Main Article

A Clinical and Radiological Evaluation of Chronic Rhinosinusitis

https://doi.org/10.47210/bjohns.2022.v30i2.806

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ABSTRACT

Introduction

The diagnosis of rhinosinusitis is based on clinical grounds having characteristic symptoms, combined with objective evidence of mucosal inflammation. We studied the corelation between the symptoms of the patients, clinical and endoscopic findings with CT scan findings in chronic rhinosinusitis (CRS).

Materials and Methods

Patients above the age of 15 yrs fulfilling the criteria of Chronic sinusitis laid by European position paper on rhinosinusitis and nasal polyps (EPOS) 2012 were prospectively studied. Demographic and clinical profile were noted. Diagnostic Nasal Endoscopy was done and findings were recorded. Patients were undergone CT evaluation after giving appropriate medical management. Clinical, endoscopic and radiological findings were compared with similar studies. Data was analysed using IBM SPSS software version 20.

Results

This study included 118 patients of Chronic Rhinosinusitis. Patients commonly male between the age group of 21-30 years presented with nasal obstruction, headache and nasal discharge in order of presentation. Diagnostic nasal endoscopy revealed septal deviation in 64.4% and medialize uncinate process in 15.2% of cases. Nasal discharge (48.3%) was commonest finding. CT scan suggested deviated nasal septum (70.4%), concha bullosa (30.5%), blocked osteo-meatal complex (68.6%) in patients of CRS. Presence of Agger Nasi cell (49.2%), Haller cell (12.7%) and Onodi cell (15.7%) seen in these patients.

Conclusion

CT scan and diagnostic endoscopy along with detailed clinical examination are essential component for assessment of a patient with chronic rhinosinusitis. CT scan is considered as gold standard but endoscopy is also a valuable tool for diagnostic evaluation of patients with CRS.

Keywords

Chronic Rhinosinusitis; Nasal Endoscopy; Tomography, X-Ray Computed

Rhinosinusitis is one of the most common health problems and is increasing in prevalence and incidence. According to the European position paper on rhinosinusitis and nasal polyps, rhinosinusitis is defined on the diagnosis made on clinical grounds based on the presence of characteristic symptoms, combined with objective evidence of mucosal inflammation.[1] New guidelines for rhinosinusitis from a multidisciplinary panel commissioned by the American Academy of Otolaryngology-Head and Neck surgery were published which stated that patients with 12 weeks or longer of two or more of the following signs and symptoms: mucopurulent drainage (anterior, posterior, or both); nasal obstruction (congestion); facial pain/pressure/fullness; or decreased sense of smell with additional information from the investigative modalities such as computed tomography (CT) scan of nose and PNS and diagnostic nasal endoscopy (DNE) can be used to diagnose, assess the severity of disease and plan the definitive line of management.[2]

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EPOS 2012 has included the need for endoscopic or radiological findings in the diagnosis of chronic rhinosinusitis. Today the rigid nasal endoscopy and CT imaging are the gold standard investigation in diagnosing CRS. Multiple causes contribute to the development of CRS, but a common pathophysiologic sequela is mucosal oedema and ineffective sino-nasal mucociliary clearance (MCC) due to impairment of 1 or more or its components (epithelium, cilia, mucus) resulting on stasis of sinonasal secretions and subsequent chronic infection or persistent inflammation. The anatomy of sinonasal area has a very wide range of anatomical variants. Due to their complex three-dimensional structure and many morphological variations, understanding these anatomical aspects is of paramount importance to a sinus surgeon.

Osteomeatal complex is an important functional unit which consist of Multiple bony structures (middle turbinate, uncinate process, bulla ethmoidalis); Air spaces (Frontal recess, ethmoidal infundibulum, middle meatus); Ostia (anterior ethmoidal, maxillary and frontal sinuses). It is the key area for the pathogenesis of chronic rhinosinusitis.

The present study was undertaken to study the signs and symptoms, radiological evaluation of Osteo-meatal complex and correlate the clinical and endoscopic findings with the radiological findings in Chronic Rhinosinusitis.

Materials and Methods

This Prospective observational study was conducted in the department of ENT between December 2019 and June 2021 with the sample size of 118 chronic Rhinosinusitis patients. Clinical diagnosis of CRS was made using the guidelines by the European position paper on rhinosinusitis and nasal polyps (EPOS) which defined rhinosinusitis as a diagnosis made on clinical grounds based on the presence of characteristic symptoms, combined with objective evidence of mucosal inflammation.[3] Chronic rhinosinusitis refers when the symptoms persist for 12 weeks or longer. OS 2012 has included the need for endoscopic or radiological findings in the diagnosis of chronic rhinosinusitis. Informed written consent was obtained from all the patients. Data was analysed using IBM SPSS software version 20. Categorical data was expressed as frequency and proportion whereas continuous data was expressed as mean and standard deviation. Association between categorical variables was done using chi square test and p value of less than 0.05 was considered statistically significant.

