

Original Research Article

## Computed Tomographic Evaluation of Diseases Affecting Paranasal Sinuses

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**Abstract:** The study was carried out in DVVPF Medical College and Hospital, Ahmednagar during a period of one year. In this study, a total of 50 cases were included, which were referred to our department for signs and symptoms referable to paranasal sinus disease. The main objective of our study is to delineate the various diseases affecting the paranasal sinuses and to study the computed tomographic anatomy and anatomical variations of the paranasal sinuses. After an elaborate discussion with the patient, who wished to take part voluntarily in our study, CT was performed using a GE LIGHTSPEED 16 SLICE SPIRAL CT scanner. A coronal plain 5mm sections were taken and intravenous contrast was injected wherever it was indicated. Out of the 50 patients, 40 were males and 10 were females. Chronic sinusitis (42 cases - 84%) formed the bulk of the cases, followed by tumors (5 cases-10%). The ethmoid sinus (60%) was the most commonly involved sinus followed by OM complex blockage. Chronic sinusitis manifested as mucosal thickening and polyp formation. Maxillary antral carcinoma (60%) was the most common tumor of the neoplasms found in our study. The most common anatomical variation found was deviated nasal septum (68.9%), followed by concha bullosa (46.67%), turbinate hypertrophy (40.0%), Haller cell (33.33%), Onodi cell (11.11%), internal carotid artery impinging on sphenoid sinus 2.2%) and Agger nasi cell (2.22%). CT is the preferred modality for evaluation of paranasal sinuses. It provides excellent map to help the sinus surgeon to operate. CT provides invaluable information to help in the diagnosis of atypical sinus infections, malignancy and in the management of complications.

**Keywords:** Paranasal sinuses (PNS); Computed Tomography (CT); Osteo meatal unit/complex (OMU)

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### INTRODUCTION

The disease of the paranasal sinuses especially sinusitis is one of the most common disease treated by primary care physicians. Adults as well as children suffer from common cold 3-4 times/year on an average and 0.5% of viral upper respiratory infections are complicated by sinusitis [1].

There has been evolution of sinonasal imaging methodically as each new generation of imaging has stamped its authority on the domain of the former generation. While plain radiography was the go to investigation for evaluation of the sinonasal cavity, Computed Tomographic scanning has surpassed plain radiography because the endoscopic sinus surgeon has

required greater anatomic precision. Coronal CT has become the study of choice for chronic sinusitis, since it simulates the endoscopists view of the sinonasal cavity and provides a roadmap for surgery [2]. Earlier the malignant conditions of the sinonasal tract that were unresectable as they were invading the skull base can now be treated based on the imaging by coronal CT [3].

### AIMS AND OBJECTIVES

- To assess and clearly delineate the extent of the diseases affecting paranasal sinuses by computed tomography.
- To study CT anatomy and anatomical variations of the paranasal sinus.

**MATERIALS AND METHODS**

A hospital based descriptive study conducted in the department of radio-diagnosis and imaging, Study period was from October 15, 2015 to October 14, 2016. 50 cases referred for CT were reviewed.

**Equipment:**

All the patients were examined using a GE LIGHTSPEED 16 SLICE SPIRAL CT scanner

**Inclusion Criteria:**

All cases referred for CT scan with clinically suspected disease of paranasal sinuses attending DVVPF Medical College and Hospital, Ahmednagar at over a period of one year

**Exclusion Criteria:**

Pregnancy, lesions encroaching upon paranasal sinuses but not arising from it is excluded from the study.

**Technique:**

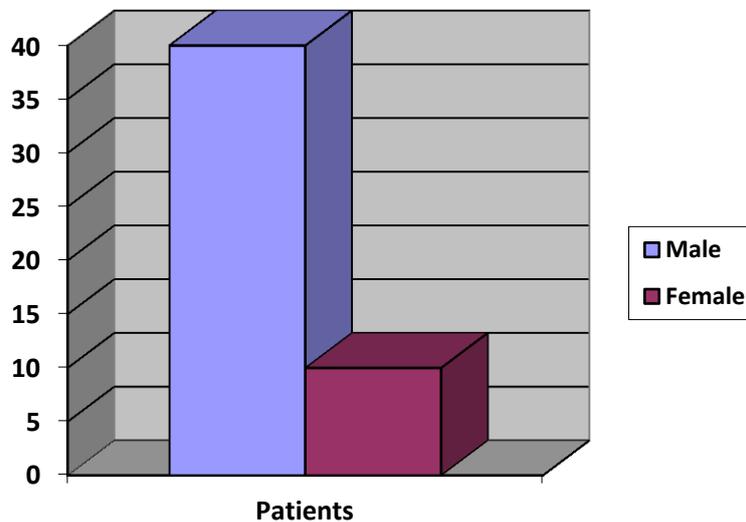
- The study was performed by taking continuous coronal plain 5mm sections. Coronal section was taken with the patient in supine position and neck extended. Gantry angle was perpendicular to hard palate. Scan sections were taken from the anterior margin of frontal sinuses till the posterior margin of sphenoid sinuses.
- Imaging algorithm- bone.
- Window width-2000-3500 HU.
- Window level- 300- 700 HU.
- kVp- 120.
- mAs- 160.
- Soft tissue window was used wherever necessary.
- Axial and saggital images were obtained wherever necessary.

