ROLE OF MULTIDETECTOR COMPUTED TOMOGRAPHY IN EVALUATION OF PARANASAL SINUS PATHOLOGY

Radiology

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ABSTRACT

BACKGROUND: Paranasal sinus diseases are commonly encountered in clinical practice. These include a wide spectrum of pathologies ranging from inflammatory to neoplastic. Clinical examination followed by imaging is the mainstay in making a correct diagnosis. **METHODS:** 100 consecutive patients underwent CT scan in the department of Radiology using Siemens Somatom Definition Flash 128 slice MDCT scanner as per standard protocol. Images were acquired in the axial plane with reformation in coronal and sagittal planes. **RESULTS:** Most of the patients were in the age group of 30-39 years. The most common pathology was found to be inflammatory sinonasal disease. The most common CT inflammatory pattern was the osteomeatal pattern. The most common benign tumour was found to be juvenile nasopharyngeal angiofibroma and the most common malignant tumour was squamous cell carcinoma of maxillary sinus. **CONCLUSIONS:** MDCT proved to be highly sensitive in classifying the lesions into clinically relevant categories, establishing the diagnosis, for delineating the extent and for prognostication. MDCT is the modality of choice for imaging because of its ease, availability, speed and ability to reveal anatomy of structures, commonly found variations, extent of disease process as well as subtle bone changes that are important in diagnosing lesions and most importantly guiding the surgeons to plan the operation.

KEYWORDS

Computed Tomography, Multidetector Computed Tomography, Paranasal Sinuses, Maxillary Sinus, Ethmoid Sinus, Sphenoid Sinus And Frontal Sinus.

INTRODUCTION

Paranasal sinus (PNS) diseases are commonly encountered in clinical practice. Clinical examination followed by imaging is the mainstay in making correct diagnosis. Radiological imaging is required to determine the extent of lesion, for pre-operative assessment of sinonasal anatomy and to ascertain the anatomic variations, if any. The utility of plain radiography^(1,2) is overshadowed now with improved availability of CT which has far superior spatial resolution. Plain radiography still has a limited role in management of sinusitis, for instance, confirming the presence of air-fluid levels in acute sinusitis as well as in evaluation of size and integrity of the paranasal sinuses⁽¹⁾. However for evaluation of chronic sinusitis where mucosal thickening alone may be present, plain radiography does not suffice.⁽²⁾ Computed Tomography is an outstanding milestone for imaging of paranasal sinus pathologies. Of the various modalities available, MDCT is preferred for its accuracy, speed, lower cost (as compared with MRI) and ease to work with. It has wide availability and has a user friendly platform. CT scan, with its excellent capability to image both bones and soft tissues reliably, allows higher accuracy of defining the cause and extent of both inflammatory and neoplastic pathologies of PNS.⁽³⁾ MRI can be done in cases of complications of sinusitis, extrasinus extension of malignancy and to evaluate intracranial extension^(4,5). In this study, we aimed to assess the utility of HRCT in sinus disease.

METHODS

This Institute Ethics Committee approved, cross sectional study was conducted on 100 consecutive patients referred to the Department of Radiodiagnosis with complaints pertaining to nose and paranasal sinuses, such as nasal obstruction, congestion, purulent rhinorrhea, facial pain with or without headache or fever. Detailed history was taken for onset & duration of symptoms like nasal obstruction, mass, epistaxis, swelling, headache post nasal drip fever etc. History of atopy, allergy and smoking was taken.

All the sinuses (frontal, maxillary, ethmoid & sphenoid) were assessed for pattern of aeration, location, presence of mucosal thickening, opacification, extent of soft tissue/ bone involvement, expansion of sinuses and anatomical variants.

RESULTS

Demographic data is as per table 1. Most patients affected by inflammatory sinonasal diseases were less than 40 years of age.