This study aimed to correlate the signs and symptoms of chronic rhinosinusitis and the endoscopic features with radiological findings. We also assessed the anatomical variants in the osteo-meatal complex in patients of chronic rhinosinusitis.

Patients above the age of 15 years presenting with symptoms of chronic rhinosinusitis were included in the study. Patients with prior h/o nasal or sinus surgery or nasal trauma, nasal polyp, allergic rhinitis, odontogenic sinusitis, nasal mass, immunodeficiency and muco-ciliary disorders and patients not willing to give consent were excluded from the study.

The major diagnostic criteria of rhinosinusitis in adults are presence of at least one of the primary symptoms[3] [Nasal blockage/obstruction/congestion and Nasal discharge (anterior/posterior)]. At least one of the additional symptoms (facial pain/pressure, hyposmia/anosmia) is needed if only one of the primary symptoms is present to establish the diagnosis. The symptoms need to be corroborated with presence of Nasal polyp/mucopurulent discharge (middle meatus)/oedema/mucosal obstruction in middle meatus on nasal endoscopy and characteristic CT scan findings of mucosal changes within the osteo-meatal complex and/or sinuses.

The cases selected for the study were subjected to detailed history taking which includes personal history, clinical history and treatment history. further these cases were clinically examined in detail which includes anterior and posterior rhinoscopy, throat and sinus examination. A routine blood investigation was done in all the selected cases which includes complete blood count, serology, RBS, urine routine examination etc. All the patients in

active stage of the disease were treated with course of suitable antibiotic, systemic antihistamines, local decongestants and steroids. They were also treated for medical conditions like diabetes mellitus and hypertension. Each patient underwent a systematic diagnostic nasal endoscopy and Computed Tomography of nose and paranasal sinuses was performed in each patient after 2 weeks of treatment.

Nasal endoscopy was performed in all cases to note mucosal hyperaemia, oedema, sites of origin of nasal polyps and septal deformities or any other abnormalities impacting sinus drainage.

Before undergoing CT scanning, the patients were instructed to clean their nose by blowing out any secretions. Xylometazoline 0.1 % drops were instilled in both nasal cavities 30 minutes prior to scanning. All the patients in this study were scanned with 128 Slice Multi detector CT system. Direct axial sections were taken in all patients in the supine position. Later scans were post processed and reconstructed in sagittal as well as coronal sections and evaluated in all the three planes.

Results

The present study was conducted on a total of 118 patients with chronic rhinosinusitis. The findings of present study are as follows:

Age and Gender: Mean age of patients with chronic sinusitis was 35.23±12.77 years and maximum i.e., 40.7% cases belonged to age range of 21 to 30 years of age. Male predominance was observed for chronic rhinosinusitis with the male: female ratio of 1.8:1. About 64.4% cases were males whereas only 35.6% were females.

Clinical Features: Nasal obstruction was noted in 94.9% cases whereas 66.9% and 61% cases presented with headache and nasal discharge respectively. However, hyposmia, anosmia and paraosmia were noted in 33.1%, 7.6% and 2.5% cases respectively. About 29.7% cases had facial pain and 28.8% cases had postnasal drip (Fig. 1).