**RESULTS**

In the present study, there were 40 males comprising to 80% and females comprising to 20% of the population.

**Table 1: Sex wise distribution of cases**

Sex	No. of case	Percentage
Male	40	80%
Female	10	20%



**Fig 1: Showing Distribution of Gender Wise Distribution of Patients**

The age of the patients ranged from 12 Yrs to 70 Yrs.

**Table 2: Age wise distribution**

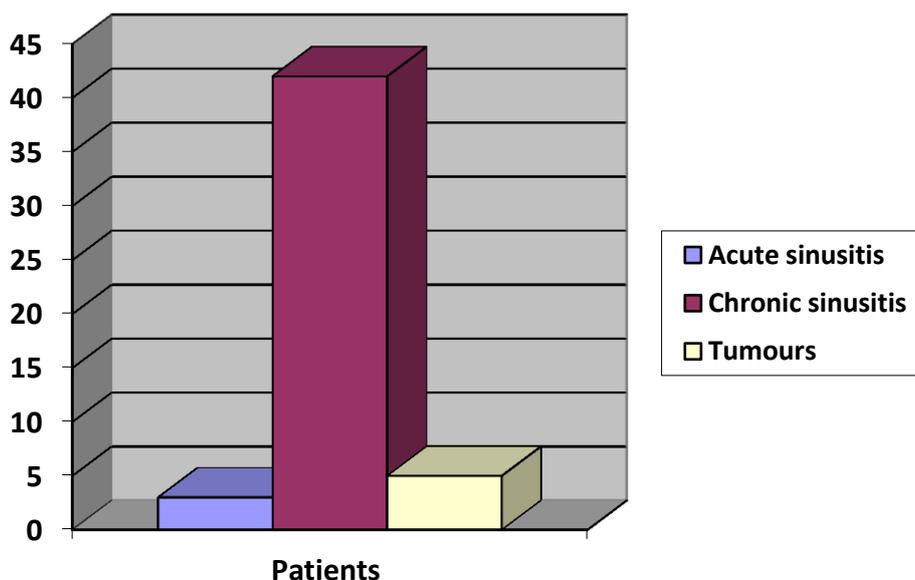
Age	No. of case	Percentage
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0-10	0	0
11-20	6	12%
21-30	10	20%
31-40	12	24%
41-50	11	22%
51-60	7	14%
>60 Years	4	8%

In the present study on sinuses, chronic sinusitis contributed to 42 cases (84%) followed by tumors 5 cases (10%).

**Table 3: Diseases of Paranasal Sinuses**

Disease	No. of case	Percentage
Acute sinusitis	3	6%
Chronic Sinusitis Chronic sinusitis	42	84%
Tumors	5	10%



**Fig 2: Showing Distribution Of Diseases**

Sinusitis manifested most commonly as mucosal thickening in 33 cases (73.3%) out of 45 cases, with next in frequency being polyp formation (14 cases -31.1%)

**Table 4: Manifestations of sinusitis**

Manifestations	No. of case	Percentage
Mucosal thickening intrasinus	33	73.3%
Intrasinus Polyp	14	31.1%
Fluid level	3	6.7%

The ethmoid sinus was most commonly involved (Rt 60% and Lt 55.6%), followed by maxillary antra (Rt 42.2% and Lt 40%), frontal sinus (Rt 31.1% and Lt 26.7%), and sphenoid sinus was the least to be

involved (17.8% and 13.3%). Osteo meatal complex was blocked in 37.8% (on Rt side) and 40% (on Lt side) of the cases

**Table 5: CT Scan detection of mucosal abnormalities**

Mucosal abnormalities	Right		Left	
	No. of cases	Percentage	No. of cases	Percentage
O.M. Complex	17	37.8%	18	40%
Maxillary antra	19	42.2%	18	40%
Ethmoids	27	60%	25	55.6%
Frontal sinus	14	31.1%	12	26.7%
Sphenoid	08	17.8%	06	13.3%

In die detection of anatomical variants, deviated nasal septum was found in 31 cases (68.9%), followed by concha bullosa (46.67%), inferior turbinate

hypertrophy (40.0%), Haller cell (33.33%), Onodi cell (11.11%).

