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Role of Computed Tomography in The Evaluation of Pathological Lesions of Paranasal Sinuses

KEYWORDS: CT, PNS, OMU, FESS, Concha bullosa, DNS.

*** Dr. SACHIN BANTHIA**
RESIDENT, DEPARTMENT OF ADIO-DIAGNOSIS, S.P.MEDICAL COLLEGE,BIKANER(RAJASTHAN).
* CORRESPONDING AUTHOR

Dr. G.L.MEENA
SENIOR PROFESSOR AND HEAD,DEPARTMENT OF RADIO-DIAGNOSIS, S.P.MEDICAL COLLEGE, BIKANER (RAJASTHAN)

ABSTRACT *OBJECTIVES: To diagnose accurately the pathological lesions of PNS, to find out their exact extension & to compare the clinical & Ct findings. MATERIALS & METHODS: In this prospective descriptive clinical study, 100 symptomatic paranasal sinus diseased patients were evaluated by clinical and CT findings for the management of patients. All the patients underwent endoscopy or FESS following CT evaluation and findings were compared. RESULTS: CT diagnosis had higher sensitivity, specificity in diagnosing chronic sinusitis, sinonasal polyps, fungal sinusitis and other lesions in comparison to clinical diagnosis. However, sensitivity of CT was not so high in diagnosing fungal sinusitis as seen with other lesions when compared with final diagnosis. But involvement of the bone by PNS lesions was always demonstrated by the CT, which is the standard imaging modality to demonstrate it accurately. CONCLUSION: CT is the modality of choice of imaging in PNS diseases and associated complications, in evaluating bone erosions & destruction. Fungal sinusitis is potential pitfall on CT. CT helps in planning & further management of patients with PNS diseases.*

INTRODUCTION:
Pathological lesions of the paranasal sinuses include a wide spectrum of conditions ranging from inflammation to neoplasms both benign and malignant. These sinuses are in close anatomical relationship with orbit, cranial fossa and pterygopalatine fossa. Hence early involvement of these areas is an important feature. Since clinical assessment is hampered by the surrounding bony structures, diagnostic radiology is of paramount importance.[1] While conventional plain radiography readily demonstrates maxillary and frontal sinus disease they provide limited views of the anterior ethmoid cells, the upper two thirds of the nasal cavity and the frontal recess.[2] CT imaging provides detailed information of the paranasal sinuses and is now well established as an alternative to standard radiographs.[3] CT demonstrates the anatomical details and true local extent of the disease, which is essential in choosing the appropriate treatment modality.

Now with the unique ability of CT to image both the bones and soft tissues, direct coronal scanning and sagittal reconstruction imaging the space occupying lesions has been revolutionalised. Accurate delineation of disease and micro anatomic locales provide a reliable preoperative road map to endoscopic sinus surgery. A combination of CT and diagnostic endoscopy has become the corner stone in evaluation of the paranasal sinus diseases. Hence CT has immense value and offers standard imaging of paranasal sinus diseases.

OBJECTIVES:
The study entitled **"**ROLE OF COMPUTED TOMOGRAPHY IN THE EVALUATION OF PATHOLOGICAL LESIONS OF PARANASAL SINUSES" was conducted with the following objectives:

1. To diagnose accurately the pathological lesions of the paranasal sinuses.
2. To diagnose accurately the site and extension of lesion into the surrounding structures and to assess bony involvement.
3. To compare the clinical diagnosis with CT diagnosis.

MATERIALS AND METHODS:
This prospective study was carried out on 100 patients with suspected paranasal sinus disease in department of Radiodiagnosis & modern imaging, Sardar Patel Medical College & Associate Group of Hospitals, Bikaner.

Source of Data: The source of data for this study were patients referred to Department of Radiodiagnosis ,SPMC BIKANER with clinically suspected paranasal sinus diseases between june 2015 to January 2016.

Inclusion Criteria: All the patients with clinically suspected paranasal sinus diseases.