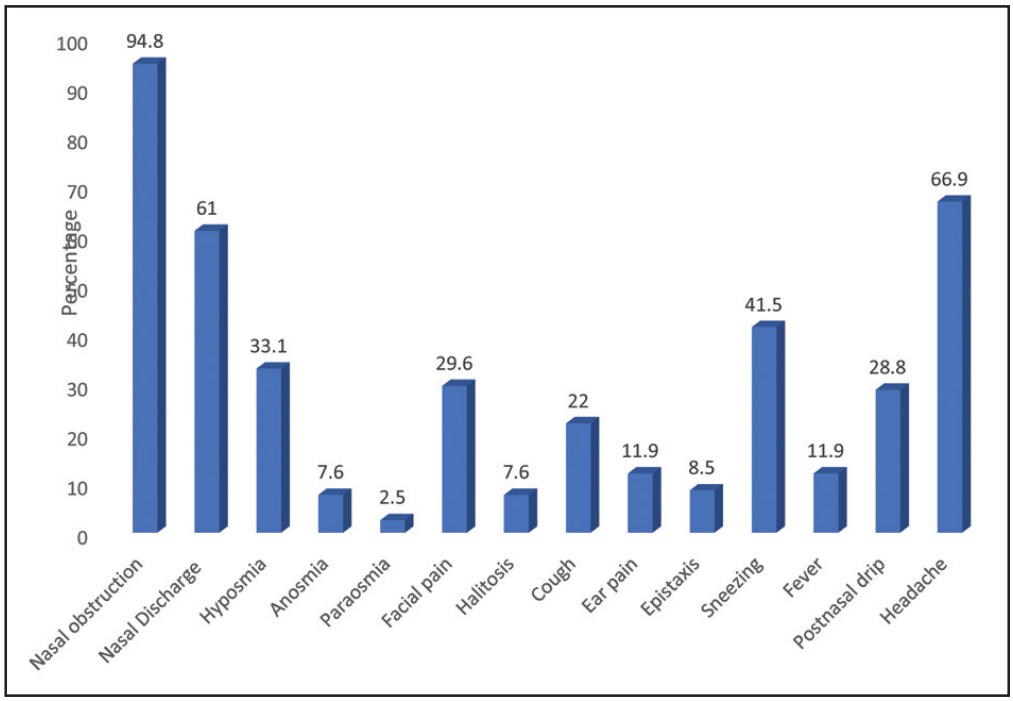

Fig. 1. Distribution of patients according to symptoms

Clinical examination including anterior and posterior rhinoscopy: Anterior rhinoscopy revealed nasal discharge in 55.9% cases, Discharge was mucoid and mucopurulent in 29.7% and 21.2% cases respectively whereas it was purulent in 5.1% cases. Nasal mucosa was congested in 33.9% cases, oedematous in 12.7% and pale in 8.5% cases. Septal deviation was observed in 66.1% cases. Deviation was on right side in 26.3%, left side in 31.4% cases and it was S shaped in 8.5% cases. Anterior rhinoscopy revealed unilateral inferior turbinate hypertrophy in 31.4% and bilateral inferior turbinate hypertrophy. However, unilateral and bilateral middle turbinate hypertrophy was noted in 19.5% and 6.8% respectively (Table I).

Table I: Distribution according to anterior rhinoscopy findings

ANTERIOR RHINOSCOPY		FREQUENCY (N=118)	PERCENTAGE
Nasal discharge	**Mucopurulent**	**25**	**21.2**
	Mucoid	**35**	**29.7**
	Purulent	**6**	**5.1**
	Absent	**52**	**44.1**
Nasal mucosa	**Congested**	**40**	**33.9**
	Edematous	**15**	**12.7**
	Pale	**10**	**8.5**
	Normal	**53**	**44.9**
Septal deviation	**Left**	**37**	**31.4**
	Right	**31**	**26.3**
	S shaped	**10**	**8.5**
	Absent	**40**	**33.9**
Inferior turbinate hypertrophy	**Unilateral**	**37**	**31.4**
	Bilateral	**31**	**26.3**
	Absent	**50**	**42.4**
Middle turbinate hypertrophy	**Unilateral**	**23**	**19.5**
	Bilateral	**8**	**6.8**
	Absent	**87**	**73.7**

Diagnostic Nasal Endoscopy (DNE): DNE revealed nasal discharge in 48.3% cases, and it was mucopurulent discharge in maximum cases. However, nasal mucosa was congested in 30.5% and oedematous in 20.3% cases. Septal deviation on right and left side and S shaped in 24.6%, 28.8% and 11% respectively. Above table reveals that inferior turbinate was hypertrophied unilaterally in 30.5% and bilaterally in 24.6%. Unilateral and bilateral Middle turbinate hypertrophy was noted in 29.7% and 6.8% cases respectively. Discharged from inferior meatus was seen in 17.8% cases whereas that from superior meatus and Spheno-ethmoidal recess was observed in 19.5% and 21.2% cases. Accessory ostium was seen in 5.1% cases unilaterally and 11.9% bilaterally. Discharge from middle meatus was noted in 33.1% cases unilaterally and 20.3% cases bilaterally. Hypertrophied uncinated process was observed in 6.8% cases on right and left side each. Uncinate process was medialized in 9.3% cases on right side and 5.9% cases on left side. Uncinate process was normal in 83.9% and 87.3% cases on right and left side respectively (Fig. 2).