**Table 6: CT Scan detection of anatomical variants**

Anatomical variation	No. of cases	Percentage
Deviated nasal septum	31	68.9%
Turbinate hypertrophy	18	40.0%
Concha bullosa	21	46.6%
Haller cell	15	33.33%
Onodi cell	5	11.11%
ICA impinging on sphenoid sinus	1	2.22%
Ager nasi cell	1	2.22%

Complicated sinusitis was found in 10 cases (22.22%) and antro-choanal polyps were the most common (90%) of complicated sinusitis.

**Table 7: Complicated / Uncomplicated sinusitis**

Disease	No. of case	Percentage
Complicated	10	22.22%
Uncomplicated cases	35	77.78%

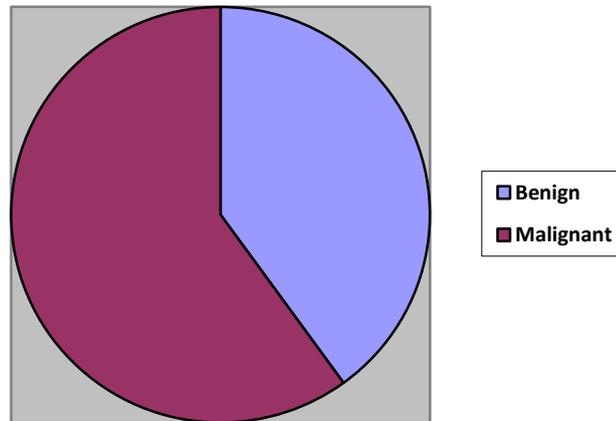
**Table 8: Complicated Sinusitis**

Disease	No. of cases	Percentage
Mucocoele	1	10%
Antrochoanal polyp	9	90%

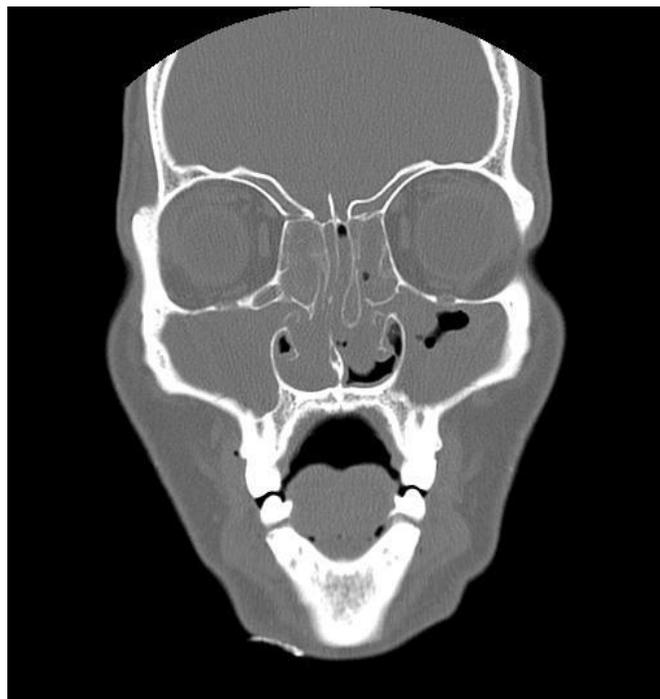
Of the 5 tumors, malignant tumors comprised the most (3 cases, 60%) followed by benign tumors (2 cases, 40%)

**Table 9: Distribution of tumors**

Disease	No. of cases	Percentage
Benign	2	40%
Malignant	3	60%



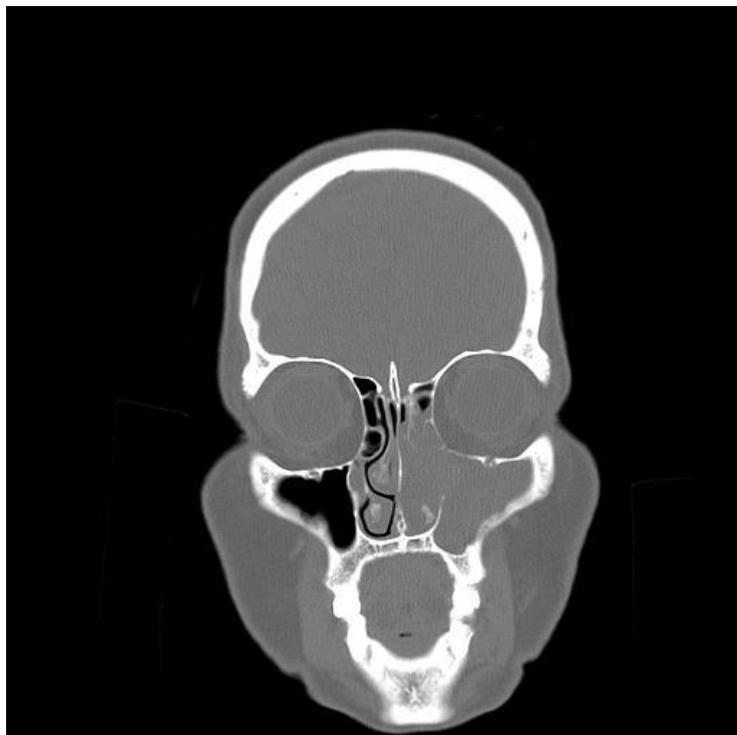
**Fig 3: Showing Distribution of Tumours**



