Section: Radiology

Original Research Article

ROLE OF CT IN PARANASAL SINUS EVALUATION: A CROSS-SECTIONAL ANALYSIS

Vardhaneni Pavan[1], Saripalli Jagan Kumar[2], Sirasapalli Chinnam Naidu[3]

[1]*Assistant Professor, Department of Radiology, Arundathi Institute of Medical Sciences, Gandimaisamma, Dundigal, Hyderabad, Telangana, India.*
[2]*Associate Professor, Department of Radiology, Arundathi Institute of Medical Sciences, Gandimaisamma, Dundigal, Hyderabad, Telangana, India.*
[3]*Assistant Professor, Department of Radiology, Arundathi Institute of Medical Sciences, Gandimaisamma, Dundigal, Hyderabad, Telangana, India.*

Received *: 10/07/2025*
Received in revised form *: 25/08/2025*
Accepted *: 17/09/2025*

Corresponding Author:
Dr. Sirasapalli Chinnam Naidu,
Assistant Professor, Department of Radiology, Arundathi Institute of Medical Sciences, Gandimaisamma, Dundigal, Hyderabad, Telangana, India.
Email: drsirasapallinaidu2222@gmail.com

DOI: 10.70034/ijmedph.2025.3.594

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2025; 15 (3); 3243-3247

ABSTRACT

Background: CT accurately depicts the boundaries between the paranasal sinuses, the orbit and the intracranial compartment and also the relationship between the optic nerve, cavernous sinus, carotid artery and fifth cranial and vidian nerves to the sphenoid sinuses. **Aim of the study:** To evaluate the role of CT in diagnosing sinonasal diseases. Assess the ability of CT to identify various pathologies such as chronic rhinosinusitis, polyps, fungal infections, benign and malignant masses.

Materials and Methods: This is a prospective study was done in the Department of Radiodiagnosis, at Arundhati institute of medical sciences, Hyderabad.

A total of 110 patients with suspected diseases of paranasal sinuses were evaluated by computed tomography. The cases were referred by the Department of Otolaryngology.

Results: Maxillary antrum was single most commonly involved site of disease (36.3% of cases) next common was Anterior Ethmoid accounting 32.7% followed by posterior ethmoid in 15.4%. Sphenoid and frontal sinuses were less commonly involved as demonstrated in CT scan of present study (7.2% and 8.1%).

Conclusion: CT is the modality of choice in imaging the sinonasal region for evaluating various congenital, inflammatory, benign and malignant pathologies and associated complications thereby planning the further management of the patient. CT is the best modality of choice for evaluating the bone erosion or destruction.

Key words: Computed tomography, Paranasal sinus, Nasal Polyps, Functional Endoscopic Sinus Surgery (FESS).

INTRODUCTION

Sinonasal imaging has progressed in an orderly fashion as each generation of imaging modality has advanced gradually on the domain of the former generation. New generation of imaging modalities have completely changed the picture of sinonasal imaging. previously plain radiography was most commonly done, now it's been replaced by Computed Tomography (CT) as per endoscopic sinus surgeon requirement for greater anatomic precision.[1] CT also plays an important role in excluding the existence of aggressive infections or neoplasms with features of extra-sinus extension, osseous destruction and local invasion.[2]

Various inflammatory, benign/ malignant neoplastic conditions affect the paranasal sinuses. The primary role of imaging is to document the extent of the disease, to provide accurate display of the anatomy of the sinonasal system. Characterization of the lesion can be helpful in ambiguous cases. Contrast media helps evaluate the vascularity and contrast enhancing characteristics of lesions, giving clues to the histology and extent of abnormality.[3]

CT helps in the diagnosis of the anatomic variations that may lead to intra-operative and post-operative FESS complications and reduces the mortality and morbidity of patients. A combination of CT and diagnostic endoscopy has become the mainstay in evaluation of the sinonasal diseases. Hence, CT has immense value and offers standard imaging of sinonasal diseases 4

Aim of the study: To Evaluate Sinonasal Diseases by Computed Tomography

Objectives

- To analyze the spectrum of sinonasal diseases (inflammatory, infective, benign, and malignant) by CT.
- To assess the anatomical variations of the sinonasal region that may predispose to disease or complicate surgery (e.g., deviated septum, concha bullosa, Haller cells).
- To evaluate the extent of disease involvement in adjacent structures (orbit, skull base, intracranial extension).

MATERIALS AND METHODS

Study was approved by ethical committee of the institute. A written consent was taken after explaining study to them. This is a prospective study was done in the Department of Radiodiagnosis, at Arundathi institute of medical sciences, Dundigal, Medchal, Hyderabad, Telangana. A total of 110 patients with suspected diseases of paranasal sinuses were evaluated by computed tomography. The cases were referred by the Department of Otolaryngology.