Table 1: Demographic details

AGE IN YEARS	NO OF PATIENTS		
	males	Females	TOTAL
<30	23	8	31
30-39	24	19	43
40-49	10	9	19
50-59	3	2	5
>60	2	0	2
TOTAL	62	38	100

Table no. 2 lists the number of cases of different pathologies.

Table No 2: Distribution of pathologies

Pathology		No of pt.s
1.Inflammatory sinonasal disease	subacute to chronic sinusitis	10
	Osteomeatal	19
	Sphenoethmoidal	5
	Sinonasal polyp	9
	Sporadic	7
2.Benign Non-inflammatory Sinonasal Disease	allergic fungal rhinosinusitis	10
	invasive fungal sinusitis	2
	Sinonasal polyp	11
	Ethmoidal polyp	6
	AC polyp	5
3.Tumours and Tumour Like Conditions	Mucocele	2
	Retention cyst	7
	Benign malignant	2
4.Miscellaneous	Rhinolith	2
	Osteoma	3
Imaging features of subacute to chronic sinusitis		
Mucosal thickening and opacification		50
Bone Remodeling total/ Thinning/ Sclerosis		35/23/12
Air fluid level		8
Anatomical variation		32
Loco regional complication.		3

Table 3 gives details of anatomical variations found in the subjects and imaging features of different pathologies.

Table No 3: Anatomical Variations & Imaging features of various pathologies

Type of variation	Agger Nasi cell	Haller cell	Concha Bullosa	Paradoxical Middle turbinate	DNS & Septal spur	
No. of cases	12	5	6	4	5	
Imaging features of fungal sinusitis	Bilateral and multi-sinus involvement(pansinusitis)	Expansion and thinning of sinus walls	Hyperdensity on plain scan	Calcification	Bony Erosion	Heterogeneity
No. of cases	7	5	8	3	2	8
Imaging features of Benign Tumors	Bone Destruction	Bone Remodeling	Contrast Enhancement	Invasion of Surrounding structures	Calcification	
No. of cases	2	5	5	3	2	
Imaging features of malignant tumors	Bone Destruction	Contrast Enhancement	Invasion of Surrounding structures	Calcification		
No. of cases	2	2	2	1		

Legend: a. Anatomical variations: DNS and bilateral concha bullosa; b. Mucocoele; c. Antrochoanal polyp; d. Chronic sinusitis; e. Fungal sinusitis; f. Juvenile nasopharyngeal angiofibroma; g. Squamous cell carcinoma; h. Fibrous dysplasia of frontal sinus; i. Inverted papilloma.

Tumors and Tumor like conditions were noted in nine patients, of whom, seven were benign (3 JNA, 2 inverted papillomas, 1 hemangioma and 1 fibrous dysplasia) and two were malignant (both were biopsy proven squamous cell carcinoma). Invasion into the surrounding structures was noted in JNA and inverted papilloma. Calcification was seen in cases of hemangioma and inverted papilloma.

Imaging features of aggressive bone destruction, a hallmark of malignant lesions, was seen in both patients. Contrast enhancement and invasion of surrounding structure were seen in both malignant lesions. Calcification was seen in one case.

Miscellaneous lesions: Three cases were categorized as miscellaneous. Of these, two were rhinoliths and 3 were cases of osteoma.

DISCUSSION

PNS diseases are fairly common in practice and imaging has an important role to diagnose & to know the extent of disease process. Computed tomography has become the method of choice in evaluation of paranasal sinuses. Radiation exposure, artefacts from metal, such as, dental work etc are the main limitations of paranasal sinus CT. CT is superior to MR in delineating the bony details and anatomical variations.^(5,6,7,8) It is vital for planning surgery.

Age distribution: Mean age of patients suffering from sinus disease in the current study was 33.6 years, similar to the study of 2405 patients of chronic sinusitis conducted by Shashy RG et al.⁽⁹⁾ where mean age was 39.4 years.