Exclusion criteria:
1) All other lesions mimicking paranasal sinus diseases.
2) All traumatic conditions requiring paranasal sinus CT

Method of collection of data: After obtaining clinical history relevant clinical examination was done. With relevance to clinical diagnosis laboratory investigations were asked for. Then patients underwent CT PNS.

CT PROTOCOL: All the scans were performed at our institute using Philips Brilliance 64 Slice MDCT scanner with Philips windows workstation and software.

Patient position	:	Prone for coronal sections , axial & sagittal sections were reconstructed.
Angulation	:	Parallel to hard palate for axial sections Perpendicular to hard palate for coronal sections
Thickness	:	5 mm for both coronal & axial sections. 3 mm were taken at osteomeatal unit on coronal sections.

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Extent	:	Coronal- posterior margin of sphenoid sinus to anterior margin of frontal sinus Axial - hard palate to upper margin of frontal sinus
If necessary extended beyond above mentioned extent as required.		
Exposure	:	120 kVp , 130 mAs, 1.5seconds scan time.
Bone window	:	Window width- 4000 HU Window level – 500HU
Soft tissue window	:	Window width – 90 HU Window level – 40HU
Contrast agent	:	Non-ionic contrast medium was given in optimal doses after measuring eGFR & s. creatinine level.

Diagnostic nasal endoscopy was carried out under general anaesthesia. Endoscopic sinus surgery : tailored according to the CT scan was carried out mainly concentrating on sinus drainage, collection of mucopus, destruction of bones. Any polypoidal or mass lesions were debrided or biopsy taken for histopathological examination and fungal culture in selected cases. CT PNS findings were compared with endoscopic/ endoscopic sinus surgery findings. Sensitivity and specificity of CT findings were calculated using endoscopic/ endoscopic sinus surgery findings as standard with reference to mucosal thickening, polypoidal/mass lesions, involvement of adjacent bones and soft tissue. Finally clinical diagnosis was compared with CT diagnosis.

OBSERVATIONS & RESULTS: A prospective clinical study of 100 patients who underwent CT PNS was done and compared with the final diagnosis after FESS and HPR.

Table 1: Age distribution of patients studied

Age in years	Number(n=100)	%
1-10	2	2
11-20	23	23
21-30	30	30
31-40	17	17
41-50	16	16
51-60	5	5
>60	7	7
Total	100	100

Table 2: Sex distribution of patients studied

Sex	Number (n=100)	%
Male	42	42
Female	58	58
Total	100	100

Table 3: Sinus Diseased

SINUS	NUMBER (n=100)	%
Maxillary	85	85
Anterior ethmoid	78	78
Posterior ethmoid	73	73
Frontal	55	55
Sphenoid	28	28

Table 4: Endoscopy / FESS findings

ENDOSCOPY	NUMBER (n=100)	%
Different from CT	3	3
Same as CT	97	97

Table 5: Histopathological Report

HPR	Number	%
1.Inflammation polyp	31	31
2.Non-specific inflammation	12	12
3.Fungal Sinusitis	8	8
4.Mucocele	4	4
5.Angiofibroma	1	1
6.Inverted papilloma	1	1
7.Malignant	3	3

Out of 100 patients, biopsy of 60 patients were sent for histopathological examination. Inflammatory polyps were common among them.

Table 6: Bone Involvement

Bone Involvement	No.	Sensitivity	Specificity
In clinical diagnosis	1	11.11	100
CT diagnosis	9	100	100
Final Diagnosis	9	-	-

Table 7: Comparison of findings of Clinical, CT and final diagnosis

FINDINGS	CLINICAL		CT		FINAL	
	NO.	%	NO.	%	NO.	%
Chronic Sinusitis	88	88	54	54	51	51
Polyp	6	6	32	32	32	32
Fungal sinusitis	1	1	5	5	8	8
Others	5	5	9	9	9	9

