

# Prospective study to compare clinical, X-ray and computed tomography findings in various paranasal sinus pathologies

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## ABSTRACT

**Background:** Paranasal sinuses (PNS) diseases are very common and comprises wide spectrum ranging from inflammation to neoplasm. **Objectives:** Objectives of the study were to study and compare clinical, X-ray and computed tomography (CT) findings in various PNS pathologies. **Materials and Methods:** A total of 50 patients presented for PNS were studied in the Department of Radiodiagnosis, Gajra Raja Medical College, from May 2015 to September 2016 using CT and X-ray imaging techniques. Detailed history and clinical examination were also done for each patient. **Results:** Male preponderance was noted with mean age of  $36.93 \pm 18.45$  years. The most common clinical presentation was headache (52%) followed by nasal obstruction (40%). Clinical findings revealed that bacterial sinusitis, fungal sinusitis, polyp, polyps with sinusitis, mucous retention cyst (MRC), MRC with sinusitis, benign lesions, benign lesion with sinusitis, malignant lesions, encephaloceles, and dyke-davidoff-masson syndrome was observed in 66%, 8%, 2%, 8%, 2%, 2%, 12%, 10%, 8%, 2%, and 2% patients, respectively. A total of 45 specific diagnoses could be made in X-ray which is in contrast to CT where a total of 56 diagnoses were made compared to clinical findings. **Conclusion:** CT should be the preferred modality of all imaging studies available because of its ease, availability, accuracy and precision in diagnosis of PNS pathologies.

**KEY WORDS:** Paranasal Sinus Diseases; X-ray Water View; Computed Tomography Scan; Imaging Techniques


## INTRODUCTION

Paranasal sinuses (PNS) diseases are the major health problems in Indian population. Many a time physical examination is not enough, so radiological examination plays a very important role in conforming the diagnosis.<sup>[1,2]</sup> Traditionally, plain radiological evaluation is choice for the diagnosis of PNS diseases. In recent years, with the technologic advancements in the field of imaging, computed tomography (CT) scan has replaced the traditional way of imaging as the primary diagnostic modality.<sup>[3]</sup> CT scan evaluation for PNS

pathologies has contributed more and changed the way of therapeutic approach. Although traditional plan radiograph using X-ray techniques has limited role in the diagnosis of PNS disease, it is still being used as the initial diagnostic modality before using CT scan.<sup>[4-6]</sup> Hence, this study was performed to evaluate and compare the role of clinical, X-ray and CT scan for the diagnosis of different types of pathological condition of PNS diseases.

## MATERIALS AND METHODS

The present prospective study was conducted on 50 patients with clinical complaints referring to nose and PNS in Department of Radiodiagnosis, Gajra Raja Medical College, in close association with ear nose throat (ENT) department from May 2015 to September 2016. Each patient in the study after obtaining an informed consent was subjected to detailed history and clinical examination. Patients of either sex with signs and symptoms referring to nose and PNS pathology including headache, nasal

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discharge, postnasal drip, fever and malaise, epistaxis, mass, facial swelling, and central nervous system involvement or incidentally detected sinonasal pathology on either radiographs or CT were included in the present study. Operated patients, patients with fractures and with disease conditions requiring contrast-enhanced CT with a history of contrast allergy and/or deranged renal function tests were excluded from the study. Detailed history was taken for onset, duration and regarding symptoms such as nasal obstruction, mass, epistaxis, swelling, headache, postnasal drip, fever, proptosis, diplopia, systemic illness like diabetes and HIV and history of previous medical management was recorded in preapproved format. After general and systemic examination, ENT examination including anterior rhinoscopy to look for polyposis, mucopus, deviated nasal septum (DNS) and posterior rhinoscopy for assessment of nasopharyngeal extent was done for each patient. Plain X-ray PNS and CT scans (siemens somatom definition as 128 slice CT) were done for all patients. A separate informed consent was obtained from the patient and radiation risk of diagnostic imaging was informed. The statistical analysis was performed using IBM Statistical Package for Social Sciences version 20.0 statistical analysis software. The values were represented in number (percentage) and mean  $\pm$  standard deviation.  $P < 0.05$  is considered as significant.

## RESULTS

Mean age of study cohort was  $36.93 \pm 18.45$  years which range from 5 months to 76 years. Maximum patients were of age more than 40 years (21 [42%]). Male (32 [64%]) outnumbered the female (18 [36%]). Observation regarding age incidence with lesions revealed that most of the inflammatory cases were seen below the age of 25 years (20 [40%]), benign cases were 25-50 years (18 [36%]) and malignant cases were above 50 years (12 [24%]). The most common clinical presentation was headache (26 [52%]) followed by nasal obstruction (20 [40%]) and nasal discharge (15 [30%]). Out of 50 patients, 39 (78%) were of inflammatory sinonasal diseases, 11 (22%) were of benign neoplastic, and 4 (8%) were of malignant neoplastic (Table 1).