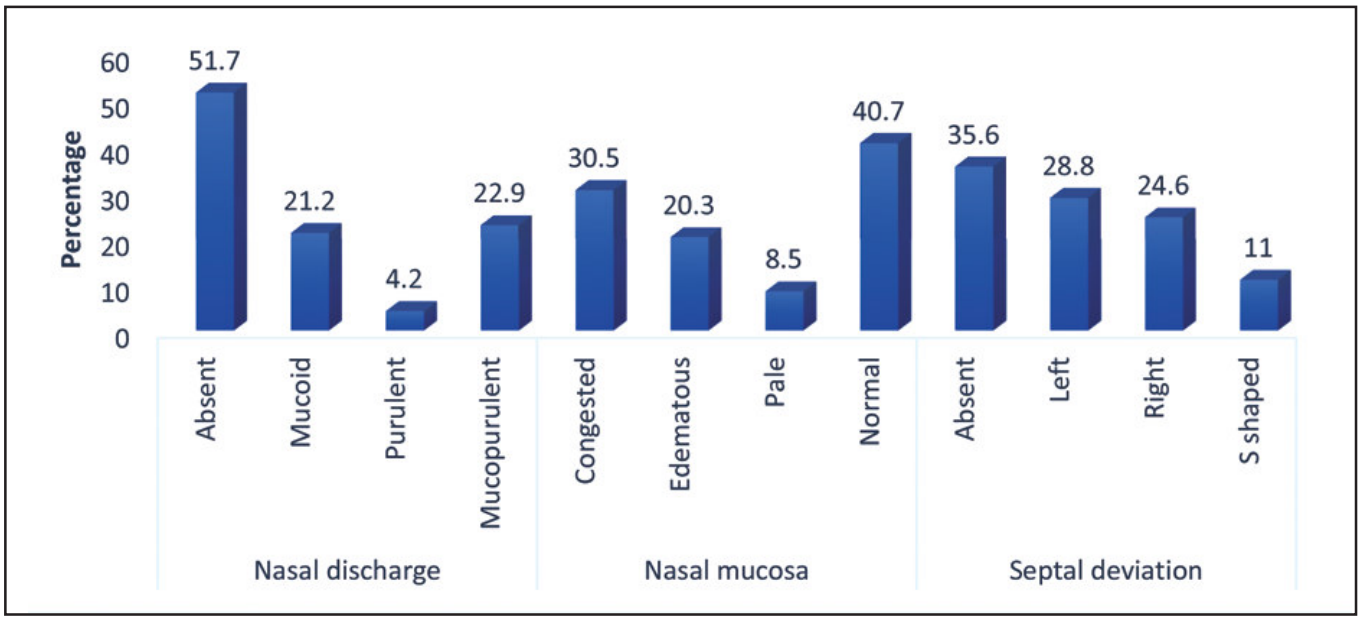

Fig. 2. Distribution according to findings of DNE

CT Scan Findings: Osteo-meatal complex was patent on one side in 31.4% cases whereas it was patent on both side in 33.1% cases. Maxillary sinusitis was noted in 17.8% and 31.4% cases on right and left side respectively whereas anterior ethmoidal sinusitis was noted in 23.7% cases on right side and 34.7% cases on left side. Other findings observed in cases with chronic rhinosinusitis were frontal, posterior ethmoid and sphenoid sinus mucosal hypertrophy. CT scan not only revealed hypertrophy of middle turbinate as seen in clinical examination and DNE, it also revealed concha bullosa and paradoxical middle turbinate. Based upon CT scan findings, concha bullosa was seen in 14.4% and 16.1% cases on right and left side respectively. About 7.6% cases and 16.1% cases respectively had hypertrophied middle turbinate. Paradoxical middle turbinate was seen in CT scan in 4.2% cases on right side and 3.4% cases on left side. Most common attachment of uncinate process was seen on lamina papyracea followed by middle turbinate and skull base. Uncinate process was attached on lamina papyracea in 56.8% cases on right and 61.9% cases on left. On right side, uncinate process was hypertrophied, medialized and pneumatized in 0.8%, 10.2% and 9.3% cases respectively.

