

# Conventional Radiography and CT Scan Correlation for Evaluation of Paranasal Sinus Pathologies

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**Abstract:** ***Introduction:** Paranasal sinuses are hollow air-filled spaces located within the bones of the face and base of the skull surrounding the nasal cavity. Plain X-ray is first line investigation for paranasal sinus lesions while CT scan provides excellent bone detail and accurate soft tissue mapping. The purpose of this study is to investigate paranasal sinuses with the help of plain X-rays and CT scan. **Material & Method:** This was an observational study conducted in Department of Radiology, Dhiraj Hospital, from year 2017 to 2019 in which 68 patients with paranasal sinus pathologies were investigated with X-rays and CT scan. **Results:** The average age of patients was 33.5 years with male predominance. The most commonly involved pathology of paranasal sinuses was sinusitis due to inflammatory origin (66.1%). Maxillary sinus being the most commonly affected sinus except in osseous lesions. Out of 68 patients, 22 (33.3%) on CT scan and 16 (23.6%) on X-ray had deviated nasal septum. **Conclusion:** Plain film radiography of paranasal sinuses are rapid and safe test, comparatively low cost, easy availability and easy examination. CT scan is the most reliable imaging technique for sinusitis and if any nasal septum is deviated. Thus, CT scan of paranasal sinuses is the investigation of choice for characterisation, location, extent and diagnosis of paranasal pathologies than X-ray.*

**Keywords:** Paranasal sinus, conventional radiography, CT scan, sinusitis

## 1. Introduction

Para-nasal sinuses are hollow, air-filled spaces located within the bones of the face and base of the skull surrounding the nasal cavity. There are four pairs of sinuses, each connected to the nasal cavity by small canal. They include the frontal, ethmoidal, maxillary and sphenoid sinuses<sup>[1]</sup>. They have various functions, including lightening the weight of the head, humidifying and heating inhaled air, increasing the resonance of speech, and serving as a crumple zone to protect vital structures in the event of facial trauma. Diseases of the paranasal sinuses are very common and are important because of the intimate relationship of the sinuses to the neighbouring structures such as the brain and the orbit. Any condition (inflammation, neoplasm, foreign body) that interferes with drainage of a sinus renders it liable to infection.<sup>[2]</sup>

Sinusitis is primarily a clinical diagnosis. Provisional diagnosis can be made on the basis of clinical history and physical examination while radiology and sinus endoscopy are necessary in making the definitive diagnosis and management protocol.

Plain X-ray is the mainstay of radiological diagnosis in most developing countries because it is cheap, simple and widely available. They are used as primary investigation for paranasal sinus lesions, but many a times it's not sufficient to reach at final diagnosis. The standard views provide only limited display of anterior ethmoid cells, osteomeatal complex, middle turbinate, upper two thirds of nasal cavity and frontal recess area because of overlapping.<sup>[3]</sup> Plain radiographs do not help to provide sufficient information for preoperative surgical planning.

The use of CT scan combined with functional endoscopic sinus surgery (FESS) enables modern sinus surgeons to treat

patients more effectively, facilitating reduced morbidity and complications.

CT scan provides excellent bone detail and accurate soft tissue mapping. It is used routinely before endoscopic surgery to evaluate extent of the inflammatory disease and to assess important anatomic landmarks and their variations.<sup>[4]</sup> The purpose of this study is to investigate paranasal sinuses with the help of plain X-rays and CT scan to confirm the diagnosis of different lesions by histopathological examinations.

## 2. Materials and Method

The main source of data for this observational study are 68 patients referred to the Radiology Department over a period of 1.5 years for X-ray PNS and CT scan from OPDs of Dhiraj General hospital with signs and symptoms of paranasal sinus pathology will be taken up for the study. Each patient's demographic profile and laboratory investigations is noted down. Confidentiality of the patient's information will be maintained. Scans will be carried out on 600 mA Siemens XRAY machine and SIEMENS Somatom Emotion 16 Slice CT -scanner that is available in the radiodiagnosis department. Informed written consent in English and vernacular languages will be taken.

Patients referred to the radiology department for plain X-ray and CT scan PNS with clinical diagnosis of sinusitis or lesions in paranasal sinuses, will be included in this study. Already diagnosed cases of paranasal sinus lesions which need follow up radiological investigations and are referred to our radiology department will be included in study. Patients coming for plain X-rays and CT scan for diseases other than paranasal sinus lesions, and are accidentally found to have paranasal sinus lesion, will be included in this study. Patients presenting to radiology department having paranasal sinus lesion in past and are

cured completely will be excluded from the study. Pregnant patients unless absolute necessity were excluded. The selected patients underwent to x-ray PNS (water's view) and CT-PNS examination in both coronal and axial planes. X-ray for paranasal sinuses were performed by Siemens 600mA X-ray machine and CT scan using Siemens emotion 16. The collimated field was limited to a range covering just the four sinuses and exposure factor was kept at 75Kvp and 20mAs to prevent unnecessary exposure to radiation.