Inclusion Criteria

- Age distribution >9 to <69 years
- Patients with sings and symptoms of paranasal sinus diseases
- Patients willing to participate

Exclusion Criteria

- Patients with history of trauma to face
- Patients who were allergic to contrast
- Patients not willing to participate

Methodology

Data was collected with pretested questionnaire. Demographic data like age, sex was collected. Clinical history (headache, nasal discharge, nasal obstruction, epistaxis, facial swelling, proptosis) duration symptoms and any relevant past history were noted. A through clinical examination was done. Local examination was done with posterior rhinoscopy, oro-pharyngeal examination and dental examination.

All patients underwent Hb, ESR, TLC/DLC, FNAC/Biopsy and other required investigations.

All patients underwent CT for paranasal sinuses. Equipment used was Multidetector Spiral CT, Siemens Somatom Volume Access Somaris, Siemens Medical Systems, Forchiem, Germany. CT scan of PNS was done in coronal and axial planes. A lateral 256 mm scout scan was done at 120 kVp and 100 mA. Axial scanning was done in supine position.

Reformatting in coronal and sagittal planes was done using software provided. If necessary direct coronal imaging was done. For direct coronal imaging patients were kept in prone position or supine position with head of patient free leading edge of the table of the scanner. The gantry angle used in case of coronal imaging was perpendicular to the plane of hard palate. 3 mm sections from anterior margin of nose to the posterior margin of sphenoid sinus were taken. CT features noted were sinuses involved, size of the mass, characterization of lesion (air fluid level, mucosal changes, necrosis, calcification, cystic changes, hyperdense areas, contrast enhancement etc) and bony changes.

Statistical Analysis: All the data was entered in excel sheet and analysed with Statistical package for social sciences (SPSS v 21.0, IBM).

RESULTS

Table 1: Age distribution

Age distribution	No. of cases	Percentage
0-9 years	4	3.6
10-19 years	20	18.1
20-29 years	28	25.4
30-39 years	30	27.2
40-49 years	13	11.8
50-59 years	10	9.09
60-69 years	5	4.5
Total	**110**	99.9%

In the present study age distribution varied from 9 years to 69 years. Majority noted among 30-39 years constituting 25.4% followed by 20-29 years accounting 25.4%

Sex distribution: There was Male predominance 65(59%) compared to Females 45(40.9%).

According to CT diagnosis of Para nasal Sinus lesions: Inflammatory lesions 75(68.1%), Neoplastic lesions 25(22.7%) and Congenital or developmental accounting 9.09%.

According to Distribution of clinical features: In the present study majority of the cases presented with Headache constituting 85 (77.2%), followed by 10 (9.09%), Nausea 8(7.2%), cough 5(4.5%), cough with sputum 2(1.8%).

Table 2: CT Localization of Diseases of Paranasal Sinus

CT Localization of Diseases of Paranasal Sinus	No. of cases	Percentage
Frontal	8	7.2
Anterior Ethmoid	**36**	**32.7**
Maxillary	**40**	**36.3**
Posterior Ethmoid	17	15.4
Sphenoid	9	8.1
Total	**110**	99.9%

In the present study Maxillary antrum was single most commonly involved site of disease (36.3% of cases) next common was Anterior Ethmoid accounting 32.7% followed by posterior ethmoid in 15.4%. Sphenoid and frontal sinuses were less commonly involved as demonstrated in CT scan of present study (7.2% and 8.1%).

Table 3: Distribution on the basis of finding location

Distribution on the basis of finding location	No. of cases	Percentage
left maxillary	**51**	**46.3**
B/L maxilary	15	13.6
Right sphenoid	**16**	**14.5**
Left sphenoid	4	3.6
Right ethmoid	8	7.2
Left ethmoid	2	1.8
B/L ethmoid	8	7.2
Right frontal ethmoid	3	2.7
Left frontal ethmoid	3	2.7
Total	**110**	**99.9%**

In the present study majority of the cases presented at left maxillary accounting 46.3%, next common Right sphenoid 14.5% and B/L maxillary 13.6%.

Table 4: Characterization of the various Sinonasal lesions on basis of CT parameters

Sinonasal lesion	No. of cases	Percentage
Sinusitis	57	51.8
Sinonasal polyps	10	9.09
Sinusitis + polyps	21	19.0
Fungal	15	13.6
Mucocele	05	4.5
Rhinoscleroma	02	1.8
Total	**110**	**99.9%**

In the present study Sinusitis was the most common pathology that show in most of the patient 21 (51.8%). Sinonasal polyps 9.09%, Sinusitis + Polyps 9.09%, Fungal 13.6%, Mucocele 4.5%, Rhinoscleroma1.8%.