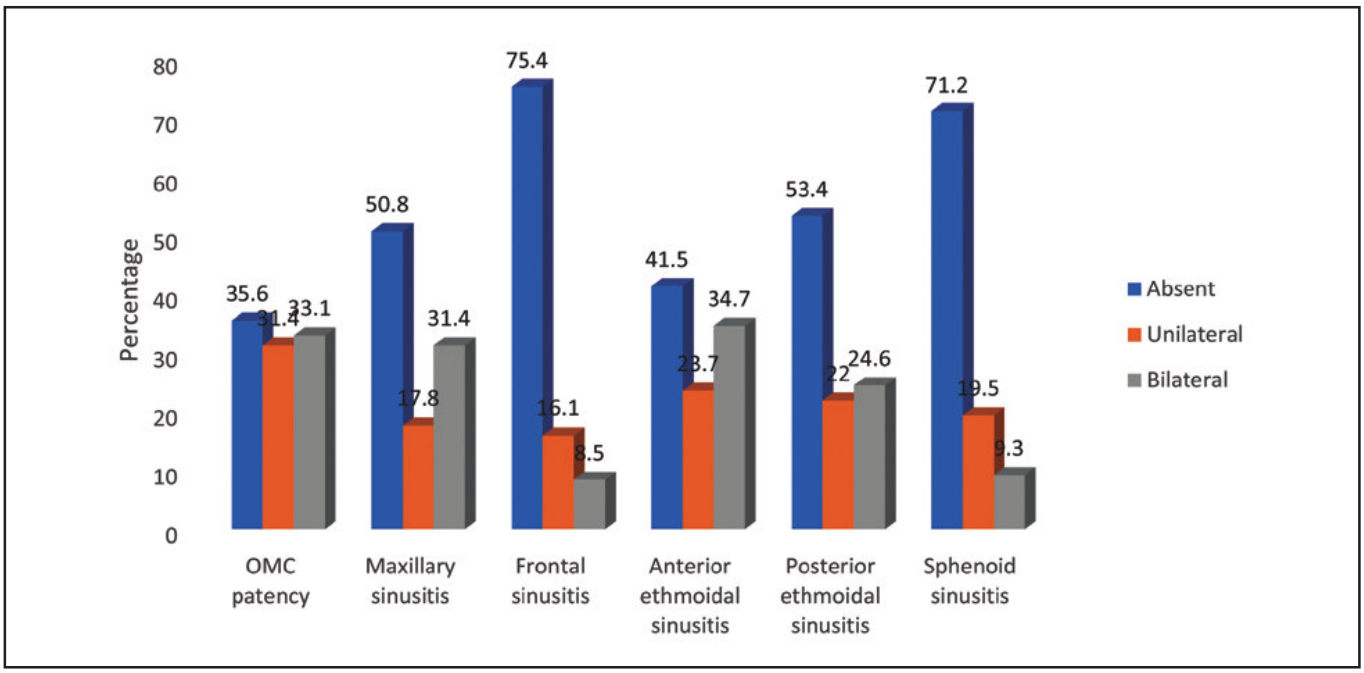

Fig. 3. Distribution according to OMC patency and sinus haziness on CT scan

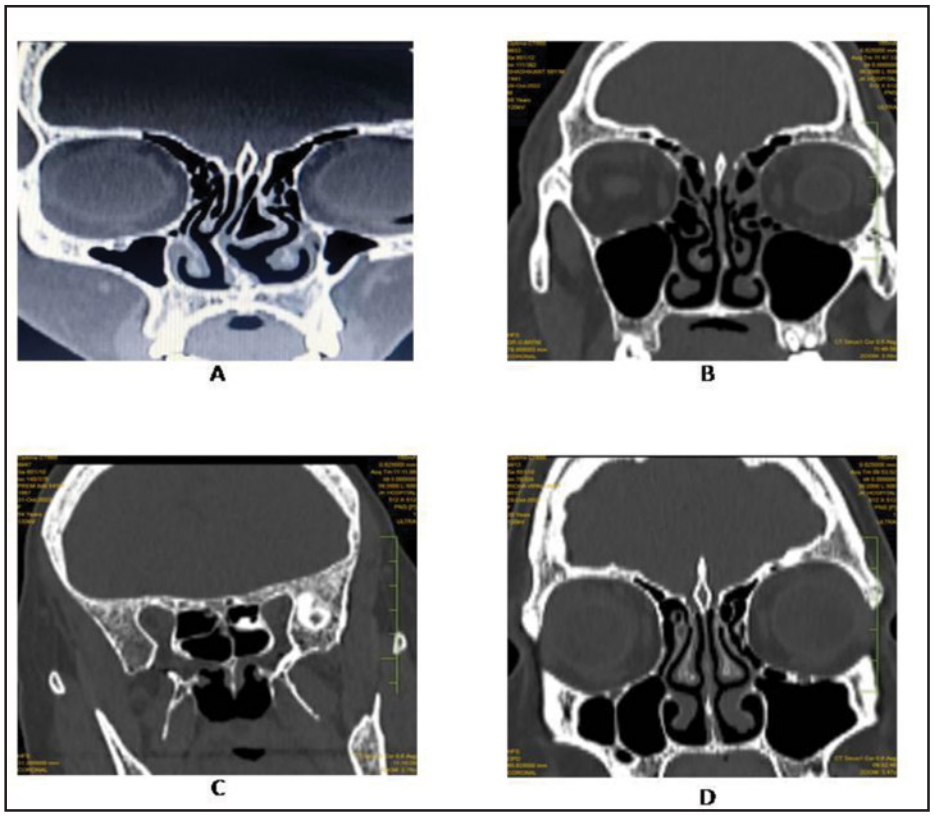

Fig. 4. A. CT scan showing left septal spur with Concha Bullosa

B. CT scan showing right paradoxical middle turbinate

C. CT scan showing bilateral Onodi Cells

D. CT scan showing attachment of the right uncinate process to the skull base and to the Middle Turbinate on the left side

Whereas that on left side was 2.5%, 6.8% and 9.3% cases respectively. Frontal cells of type 1 to 4 were present in 74.4% cases on right and 67.8% cases on left side with maximum number has type 1 frontal cell (rt-38.1% and lt-32.2%) followed by type 2 (rt-16.9 and lt-22.9), type 3 (rt-5.1 and lt-5.1) and type 4 (rt-4.2 and lt-5.1). On right side, out of 56 cases with patent OMC, septal deviation on right side was noted in 26.9% cases whereas 19.6% cases had S shaped septal deviation. Concha bullosa was noted in 10.7% cases with patent OMC on right side. In patients with patent OMC on right side, Agger cells, Haller cells and Onodi cells were present in 62.5%, 25% and 23.2% cases respectively on right side. Similarly, on left side, out of 59 cases with patent OMC on left, 22 and 23.7% cases had left sided and S shaped septal deviation. In patients with patent OMC on left side, 50.5% cases had Agger Nasi, 22% had Haller cells and 20.3% had Onodi cells. In present study, we observed no significant association of OMC patency with anatomical variations irrespective of side of variations ($p>0.05$) (Figs. 3, 4) (Table II, III, IV).

Table II: Distribution according to findings on CT scan

CT SCAN		RIGHT		LEFT	
		n	%	n	%