Pattern of involvement: OMC pattern of involvement was seen in most (19/50, that is 38%) patients of inflammatory sinonasal disease. In the study by Jagram Verma et al.⁽⁸⁾ sinonasal polyposis was the commonest (41.7%) inflammatory sinonasal disease. Babbal et al.⁽¹⁰⁾ noted that, among 500 pts, infundibular (26%) and OMC types of inflammatory sinonasal disease were the commonest (25%) types.

Imaging findings: Mucosal thickening was noted in all 50 patients of bacterial sinusitis. Yousem et al.⁽¹¹⁾ on a study of CT and MRI on 100 patients observed that the positive predictive value of OMC opacification was 79% for the presence of inflammatory sinonasal disease. The next common finding were mucous cysts. They stated that sclerosis of sinus walls was an important finding that helps in differentiating subacute from chronic sinusitis.

Anatomic variations: Agger nasi cells were most common, while paradoxical middle turbinate was the least common anatomic variation, in the current study. John Earwaker⁽¹²⁾ found that concha bullosa was the most common anatomic variant followed by deviated nasal septum (DNS), on MDCT of 800 cases.

Fungal sinusitis: 12 cases had fungal sinusitis, in the current study. Hyper attenuation and heterogeneity of contents, bilateral multi-sinus involvement, multiple areas of bone erosion and thinning were noted in almost all patients of allergic fungal rhinosinusitis (AFRS). Similar observations were made by C.Ekambar Eshwara Reddy et al.⁽¹³⁾. They also noted bilaterality in 58.3%, as against 83.3% in our study. In our study calcification was noted in 25% cases; slightly lower than in their study.

Benign non-inflammatory sinonasal disease: In our study 24 patients had non-inflammatory sinonasal disease. On imaging they appeared expansile soft attenuating homogenous masses causing pressure erosion of bones. SH Nanda et al.⁽¹⁴⁾ evaluated 60 patients for nasal polyps. They found that ethmoidal polyps occur far more commonly than antro-choanal polyps by a ratio of 9:1.

Tumours and tumour like conditions: The most common benign neoplasm was JNA. Mohammed A. Gomaa et al.⁽¹⁵⁾ made a similar observation. The most common malignant pathology was squamous cell carcinoma of maxillary sinus, similar to findings of Azzam MA. Salami et al.⁽¹⁶⁾.

In our study bone destruction and contrast enhancement were noted in both patients of malignant etiology and calcification was seen in 1 case. As per literature, between 80% and 90% of all sinonasal tumours are carcinomas and the vast majority of these are either squamous cell or undifferentiated lesions that typically produce aggressive permeative bone destruction seen in up to 80% cases.

Contrast enhancement and bone remodelling were noted in the majority of benign tumours. Surprisingly, two cases of benign tumours had bony destruction. Calcification was seen in 2 cases - one inverted papilloma and one haemangioma. Our study is in concordance with literature that bony remodelling is a feature of both benign and low-grade malignant tumours. Focal hyperostosis was also noted in one case of inverted papilloma, similar to the findings of Jeon TY et al.⁽¹⁷⁾ They stated that focal hyperostosis represents an area of tumour origin in 89% cases.

CONCLUSION

PNS diseases are commonly encountered in clinical practice. Clinical examination followed by imaging is the mainstay to make the correct diagnosis, to define the extent of the lesion, to demonstrate the assessment of sinonasal anatomy pre-operatively, as well as to ascertain commonly encountered anatomic variations.

MDCT is the modality of choice for imaging because of its availability, speed, high spatial and tissue resolution.

DECLARATIONS*Funding: none**Conflict of interest: none declared**Ethical approval: approved by Ethics committee***Abbreviations**

CT: Computed Tomography

MDCT: multidetector CT

PNS: Paranasal sinus

MRI: Magnetic Resonance Imaging

HRCT: High Resolution CT

JNA: Juvenile nasopharyngeal angiofibroma

OMC : Osteomeatal complex

DNS: Deviated nasal septum

AFRS: allergic fungal rhinosinusitis

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