**Fig 4: showing sinusitis with OMU pattern on both sides**



**Fig 5: showing sinusitis predominantly affecting the ethmoid sinus**



**Fig 6: showing polyp on left side**



Fig 7: showing carcinoma of maxillary sinus

## DISCUSSION

The purpose of our study is to study the various diseases affecting the paranasal sinuses and their presentation in CT. In the present study, there were 40 males and 10 females. 50 patients were included in the study. Age of the patient in our study ranged from 12 to 70 years. In our study, sinusitis comprised the number of cases 42 in number (84%) followed by tumors. The ethmoid sinuses were most commonly involved affecting 60% on right side and 55.6% on left side. This correlates with the study conducted by Bolger *et al.*; in 1991 [4]. Maxillary sinus was the next most commonly involved sinus affecting 42.2% on right side and 40% on left side. This similar in comparison to the study done by Dua *et al.*; in 2005 [5]. Frontal sinus (31.1% and 26.7%) and the sphenoid sinus were the least involved. Chronic sinusitis is displayed on CT as mucosal thickening or polyp formation (HU 20-40). Acute sinusitis presented as air-fluid level in the sinuses. Osteomeatal complex was involved in 37.8% on right and 40% on left, which was comparable to the study done in 2005 by Dua *et al.*; [5] who demonstrated that the anterior ethmoids and osteomeatal unit were the most commonly involved (88%) in their study.

In our study, the most common anatomical variation was deviated nasal septum (68.9%) followed

by concha bullosa (46.57%) which was comparable to 2 other studies conducted by Maru *et al.*; and Yadav *et al.*; [6, 7]. Deviated nasal septum causes a decrease in the area of the osteomeatal unit which can lead to complications like obstruction and sinusitis. Haller's cell was the next most common anatomical variant after turbinate hypertrophy, which was similar to the study conducted in 1993 [8] by J Earwaker who had 23.8%. Internal carotid artery impinging on the sphenoid sinus and Onodi cell comprised a small group i.e. 1% and 11.11% respectively which was comparable to the same study as mentioned above conducted in 1993 [8].

Complicated sinusitis manifested as antrochoanal polyp (90%) and mucocoele (10%) in our study. Antrochoanal polyps manifested as soft tissue mass filling up the entire maxillary sinus with obliteration of the OM complex with extension of the soft tissue density mass into either the anterior or posterior choana. Mucocoeles manifested with low density soft tissue mass in the sinus with bone remodelling. In our study mucocoeles were found in one patient and were bilateral and involved the maxillary antra. In our study, of 5 the cases, 3 cases were malignant neoplasms arising from the maxillary antrum and 2 were benign i.e. osteoid osteoma and fibrous dysplasia. Carcinomas comprised the most

common tumors to affect the paranasal sinuses was shown by Batsakis *et al.*; and is similar to the result of our study [9]. Carcinomas arising from the maxillary antra presented later in life and the patients were 55 years to 65 years of age. They had intra-orbital, intraoral extension, destruction of the concerned sinus and bone destruction. On contrast study, they showed heterogenous enhancement.

## CONCLUSION

CT of the paranasal sinuses has improved the visualisation of the paranasal sinus anatomy and has allowed greater accuracy in evaluating paranasal sinus disease. It evaluates the osteomeatal complex anatomy, which is not possible with plain radiographs.

CT provides an excellent map to help the sinus surgeons operate. CT does provide invaluable information to help in the diagnosis of atypical sinus infections, malignancy and in the management of the complications of sinusitis.

Sinonasal malignancies are highly heterogenous lesions that are challenging to diagnose, treat and follow clinically. CT helps in identifying the “red flags” of early tumor diagnosis, spread of the tumor to adjacent structures and distal visceral and nodal spread and also in the follow up of residual / recurrent tumor growth. Hence, CT is the preferred modality for pre-treatment work up and for follow up of the diseases of the paranasal sinus.

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