Middle turbinate	Concha bullosa	17	14.4	19	16.1
	Hypertrophied	9	7.6	19	16.1
	Paradoxical middle turbinate	5	4.2	4	3.4
	Normal	87	73.7	76	64.4
Attachment of uncinate process	Lamina Papyracea	67	56.8	73	61.9
	Middle turbinate	26	22	21	17.8
	Skull base	25	21.2	24	20.3
Uncinate process variation	Hypertrophied	1	0.8	3	2.5
	Medialized	12	10.2	8	6.8
	Pneumatized	11	9.3	11	9.3
	Normal	94	79.7	96	81.4
Frontal cell	Type 1	45	38.1	38	32.2
	Type 2	20	16.9	27	22.9
	Type 3	6	5.1	6	5.1
	Type 4	5	4.2	6	5.1
	Absent	42	35.6	41	34.7

Table III: Distribution according to anatomical variations on CT scan

ANATOMICAL VARIATION BASED ON CT		FREQUENCY (N=118)	PERCENTAGE
Septal deviation	Left	31	26.3
	Right	27	22.9
	S shaped	25	21.2
	Absent	35	29.7
Concha Bullosa	Right	17	14.4
	Left	19	16.1
Agger Nasi	Unilateral	23	19.5
	Bilateral	58	49.2
	Absent	37	31.4
Haller cells	Unilateral	15	12.7
	Bilateral	15	12.7
	Absent	88	74.6
Onodi cells	Unilateral	6	5.1
	Bilateral	18	15.3
	Absent	94	79.7

Table IV: Association of OMC patency with anatomical variations

ANATOMICAL VARIATIONS		OMC PATENCY			
		RIGHT		LEFT	
		ABSENT (n = 62)	PRESENT (n = 56)	ABSENT (n = 59)	PRESENT (n = 59)
Septal deviation	Absent	16 (25.8)	19 (33.9)	18 (30.5)	17 (28.8)
	Left	20 (32.3)	11 (19.6)	18 (30.5)	13 (22)
	Right	12 (19.4)	15 (26.9)	12 (20.3)	15 (25.4)
	S shaped	14 (22.6)	11 (19.6)	11 (18.6)	14 (23.7)
	χ^2	3.27		1.53	
	P value	0.35		0.68	
Middle turbinate	Concha bullosa	11 (17.7)	6 (10.7)	10 (16.9)	9 (15.3)
	Hypertrophied	3 (4.8)	6 (10.7)	13 (22)	6 (10.2)
	Paradoxical middle turbinate	2 (3.2)	3 (5.4)	3 (5.1)	1 (1.7)
	Normal	46 (74.2)	41 (73.2)	33 (55.9)	43 (72.9)
	χ^2	2.66		4.95	
	P value	0.45		0.18	

Table IV: Contd.