### 3. Results and Discussion

**Table 1: Demographic Profile**

Sr. No.	Age Group (years)	No. Of Cases		Total (%)
		Male	Female	
1.	11-20	7	6	13 (19.2)
2.	21-30	13	7	20 (29.4)
3.	31-40	9	6	15 (22.0)
4.	41-50	3	3	6 (8.8)
5.	51-60	5	2	7 (10.3)
6.	61-70	4	2	6 (8.8)
7.	70 - 90	1	0	1 (1.5)
	TOTAL	42	26	68 (100)

In our study, 68 cases were taken between age of 11-90 years out of which 42 were males and 26 were females. The peak incidence was observed in the age group of 21 – 30 years, which comprised 20 (29.4%) of patients. Of both the sexes and all age groups, males in 21 – 30 years formed the bulk of study i.e. 13 (19.1%) whereas in the study conducted by Verma J et al<sup>[6]</sup> showed the commonest age group involved is between 16 – 34 years with 36% whereas Suthar et al<sup>[5]</sup> study showed that peak incidence was between 31-40 years and study done by Nondi et al<sup>[9]</sup> showed peak incidence between 21-30 years with 67 (40%) patients.

**Table 2: Etiology of the Paranasal Sinus Lesions**

	Present study (n =68)	Kelkar et al (n= 57)	Suthar et al(n=63)
Etiology	No. of Cases (%)	No. of Cases (%)	No. of Cases (%)
Congenital	00 (00)	04 (7)	00 (00)
Inflammatory	45 (66.1)	14 (25)	47 (74)
Epithelial	05 (7.3)	18 (31)	7 (11)
Soft tissue	04(6.0)	8 (14)	3 (4.7)
Osseous	04(6.0)	10 (17)	5 (8)

In our study Inflammatory conditions of paranasal sinuses were found to be most common in all groups affecting 45(66%) of patients. As compared to our study, the study conducted by Kelkar et al<sup>[7]</sup> showed epithelial lesions of paranasal sinuses as most common condition with 18 (31%) patients followed by inflammatory lesions with 14 patients (25%) while a study conducted by Suthar et al<sup>[5]</sup> showed inflammatory lesions with 47 patients (74%) to be the most common which is consistent with our study.

**Table 3: Evaluation of Nasal Septum on X-Ray and CT Scan**

Nasal Septum	X Ray	CT
Normal	46(67.6%)	41 (60.2%)
Deviated Right	8(11.8%)	12 (17.6%)
Deviated Left	8(11.8%)	10 (14.7%)
Deviated S shaped	1(1.4%)	01 (1.4%)
Destroyed / Erosion	2(2.94%)	03 (7.8%)

Out of 68 patients, 41(60.2%) patients on CT scan and 46 (67.6%) on X ray were found to have central nasal septum and 22(33.3%) on CT scan and 16 (23.6%) on X ray had deviated nasal septum, DNS towards right side were seen marginally more commonly than left. 3 patients on CT scan and 2 (2.94%) on X ray were found to have their nasal septum destroyed/ eroded due to carcinoma being the most common cause.

**Table 4: Comparison of Sinuses Involved on X-Ray and CT Scan**

Sinus	Frontal Sinus		Maxillary Sinus		Ethmoidal Sinus		Sphenoidal Sinus	
	X-Ray	CT	X-Ray	CT	X-Ray	CT	X-Ray	CT
No. Cases	19	21	38	50	18	32	11	16
%	27.9	30.8	55.8	85.2	26.4	47	16.1	23.5

The most common sinus involved was maxillary sinus with 85.2% on CT followed by frontal, ethmoidal and sphenoidal sinus with 30.8%, 47%, 23.5 % respectively which was considerable higher than Water's view with 55.8%, 27.9%&, 26.4% 16.1% respectively. Same results are noticed by Maduforo et al<sup>[8]</sup> in which he found that maxillary sinus with the percentage of 66.7% followed by frontal, ethmoidal and sphenoidal sinus with the percent of 12.5%, 34.2% and 1.7% respectively.

The shortage of water's view technique could be ascribed to anatomical causes such as: hypoplastic sinus, orbital floor fissure, superior orbital fissure and zygomatic recess which could appear as false clouding and opacification and false mucosal thickening and technical causes such as Soft exposure which can cause an impression of clouding of maxillary sinuses. Lateralization of radiographic tube which can cause mucosal thickening on the side of lateralization to be missed in the radiograph. Inadequate tilting of tube head which can cause an artificial impression of presence of fluid level. Marked tilting of tube head which can cause impression of clouding of maxillary sinuses

### 4. Conclusion

Plain film radiography of paranasal sinuses are rapid and safe test, comparatively low cost, easy availability and easy examination. CT scan is the most reliable imaging technique for determining if the sinuses are obstructed and best imaging modalities for sinusitis. Involvement of maxillary and ethmoid sinus is most common in patients of sinusitis who are treated either conservatively or operatively. Presence of erosion of bones and intraorbital, infratemporal fossa and surrounding sinus extension is effectively demonstrated on axial and coronal reconstruction CT scan of paranasal sinuses as compared to plain radiographs. Differentiation of malignant lesions and granulomatous lesions with bone erosion can be made on CT scan with enhancement pattern, extension pattern and multiplicity of sinus involved, however histopathological diagnosis is needed in severe cases. Thus, CT scan of paranasal sinuses with axial and coronal reconstruction is the investigation of choice for characterisation, location, extent and diagnosis of paranasal pathologies, providing roadmap for surgery and planning of surgery.

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