Data are expressed as number of patients (percentage), out of 50 cases; CT was able to correctly diagnose 49 cases, thereby having the diagnostic accuracy of 97.7%. Among the PNS most commonly involved was maxillary sinus (35 [70%]) followed by ethmoid sinus (20 [40%]), sphenoid sinus (17 [34%]), and frontal sinus (12 [24%]). DNS with septal spur was the most common anatomical variation 10 (20%). Agger nasi cells were seen in 2 (4.5%) patients, concha bullosa was there in 4 (8%) patient, aplastic/hypoplastic frontal sinus was noted in 2 (4%); all were bilateral. Pneumatization of anterior clinoid process was there in 2 (4%) patients; all unilateral. Out of 33 cases of bacterial sinusitis (BS), acute sinusitis was most common (30 [90.9%]). ostio-meatal unit (OMU) pattern of involvement was seen in 11 (33.3%), infundibular pattern was noted in

**Table 1:** Comparison between clinical findings versus CT scan diagnosis

Clinical findings (disease category)	n (%)	CT diagnosis	
		Same	Different
BS	33 (66)	33 (66)	0 (0)
FS	4 (8)	4 (8)	0 (0)
Polyp	1 (2)	1 (2)	0 (0)
Polyyps with sinusitis	4 (8)	4 (8)	0 (0)
Mucous retention cyst	1 (2)	1 (2)	0 (0)
Mucous retention cyst with sinusitis	1 (2)	1 (2)	0 (0)
Benign lesions	6 (12)	5 (10)	1 (2)
Benign lesion with sinusitis	5 (10)	5 (10)	0 (0)
Malignant lesions	4 (8)	4 (8)	0 (0)
Encephaloceles	1 (2)	1 (2)	0 (0)
Dyke-davidoff-masson syndrome	1 (2)	1 (2)	0 (0)

BS: Bacterial sinusitis, FS: Fungal sinusitis, CT: Computed tomography

14 (42.4%), sphenothmoidal recess pattern in 3 (9%), and sporadic pattern was noted in 5 (15.2%) patients. Mucosal thickening and opacification of sinuses were observed in all patients, bone remodeling was there in 4 (12.1%), out of which 3 (9.1%) showed thickening/sclerosis, obstruction/blockage of ostium was there in 14 (42%) patients and air-fluid level was seen in 8 (24%) patients. Out of 4 fungal sinusitis (FS) patients, nasal cavity involvement and bony erosion noted in 50% patients. Bilateral sinus involvement, sinus expansion and sinus wall changes seen in 75% patients. On the basis of imaging features, out of 10 cases, bone remodeling was seen in 7 (70%). Contrast enhancement was seen in 3 (30%) cases. Out of 10 benign lesions, four each were anthrochoanal polyp, two each were fibrous dysplasia, one each was inverted papilloma, dermoid cyst, and dentigerous cyst and osteoma. Aggressive bone destruction (75%) was the hallmark of malignant lesions. Contrast enhancement was noted in all four patients (Table 2).

In X-ray PNS waters view, 7 (13.5%) patients were found to have a normal X-ray, and we were able to arrive at provisional diagnosis in 43 (86.4%) patients. Only of the 43 patients, 35 (67.3%) had inflammatory findings like air fluid level, sinus opacification and mucosal thickening in 6 (11.5%) patients (Table 3).

Data are expressed as number of patients (percentage). BS, FS, P - polyp, S - sinusitis, mucous retention cyst; in comparison to X-ray water view, CT have relatively high sensitivity and high specificity for identifying pathological condition.

## DISCUSSION

The different etiology of PNS diseases makes their evaluation necessary for proper management. Lack of specificity of

**Table 2:** Showing correlation between CT imaging findings and clinical findings

CT imaging findings	BS (22)	FS (4)	Polyp with sinusitis (4)	Polyp (1)	Mucous retention cyst (1)	Mucous retention cyst with sinusitis (1)	Benign lesion (6)	Benign lesion with sinusitis (5)	Malignant lesion (4)	Others (2)
Mucosal thickening	22 (100)	4 (100)	4 (100)	1 (100)	0 (0)	1 (100)	0 (0)	5 (100)	0 (0)	0 (0)
Sinus opacification	20 (90.9)	4 (100)	4 (100)	1 (100)	1 (100)	1 (100)	3 (50)	5 (100)	4 (100)	0 (0)
Hyperpneumatization of sinus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (50)
Bony destruction	0 (0)	1 (25)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Cortical sclerosis	3 (13.6)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (50)	2 (40)	0 (0)	0 (0)
Cortical erosion	0 (0)	2 (50)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Rarefaction	12 (54.5)	3 (75)	3 (75)	1 (100)	0 (0)	0 (0)	3 (50)	3 (60)	0 (0)	0 (0)
Remodeling	1 (4.5)	4 (100)	0 (0)	0 (0)	0 (0)	0 (0)	3 (50)	4 (80)	0 (0)	0 (0)
Ground glass change	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (33.3)	0 (0)	0 (0)	0 (0)
Expansion of sinus	0 (0)	3 (75)	0 (0)	0 (0)	0 (0)	0 (0)	4 (66.7)	4 (80)	0 (0)	0 (0)
Enhancement	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (33.3)	2 (40)	4 (100)	0 (0)
Nasopharyngeal component	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (16.7)	2 (40)	0 (0)	0 (0)
Invasion of adjacent structure	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (50)	0 (0)
Herniation of brain parenchyma	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (50)