Table 8: Comparison of Clinical with Final Diagnosis

Parameters	Sen	Sp	PPV	NPV
1.Chronic Sinusitis	100	24.4	57.9	100
2.Polyp	18.7	100	100	72.3
3.Fungal sinusitis	12.5	100.0	100.0	92.9
4.Others	55	100.0	100.0	95.7

Table 9: Comparison of CT with Final Diagnosis

Parameters	Sen	Sp	PPV	NPV
Chronic Sinusitis	100	96.0	96.2	100
Polyp	100	100	100	100
Fungal sinusitis	62.5	100	100	96.9
Others	100.0	100.0	100.0	100.0

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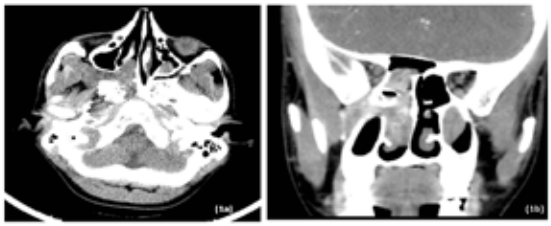
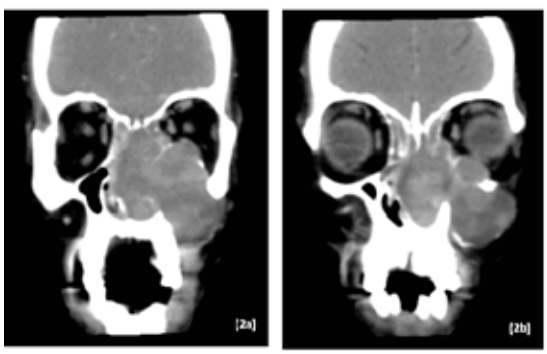
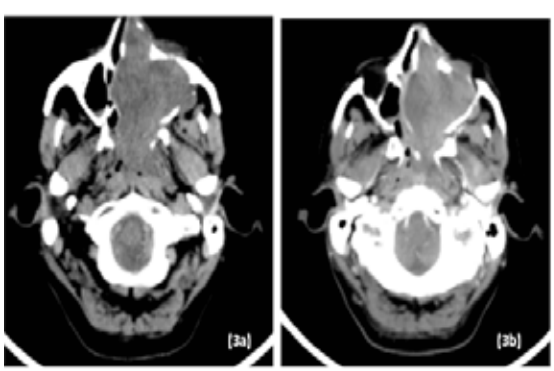


ANGIOFIBROMA : Fig.1(a) and 1(b) showing highly vascular homogenous polypoidal soft tissue mass in nasopharynx suggestive of angiofibroma



INVERTED PAPILLOMA : Fig.2(a) and 2 (b) show soft tissue attenuated mass lesion across the Lt nasal cavity showing variegated post contrast enhancement with minimal Lt maxillary and ethmoid sinus extension and filling the Lt paramedian nasopharynx.



NASOPHARYNGEAL NEOPLASM: Fig. 3 (a) & (b) show enhancing soft tissue mass lesion occupying Lt nasopharynx extending to the sella, Lt temporal lobe with destruction of sella, sphenoid sinus, Lt pterygoid plate, Lt temporal bone and Lt maxillary bone suggestive of malignant nasopharyngeal neoplasm.

DISCUSSION: This study was carried out to evaluate the pathological lesions of the paranasal sinuses by CT. 100 patients were evaluated with CT which were referred after clinical examination and then compared with endoscopic/ FESS findings.