Table 5: Technique for CT of Paranasal Sinuses

CT of Paranasal Sinuses	Axial (n=60)	Coronal (n=50)
Gantry angulation	Parallel to IOML	Perpendicular to IOML
Extent to study	From hard palate through frontal sinus	From anterior frontal sinus to post. Sphenoid sinus
Section thickness	5 mm/3mm	5 mm/3mm
Table incrementation	5mm/3mm	5mm/3mm

In our study Axial scans were performed in all 60 cases and direct coronal scans in 30 cases.

Age Distribution-Chi-square test indicated a statistically significant clustering of cases in the younger age groups ($p < 0.05$).

Sex Distribution- The difference in sex distribution was statistically significant (Chi-square = 3.92, df = 1, $p = 0.047$), indicating a male predominance.

CT Diagnosis of PNS Lesions-The difference among groups was highly significant (Chi-square = 58.9, df = 2, $p < 0.001$), confirming inflammation as the predominant pathology.

Clinical Features-Comparison of presenting complaints revealed a statistically significant predominance of headache over other symptoms (Chi-square = 187.5, df = 4, $p < 0.001$).

Sinus Involvement (CT Findings): Chi-square analysis showed a significant difference in the frequency of sinus involvement ($p < 0.001$), with maxillary sinus being most vulnerable.

CT Features of Sinusitis: Unilateral disease was more frequent (54.5%) compared to bilateral (36.3%). Air-fluid level and polyp formation were seen in 4.5% each. Chi-square test confirmed a significant preference for unilateral involvement ($p < 0.05$).

Spectrum of Pathologies: The distribution was statistically significant (Chi-square = 42.7, df = 5, $p < 0.001$).

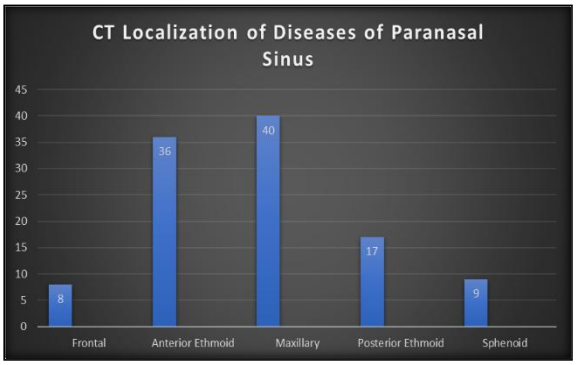

Figure 1: Bar diagram showing CT localization of diseases of paranasal sinus

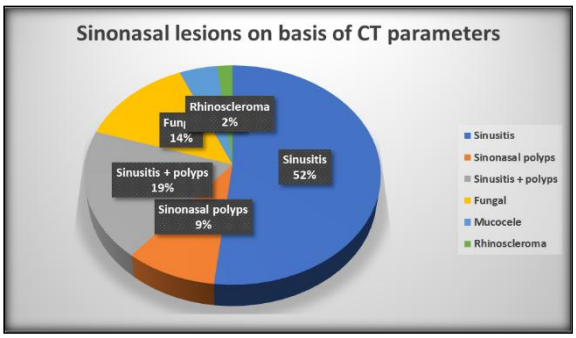

Figure 2: Sinonasal lesions on basis of CT parameters

According to Distribution of CT Features of Sinusitis of Paranasal Sinus: In the present study Unilateral presentation was more common in 54.5% cases and bilateral 36.3%, Air-fluid level and Polyp formation in 4.5%.

DISCUSSION

Comparative studies related to Age distribution

In the present study age distribution varied from 09 years to 69 years. Majority noted among 30-39 years constituting 25.4% followed by 20-29 years accounting 25.4%. The mean age was 39.8±15.8 years. In Puspa et al,[5] study there was predominance of primary sinusitis in age group of 30-49 years and prevalence of allergic sinusitis in 10-29 years of age group. In Nisha et al,[6] study highest number of patients was in 16-30 years of group (40%). Followed by 35-45 years of group (34%). The lowest number of age group 1-15 year of age comprising (2%).In Puroshotam et al,[7] majority of the patients were in the age group of 11-20 years (31%) followed by 21-30 years (26%). Patients in the age group of 31-40 years and 41-50 years were 19% and 13% respectively. PNS diseases were less observed above the age of 50 Years. (10%).

Comparative studies related to Sex distribution

In the present study there was Male predominance 65 (59%) compared to Females 45 (40.9%). In Gulay et al study 8151 were male (47.2%), and 169 were female (52.8%). In Puspa et al,[5] study there was male predominance 20 cases (66.7%)] compared to females 10 (33.3%). In Nisha et al 6study 656% male and 44% females.

Comparative studies related to Clinical features

In the present study majority of the cases presented with Headache constituting 85 (77.2%), followed by 10 (9.09%), Nausea 8(7.2%), cough 5 (4.5%), cough with sputum 2(1.8%). Nisha et al,[6] study headache was the most common clinical symptoms 36 (70%) patient. Nasal bleeding found in 7 (14%) patient. Puroshotam et al,[7] majority of the patients were complaining of headache (55%) followed by facial pain and swelling (36%). Nasal obstruction was observed in 15% patients.