Table IV (Contd.): Association of OMC patency with anatomical variations

ANATOMICAL VARIATIONS		OMC PATENCY			
		RIGHT		LEFT	
		ABSENT (n = 62)	PRESENT (n = 56)	ABSENT (n = 59)	PRESENT (n = 59)
Agger Nasi	Absent	24 (38.7)	21 (37.5)	23 (39)	29 (49.2)
	Present	38 (61.3)	35 (62.5)	36 (61)	30 (50.8)
	χ^2	0.018		1.24	
	P value	0.89		0.27	
Haller cells	Absent	54 (87.1)	42 (75)	49 (83.1)	46 (78)
	Present	8 (12.9)	14 (25)	10 (16.9)	13 (22)
	χ^2	2.94		0.486	
	P value	0.09		0.49	
Onodi cells	Absent	54 (87.1)	43 (76.8)	50 (84.7)	47 (79.7)
	Present	8 (12.9)	13 (23.2)	9 (15.3)	12 (20.3)
	χ^2	2.14		0.52	
	P value	0.14		0.47	

Discussion

The present study was conducted at tertiary care centre with the objectives to study the clinical profile of chronic rhinosinusitis, assess the anatomical variation in the osteomeatal complex and to correlate the clinical and the endoscopic findings with that of radiological findings in patients of Chronic rhinosinusitis. The study included a total of 118 patients with chronic rhinosinusitis who were then subjected to clinical (including DNE) and radiological evaluation. Above table reveal that age and gender composition of patients with chronic rhinosinusitis observed in our study was similar to that of previous studies. However, our study findings were at variance to findings of Caliaperoumal et al (2021) in which female preponderance was observed and mean age was also higher.[4]

In present study, four cardinal features were noted in majority of cases either on unilateral or bilateral sites. The most common cardinal clinical feature observed in our study was nasal obstruction (94.9%), followed by nasal discharge (61%), hyposmia/ anosmia/ parosmia in 43.2% and facial pain in 29.7% cases. Other features observed in patients with chronic rhinosinusitis included headache, sneezing, postnasal drip, cough, fever, ear pain, epistaxis and halitosis. The role of endoscopy in outpatient management was first illustrated by Hughes et al (1998).[5] Diagnostic endoscopy has been recommended for diagnosis of chronic rhinosinusitis by EPOS 2012.[3] The findings of present study were supported by findings of Baruah et al (2019) in which deviated nasal septum (60.7%) was the most common finding observed on DNE in patients with CRS.[6] Also, They also observed pneumatized middle turbinate or concha bullosa in 31.3% cases, paradoxical middle turbinate in 20% and accessory ostium in 32.3% cases. Septal deviation may compress the middle concha as well as uncinated process into the infundibulum compromising the patency of osteo-meatal complex.[7] CT scan is considered as gold standard method for diagnosis of chronic rhinosinusitis. CT scan also help in identification of anatomical variations in patients with CRS, which are often common in such cases. CT scans delineates the anatomy of sinuses and helps in identification of sinus abnormalities and pathologies with

higher accuracy.[8] CT scan is more sensitive as compared to plain X-ray for identification of sinus pathology, particularly sphenoid sinus and ethmoid sinus.[9,10] Concha bullosa by affecting the ventilation of the sinuses as well as the mucociliary clearance is implicated in the etiology of recurrent chronic rhinosinusitis.[11] In our study, CT scan revealed concha bullosa in 14.4% and 16.1% cases on right side and left side respectively whereas paradoxical middle turbinate was observed in 4.2% cases on right and 3.4% cases on left side. Our study findings were supported by findings of Kaygusuz et al (2014) in which concha bullosa was noted in 41.5% cases with CRS (9.2% on right and left side each and 23% bilateral) whereas paradoxical middle turbinate was observed in 13.8% cases in the reference study.[12] Sonone et al (2019) observed concha bullosa in 10.5% and 5.3% cases on bilateral and right side respectively and 7.02% cases had paradoxical middle turbinate.[13] Nangia et al (2019) observed Concha bullosa in 32.5 and 37.5% patients with CRS on the left and right sides respectively.[14] About 25.3% and 16.9% cases of CRS had concha bullosa and paradoxical middle turbinate in a study of Baruah et al (2019).[6] In approximately 60% cases, the uncinate process was attached on lamina papyracea irrespective of the side whereas the attachment was at middle turbinate and skull base in approximately 20% cases each. On right side, uncinated process was medialized, and pneumatized in 10.2% and 9.3% cases respectively whereas on left side, medialized and pneumatized uncinated process was noted in 6.3% and 9.3% cases respectively. However, Kaygusuz et al (2014) in their study observed pneumatized uncinated process in 4.6% cases with CRS.[12] Abnormal uncinate process was observed in 75.44% cases of CRS in a study of Sonone et al (2019).[13] Nangia et al (2019) on the other hand identified medialized uncinated process in 67.5% on left and 62.5% cases on right side.[14]

