)	1687(2.34%)	102(0.14%)

**Table 1**

The total number of patients attended to outpatient department were 72000 out of which 2118(2.94%) were with acute rhino sinusitis and 10800(15%) are with chronic rhino sinusitis. The total number of patients admitted for sinus surgery were 1687(2.34%). Our study group consists of 102(0.14%) patients with CRS.

Type of Rhino Sinusitis	No. of Patients	Percentage
Acute	2118	16.4
Chronic	10800	83.6
<b>Total</b>	<b>12918</b>	<b>100%</b>

**Table 2**

The total number of patients with rhino sinusitis were 12918 out of this 2118(16.4%) were with acute rhino sinusitis and 10800 (83.6%) were with CRS.

Age Group	No. of Patients	Percentage
0-10 Yrs.	4	3.92
11-20 Yrs.	14	14.7
21-30 Yrs.	39	38.24
31-40 Yrs.	29	28.45
41-50 Yrs.	8	7.84
51-60 Yrs.	6	5.88
61 Onwards	2	1.96
<b>Total</b>	<b>102</b>	<b>100%</b>

**Table 3**

The age group 21-30 yrs. (38.24%) is affected most commonly later 31-40 yrs. (28.45%), 11-20 yrs. (14.70%), 41-50 yrs. (7.84%), 51-60 yrs. (5.58%), 0-10 yrs. (3.92%) in descending order. The least affected group is 61- above yrs. (1.96%).

Sex	No. of Patients	Percentage
Male	69	67.64
Female	33	32.36
<b>Total</b>	<b>102</b>	<b>100%</b>

**Table 4**

Males are more affected 69 (67.64%) than females 33(32.36%) with a ratio of M:F - 1:0.47

Economic Status	No. of Patients	Percentage
HESE	46	45.09
LESE	56	54.91
<b>Total</b>	<b>102</b>	<b>100%</b>

**Table 5**

The low socio-economic status patients were (54.91%) affected most commonly than the patients in high socioeconomic status (45.09%).

Type	No. of Patients	Percentage
Allergy	64	62.8
Non-Allergic	38	37.2
<b>Total</b>	<b>102</b>	<b>100%</b>

**Table 6**

Out of 102 patients, 64 patients presented with allergy (62.8%) and 38 patients presented with non-allergic symptoms (37.2%).

**Incidence of Symptoms in Cases**

Symptom	No. of Patients	Percentage
Headache	35	35.4
Nasal obstruction	65	65.17
Nasal discharge	52	52.52
Post nasal drip	72	72.94
Disturbance of smell	14	13.72
Bleeding per nose	10	9.8
Crust	2	1.9
Sneezing	51	50.8
Irritation of throat	30	29.78
Aural problem	16	15.82
Foetid smell from mouth	5	4.82
Toothache	5	4.9
Change of voice	10	9.8

**Table 7**

In the study group, most common symptom was postnasal discharge (72.94%). The second most common symptom was nasal obstruction (65.17%), followed by nasal discharge (52.52%) sneezing (51%), headache (35%) irritation in throat (29.78%), aural problem (15.82%) disturbance of smell (13.72%), bleeding per nose and change of voice with each 9.8% and fetid smell from mouth and tooth ache with each 4.9%.

### Endoscopic Evaluation

	No. of Patients	Percentage
Concha Bullosa	33	33
Enlarged Uncinate Process	19	19
Enlarged Bulla	17	17
Paradoxical Turbinate	11	11
Purulent Discharge at OMC	23	23
Mucoid Discharge at OMC	20	20
Accessory Maxillary Ostium	25	25
Deviated Nasal Septum	75	76

**Table 8**

In our patients, on endoscopic evaluation, deviated nasal septum was the most common finding (76%) followed by concha bullosa (33%), accessory maxillary ostium (25%) purulent discharge at OMC (23%), mucoid discharge at OMC (20%), enlarged uncinate process (19%), enlarged bulla (17%). The least common observation was paradoxical turbinate (11%).

### CT Evaluation

	No. of Patients	Percentage
Deviated Nasal Septum	77	78
Uncinate Process Abnormalities	28	28
Paradoxical Middle Turbinate	22	22
Concha Bullosa	38	38
Enlarged Ethmoidal Bulla	32	32
Septal Cell	12	12
Hypoplastic Maxillary Sinus	2	2
Agger Nasi Cell	33	33
Multiseptate Sphenoid	14	14
Onodi Cell	8	8
Haller's Cell	4	4

**Table 9**

On CT evaluation, the most common variation was deviated nasal septum (78%), followed by concha bullosa (34%), agger nasi cell (33%), enlarged ethmoidal bulla (32%), uncinate process abnormalities (28%), paradoxical middle turbinate (22%), multiseptate sphenoid (14%),

septal cell (12%), Onodi cell (8%) and Haller cell (4%). The least variation was hypoplastic maxillary sinus (2%).

### DISCUSSION

Out of 72000 patients who attended the ENT OP for one year that is from July 2015 to June 2016, total case of sinusitis 12918 were identified and CRS was seen in 10800 (83.6%) and acute rhino sinusitis 2118 (16.4%). Kaliner MA, Osguthorpe JD et al<sup>7</sup>, also suggested chronic rhino sinusitis more common than acute rhinosinusitis.

Out of 10800 cases of chronic rhino sinusitis, 1687 were admitted in which 102 cases with chronic rhino sinusitis were considered in the present series under study.