Comparative studies related to CT Localization of Diseases of Paranasal Sinus

In the present study Maxillary antrum was single most commonly involved site of disease (36.3% of cases) next common was Anterior Ethmoid accounting 32.7% followed by posterior ethmoid in 15.4%. Sphenoid and frontal sinuses were less commonly involved as demonstrated in CT scan of present study (7.2% and 8.1%).

Our study correlates well with studies done by Suthar et al,[9] Chaitanya CS et al,[10] Kushwah Afis et al,[11] and Rashmi et al,[12] study where maxillary sinus was most commonly involved. In all the studies sphenoid was least involved, which is also observed in the present study.

Characterization of the various Sinonasal lesions on basis of CT parameters

In the present study Sinusitis was the most common pathology that show in most of the patient 21 (51.8%). Sinonasal polyps 9.09%, Sinusitis + Polyps 9.09%, Fungal 13.6%, Mucocele 4.5%, Rhinoscleroma1.8%. In Rashmi et al,[12] the most common inflammatory pathology was sinusitis followed by polyps , which was also found in study done by Azzam MA, Salami et al study,[13] accounting to 33.3% and 20% resepectively. Sinusitis was also most common in study done by Vijay firabhu et al,[14] accounting to 56%.

CONCLUSION

This study emphasizes the significant role of CT in diagnosis and characterisation of various sinonasal diseases. It proves the better sensitivity and specificity of CT in evaluation of various sinonasal pathologies in symptomatic patients for the diagnosis, staging and thereby better planning of management. CT is the best modality of choice for evaluating osteomeatal complex anatomy, variations and for assessing bony changes in various sinonasal diseases.

REFERENCES

1. Hagiwara M, Michaelides EM, Sedaghat AR, Arani K, Kuperman DI, Kirsch CFE, et al. ACR Appropriateness Criteria® sinonasal disease. J Am Coll Radiol. 2022;19(11S)\:S479–S494.
2. Taneja A, Mishra M, Sharma P, Batra K, Anand N, Kaur K, et al. Volumetric analysis of maxillary sinus and assessment of sinus volumes in chronic rhinosinusitis. Radiol Res Pract. 2024;2024:1–7.

3. Swain SK, Barik P, Sarangi PK. Role of magnetic resonance imaging in sinonasal pathology: A review. Int J Otorhinolaryngol Head Neck Surg. 2024;10(1):83–9.
4. Wang J, Xiao S, Fan Y, Gao Y. Changes in chronic rhinosinusitis: A retrospective analysis of computed tomography imaging and inflammatory changes either side of a 5-year interval. Biomed Rep. 2025;22(2):118.
5. Ranjan P, Ranjan R. CT evaluation of diseases of paranasal sinuses. J Evol Med Dent Sci. 2016 Aug 22;5(67):4824–9.
6. Jhinkwan N, Rawat N, Khan AA, Jain A, Parihar B, Bansal P. Role of computed tomography in evaluation of NCCT paranasal sinuses. J Emerg Technol Innov Res. 2022;9(6)\:a1–a6.
7. Raju NP. Study of computed tomography in diagnosis of paranasal sinus diseases. MedPulse Int J Radiol. 2020 Jun;14(3):80–3.
8. Güngör G, Okur N. Evaluation of paranasal sinus variations with computed tomography. J Health Sci Med. 2019;2(3):80–5.
9. Bhumikaben fi. Suthar, Divya Vaidya, fiukhraj fi. Suthar. The Role of Computed Tomography in the Evaluation of fiaranasal Sinuses Lesions. Int J Res Med. 2015; 4(4): 75-80.
10. Chaitanya CS et al. Computed tomographic evaluation of diseases of paranasal sinuses. International Journal of Recent Scientific Research. 2015;6(7):5081–86.
11. Kushwah AfiS, Bhalse R, fiande S. CT evaluation of diseases of fiaranasal sinuses & histopathological studies.Int J Med ResRev. 2015;3(11):1306-10.
12. Rashmi N, Kandukuri, N Suresh, N Phatak: Evaluation of Sinonasal Diseases by Computed Tomography: Journal of Clinical and Diagnostic Research. 2016 Nov, Vol-10(11): TC09-TC12.
13. Azzam M.A. Salami Unilateral Sinonasal Disease: analysis of the clinical, radiological and pathological features. J Fac Med Baghdad. 2009;51(4):372-75.
14. Firabhu VR, M. Adaikappan, S. Sethurajan. Computed Tomographic Evaluation of fiaranasal Sinus and fiathologies. Journal of Evolution of Medical and Dental Sciences. 2015;4(33):5741-47.