Anatomical variations are commonly associated with chronic rhinosinusitis and may be the underlying etiology for CRS. Amongst various anatomical variations, deviated nasal septum is the most common variations observed in patients with CRS which was in line with the previous studies. Agger nasi cells is also the common anatomical variation after DNS which may be observed in as high as 90% of the cases.[13] In present study, OMC was patent in 31.4% and 33.1% cases on unilateral and bilateral cases respectively. Our study observed no significant association of patency of osteometal complex with various anatomical variations in patient with CRS. Osteomeatal complex was abnormal in 77.2% cases in a study of Sonone et al (2019).[13] Baruah et al (2019) observed blockage of OMC in 31.8 % cases unilaterally and 29.3% cases bilaterally.[6] Sandhu et al (2020) in their study observed obliteration of OMC in 73.2% cases due to anatomical variations, most common being middle turbinate variation (86.4%) followed by sinus cavity variation (80%).[15]

In present study, we aimed to correlate the clinical and endoscopic findings with that of CT scan. We correlated individual CT scan finding with that of endoscopy. Endoscopy correlated with CT scan in 77.4% cases for left sided deviation, 77.8% cases for right side deviation and 44% cases for S Shaped deviation. For middle turbinate hypertrophy CT scan and endoscopy correlated in 66.7% cases on right side and 63.2% cases on left side. Paradoxical middle turbinate and concha bullosa were identified only in CT scan, which predominantly was identified as normal finding on endoscopy on right side and hypertrophy on left side. Endoscopy correlated with CT scan in 100% cases of hypertrophied uncinate process on both side, 91.7% and 87.5% cases on right and left side for medialized uncinate process. Pneumatized uncinate process was identified only on CT scan. The findings of present study were supported by the findings of Deosthale et al (2017) in which the authors observed abnormal endoscopic findings in 83.3% cases where as CT scan was abnormal in 87% cases i.e., endoscopy did not correlate with CT scan in only 4.3% cases.[16] We calculated diagnostic accuracy of endoscopy for diagnosis of septal deviation, middle turbinate variations and uncinated process individually for right and left side. Endoscopy had highest sensitivity for diagnosis of septal deviation (>70%) followed by uncinate process (approx. 70%) and it was least for middle turbinate variations. However, endoscopy had high specificity for all. Overall diagnostic accuracy of

endoscopy for diagnosis of septal deviation was 83.1 % (right) and 85.6% (left), uncinate process variation (92.4% and 94.1% for right and left side respectively), middle turbinate variations (78.8% on right and 83.9% on left side). However Nathan et al (2021) documented the diagnostic accuracy of endoscopy as 88.75% with sensitivity 92.3%, specificity 73.3%, PPV 93.75 and NPV 68.75%.[17] Nangia S et al (2019) reported the sensitivity of endoscopy as 72.2% and specificity as 63.6% with PPV and NPV of 61.9% and 73.7% respectively.[14]

Conclusion

CT Scan and diagnostic endoscopy along with detailed clinical examination are essential component for assessment of a patient with chronic rhinosinusitis. CT scan is considered as gold standard but endoscopy is also a valuable tool for diagnostic evaluation of patients with CRS. It can be utilized as an early diagnostic tool which aid the diagnostic accuracy of clinical examination and reveal the condition of sinuses and mucosa. Though endoscopy reveal sinus pathology, uncinate process variation and deviated nasal septum with high accuracy, it is less useful for studying middle turbinate variations. The endoscopy could not help in identification of anatomical variations such as concha bullosa, agger nasi, Haller cells and Onodi cells. Presence of obstruction limit the utility of endoscopy as the scope cannot be passed beyond certain point. Initially all the patients must be subjected to endoscopic examination and CT scan can be reserved for investigation of cases with negative endoscopy or in cases with high clinical suspicion of anatomical variation.

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