Males are more affected 69 (67.64%) than females 33(32.36%) with a ratio of M:F- 1: 0.47(68: 32) which is similar to, Rashi Tiwari et al<sup>8</sup> (68: 32) and Vandana Mendaritta et al<sup>9</sup> (M:F::70:30) and varies from Sweta Lohiya et al<sup>10</sup> (52: 48) even though in this also males are dominated.

The age group 21-30 yrs. (38.24%) is affected most commonly later 31-40 yrs. (28.45%), 11-20 yrs. (14.70%), 41-50 yrs. (7.84%), 51-60 yrs. (5.58%), 0-10 yrs. (3.92%) in descending order, which is similar to Vandana Mendaritta et al<sup>9</sup> in which maximum number of cases were found in the age group of 15-30 years (52.5%) and Rashi Tiwari<sup>8</sup> et al maximum number of cases were in the age group of 21-30 years. The least affected group is 61- above yrs (1.96%) which is similar to Rashi Tiwari et al.<sup>8</sup> This higher incidence of sinusitis in this age group maybe due to more exposure to infection in view of their outdoor activities.

CRS incidence is highest in poor due to poor nutrition housing and unhygienic conditions 59(54.91%).

In the present study of 102 cases of CRS 64(62.8%) are suffering from allergy and 38 (37.2%) cases are non-allergic in origin. Fergusson BJ. Narita M et al,<sup>11</sup> shown 64% of allergic cases which is almost similar to us.

In the study group, most common symptom was postnasal discharge (72.94%) which is similar to Vandana Mendaritta et al<sup>9</sup> (85%) in which postnasal discharge is the most common symptom and varies from Sweta S Lohiya et al<sup>10</sup> in which nasal obstruction (95%) is more common symptoms. The second most common symptom was nasal obstruction (65.17%), followed by nasal discharge (52.52%) sneezing (51%), headache (35%) irritation in throat (29.78%), aural problem (15.82%) disturbance of smell (13.72%) , bleeding per nose and change of voice with each 9.8% and fetid smell from mouth and tooth ache with each 4.9%.

In our patients, on endoscopic evaluation, deviated nasal septum was the most common finding (76%) followed by concha bullosa (33%) , accessory maxillary ostium (25%) purulent discharge at OMC (23%), mucoid discharge at OMC (20%), enlarged uncinate process(19%), enlarged bulla(17%). The least common observation was paradoxical turbinate (11%). In Sweta Lohiya et al,<sup>10</sup> on endoscopic evaluation most common finding was septal deviation (79%), and Vandana Mendaritta et al<sup>9</sup> septal deviation was seen in 72.75% which are almost comparable to our study.

On CT evaluation, the most common variation was deviated nasal septum (78%), which is nearer to Rashi<sup>8</sup> 88% and Vandana Mendaritta Et al<sup>9</sup> septal deviation was seen in 73% which are almost comparable to our study.

Incidence of concha bullosa in CT is 34% which is similar to Sheetal D<sup>12</sup> et al 38.5% and near to Zinreich et al.<sup>13</sup> 36%. Agger nasi cell was found in 33% in this group which is comparable to Sheetal D<sup>12</sup> et al (35%) and varies from Vandana Mendaritta Et al.<sup>9</sup> Enlarged ethmoidal bulla is noticed in 32% which is varies from Rashi Tiwari et al<sup>8</sup> with 63% The uncinate process abnormalities was seen in 28% which is nearer to Vandana Mendaritta Et al<sup>9</sup> with 32% and varies to Rashi Tiwari et al<sup>8</sup> with 11%. The paradoxical middle turbinate was in 22% which is nearer to Vandana Mendaritta Et al<sup>9</sup> with 25% and which varies from Rashi Tiwari et al<sup>8</sup> with 11%.

The Haller's cell was found in 4% cases which is similar to Rashi Tiwari et al<sup>8</sup> 3% and varies from Sheetal D<sup>12</sup> et al. (7%) Septal cell was found 12% which similar to both Rashi Tiwari et al<sup>8</sup> 8% and Sheetal D et al<sup>12</sup> (7%). Onodi cell was seen in 8% which varies from Rashi Tiwari et al<sup>8</sup> 2%. The least variation was hypoplastic maxillary sinus (2%).

## CONCLUSION

The results of this retrospective study show that some anatomical variations of the nose i.e., septum and lateral wall can play an important role in the pathogenesis of chronic rhino sinusitis, and thus may increase the risk of mucosal sinus disease.

In this study, males were more affected 69 (67.64%) than females 33(32.36%) with a ratio of M:F - 1:0.47(68:32). The age group 21-30 yrs. (38.24%) was affected most commonly. CRS incidence was highest 59 (54.91%) in low socioeconomic status due to poor nutrition, housing and unhygienic conditions. Out of 102 cases of CRS 64 (62.8%) were suffering from allergy. The most common symptom was postnasal discharge (72.94%) due to excessive secretion and natural instinct of spontaneously sniffing back the secretions aided by backward movement of cilia of the nose.

On direct nasal endoscopy and CT evaluation, the most common variation was deviated nasal septum (78%) and the second common was concha bullosa (34%).

The quality of endoscopes, cameras, monitors and image guided system will improve the results of sinus surgery. There is need of training to the ENT surgeons in CT to identify anatomical variations in coronal, sagittal and axial sections with 3-dimensional view.

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