CT: Computed tomography

**Table 3:** Comparison between clinical findings, X-ray water view and CT scan diagnosis

X-ray PNS	CT diagnosis									
	BS	FS	P	P with S	MRC Cyst	MRC with P	B with S	Benign	Malignancy	Other
Normal (n=7)	7 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Inflammatory (n=35)	22 (62.85)	4 (11.14)	1 (2.85)	4 (11.14)	1 (2.85)	1 (2.85)	5 (14.28)	5 (14.28)	5 (14.28)	2 (5.71)
Benign (n=6)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (16.66)	3 (50)	1 (16.66)	0 (0)
Malignant (n=2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (100)	0 (0)
Others (n=2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (100)

Data are expressed as number of patients (%). BS: Bacterial sinusitis, FS: Fungal sinusitis, P: Polyp, S: Sinusitis, MRC: Mucous retention cyst, In comparison to X-ray water view, CT have relatively high sensitivity and high specificity for identifying pathological condition, PNS: Paranasal sinuses, CT: Computed tomography

clinical and traditional radiograph examination has increased the confidence on CT as the modality of choice. This study has evaluated and compared different means of examination with CT scan. In this study, CT scan was able to make more diagnosis as compared to X-ray water view and clinical diagnosis. Reports of Hussein et al. highlighted the common pathologies involving sinuses as polyp, chronic sinusitis, and acute sinusitis whereas common symptoms reported by them were nasal obstruction, nasal discharge and headache.<sup>[7]</sup> Hussein et al. also reported that maxillary sinus was the most commonly involved sinus followed by ethmoidal, frontal and the sphenoidal sinuses which is in accordance to the present study findings which strengthen the findings of this study as 70% of the patients had maxillary sinus.<sup>[7]</sup> Similar results in Sudan have been reported by timmana gouda in which he reported that incidence of nasal polyp, acute, and chronic

sinusitis was 16%, 16%, and 14%, respectively, which is in accordance to the present study data where most common type of sinusitis was acute type.<sup>[8]</sup> This study has found headache (52%) as the most common symptoms followed by nasal obstruction (40%) and nasal discharge (30%). Such high incidence could be due to swelling of mucosa of nasal cavity and PNS. Furthermore, an increased amount of secretion results in nasal discharge anteriorly or posteriorly. This excess amount of secretion which is not able to release causes pressure to increase which further lead to headache. Similar findings were reported by Srinivasa et al., where they reported that nasal obstruction (48%) was most common followed by headache (42%) and nasal discharge (36%).<sup>[9]</sup> In this study, comparison of clinical diagnosis and CT revealed that CT was able to correctly diagnose 49 cases, thereby having the diagnostic accuracy of 97.7%. Whereas comparison of

findings of X-ray water view and CT scan revealed that X-ray has considerable sensitivity and specificity, but diagnosis of soft tissue disease, bone erosion and osteomeatal complex of the sphenoid/ethmoid sinuses was lacking as compared to CT. Many of the findings and diagnosis were missed by the X-ray, where CT was able to diagnose most of the pathological conditions which are in accordance to what is reported by Hussein et al.<sup>[7]</sup> Similar results were mentioned by Ahmad et al. and Ruqqayia et al.<sup>[10,11]</sup> Similar study on 110 patients from Bhopal by Bagul et al. concluded that CT scan showed both soft tissue and bony details of nose and PNS hence CT accurately detect different pathologies which affects PNS, also several anatomical variations can also be easily detected by CT, which again strengthen the findings of the present study where CT scan was easily able to evaluate various anatomical variations in the present study, most common being the DNS with septal spur.<sup>[6]</sup> The present study has covered almost all type of diagnosis possible in patients with PNS. Small sample size was the main limitation of the present study; a large randomized trial is required to strengthen the findings of present study.

## CONCLUSION

In conclusion, sensitivity and/or specificity of all these diseases indicate the shortage or weakness of water's view technique to estimate and diagnose the soft tissue disease, bone erosion and osteomeatal complex of the sphenoid/ethmoid sinuses and many of the findings and diagnosis are missed. Hence, CT scan should be used as the gold standard method for the diagnosis of PNS pathologies.

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