AGE: In present study the patients age ranged between 10-71 yrs which was similar with study done by Gliklich RE[4] and others. Maximum number of patients were aged between 21-30yrs. **SEX**: About 58% patients were females and 42% patients were males which was similar with the study by Gliklich RE and others. **SYMPTOMS:** The most common symptom was headache in 53 patients consisting of 53%, followed by nasal discharge and nasal obstruction. The least common symptom was swelling in face of 3 patients consisting of 3%. The other symptoms were facial pain, epistaxis, sneezing and dyspnoea. This was consistent with Asruddin[5] .**SINUS:** Most common sinus involved was maxillary sinus in 85 (85%), followed by anterior ethmoid, posterior ethmoid, frontal and sphenoid sinuses in decreasing order. Studies in literature observed involvement of anterior ethmoid sinus[7] and maxillary sinus[3] more common. Present study correlates well with later study, where the numbers of patients studied are also 100 and patients underwent FESS. But in the former study 60 patients were studied but there is no mention of whether all patients underwent FESS or not. In all the studies sphenoid was least involved, which is also observed in this study (28%).

FUNGAL SINUSITIS: Greatest pitfall in diagnosis of PNS diseases by CT is the fungal sinusitis. In this study 8 patients were studied among which 5 (62.5%) were diagnosed correctly and others were not diagnosed on CT. The sensitivity was 62.5% and specificity was100% for CT to diagnose fungal sinusitis. The sensitivity described in literature was 76% by Zenreich SJ et al[8], which was a retrospective study. False positives are observed as the density increase is also seen in inspissated secretion, calcification in bacterial infections etc. False negatives are observed as there will be no increase in density in some cases. But CT plays important role in diagnosing invasiveness of fungal sinusitis like spread to adjacent structures, bone erosion or destruction.

BONE INVOLVEMENT:CT has the capability to delineate the bone erosion or destruction with the highest accuracy in the imaging modalities. In this study CT detected the bone erosion or destruction in all the 9 patients which was confirmed on endoscopy/FESS. The sensitivity and specificity of CT to detect bone erosion or destruction was 100% where as clinical detection had 11.11% sensitivity and 100% specificity. This is where the CT has definite advantage over the MRI.

CT AND ENDOSCOPY/FESS COMPARISON: The findings of CT were similar to endoscopy/FESS findings in 97(97%) of patients and different in 3(3%) patients. All the false positive or false negatives are related to fungal sinusitis. Except the fungal sinusitis, sensitivity and specificity of CT was almost 100%.

CLINICAL, CT AND FINAL DIAGNOSIS: There is a best correlation between the CT diagnosis and final diagnosis but poor correlation between the clinical diagnosis and final diagnosis. On comparing clinical diagnosis with final diagnosis, chronic sinusitis has 100% sensitivity but only 24.4% specificity . Polyps has sensitivity of 18.7% and specificity of 100%. For fungal sinusitis the sensitivity was only 12.5%, which was very poor. In diagnosing benign and malignant lesions of PNS was also difficult.

On comparing CT diagnosis with final diagnosis, chronic sinusitis has 100% sensitivity and 96% specificity. Polyps has sensitivity of 100% and specificity of 100%. Again for fungal sinusitis CT has lower sensitivity of 62.5% and specific-

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ity of 100%. For diagnosing benign and malignant lesions CT has 100% sensitivity, specificity, positive predictive value and negative predictive value.

Thus, CT plays an important role in diagnosing and also adding important findings for the better management of the patients with paranasal sinus diseases.

SUMMARY & CONCLUSIONS:

CT is the modality of choice in imaging the paranasal sinuses for evaluating the chronic diseases, associated complications & in evaluating the bone erosion or destruction.

Fungal sinusitis is a potential pitfall.

CT evaluation of PNS in symptomatic patients helps in planning the further management of the patient.

Sensitivity and specificity of CT in diagnosing fungal sinusitis was 62.5% and 100% respectively. But sensitivity and specificity for detection of mucosal abnormality was very good.

CT had best statistical results in evaluating benign and aggressive lesions, which was 100% in this study. On the other hand clinical assessment of these lesions was poor, indicates that CT is mandatory in assessment of paranasal sinus diseases and also to look for any bone erosion or destruction with adjacent structure involvement.

To conclude, this study proved superiority of CT evaluation over the clinical evaluation of symptomatic patients for the diagnosis and also the planning of management in paranasal sinus diseases.

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