



CT EVALUATION OF LESIONS OF PARANASAL SINUSES

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KEYWORDS :**INTRODUCTION**

Inflammatory and neoplastic diseases are a common and serious health problem. Because physical examination of these patients can be nonspecific, for many years, radiological evaluation has been relied on to aid in confirming the diagnosis of paranasal sinus pathology.

Traditionally, plain films were the modality of choice in the evaluation of the paranasal sinuses. The standard radiographic sinus series usually consists of four views, Caldwell view, Waters view, Lateral view and Submentovertical view.

Although the standard radiographs may be accurate in showing air-fluid levels, the degree of chronic inflammatory disease present is consistently and significantly underestimated with standard radiograph. Dreaded complications like intracranial and intra-orbital involvement cannot be well assessed. Early lesions are likely to be missed and advanced disease can be underestimated. Furthermore, the superimposition of structures precludes the accurate evaluation of the anatomy of the osteomeatal channels with which the modern surgeon needs to be familiar.

The availability of high resolution coronal CT images provides an accurate display of the regional anatomy, especially osteomeatal complex.

Although MRI provides better visualisation of soft tissue than CT, its disadvantage is its inability to optimally display the cortical bone – air interface, Because both cortical bone and air have signal voids (no MR signal), at times, MR cannot be reliably used as an operative “roadmap” to guide the surgeon during Functional Endoscopic Sinus Surgery. Thus CT has an edge over MRI in this respect. Besides, during the edematous phase of the nasal cycle, both ethmoid sinuses and the nasal cavity mucosa give signal intensity similar to that the mucosal inflammation on T2 weighted images. This further limits the usefulness of MRI.

CT is currently the modality of choice in the evaluation of the paranasal sinuses and the adjacent structures. Its ability to optimally display bone, soft tissue and air facilitates accurate depiction of anatomy and extent of disease in and around the PNS. CT clearly depicts the fine bony anatomy of the osteomeatal channels.

This study also defines the indications of CT in various PNS lesions and additional information obtained with the help of CT such as orbital and intracranial extension of lesions.

An attempt is also made to correlate the CT findings in these paranasal sinus lesions with the operative and histopathological diagnosis, in order to assess the efficacy of CT in detection of these lesions which will help to achieve better management of the patients in future.

AIMS AND OBJECTIVES

- 1) To study the normal anatomy of the paranasal sinuses on CT scanning in axial and coronal planes.
- 2) CT evaluation of lesions of PNS such as –
 - A) Inflammatory Lesions :-
 1. Acute and chronic sinusitis.
 2. Nasal polyposis
 3. Mucoceles.
 - B) Fungal diseases
 - C) Neoplastic lesions
- 3) To correlate CT results with histopathological diagnosis and operative findings, wherever possible.
- 4) To establish the efficacy of CT in detection and treatment of various PNS lesions.

MATERIALS AND METHODS**Sample Size :- 50 Cases**

This study was conducted in department of Radio diagnosis and imaging, Bharati Vidyapeeth University, Medical College, Pune during 2010 - 2013

Patients were selected on the basis of:

Clinical history suggestive of PNS lesions such a

1. Epistaxis
2. Chronic sinusitis with headache
3. Swelling or deformity over the cheek and palate
4. CSF rhinorrhoea
5. Nasal blockage
6. PNS lesions detected on plain radiography
7. History of facial trauma.
8. Suspected orbital or intracranial complications of PNS lesions.

Equipment :- Philips Brilliance 16 CT Scan**Technique :**

Patient Position – head first, supine.

Axial CT sections were taken at 1mm intervals with angulation parallel to the IOML (Inferior orbito – meatal line). Coronal sections were taken with the patient in prone position with extension of the neck.

All patients were called with atleast 6 hours of fasting before the scan to minimize the sequelae such as vomiting after contrast injection.

Contrast media :

Contrast media is given as and when required. No contrast was used in patient investigated for trauma.

Scanner setting	kVp	120
	mAs	30
	Slice thickness	1mm
	Scan time	2sec

OBSERVATIONS AND RESULTS:

TABLE NO 1: AGE AND SEX DISTRIBUTION OF PNS LESIONS:

AGE(YEARS)	NO. OF PATIENTS	MALES	FEMALES
0-1	0	0	0
1-10	0	0	0
11-20	8	4	4
21-30	8	6	2
31-40	13	4	9
41-50	8	5	3
51-60	11	9	2
61-70	2	2	0
TOTAL	50	30	20

COMMENTS: Total Numbers of males: 30

Total numbers of females: 20

PNS Lesions were observed more commonly in males than in females. The commonest age group affected was 31-40 years.

TABLE 2: DISTRIBUTION OF INFLAMMATORY AND NON INFECTIVE PNS LESIONS :

CT FEATURE	NO. OF PATIENTS
SINUSITIS	24
MUCOCELE	2
POLYPS	19
FUNGAL INFECTIONS	5
TOTAL	50

TABLE 3: ANATOMIC VARIANTS CONDITIONS OF PNS:

VARIANT	NO. OF PATIENTS
DNS	14
CONCHA BULLOSA	18
PARADOXICAL TURBINATE	4
ONODI CELLS	12
HALLER CELLS	13
AERATED ANT CLINOID	10

COMMENTS: The anatomic variations were common in patients with inflammatory sinus pathologies.

TABLE 4: INCIDENCE OF VARIOUS NEOPLASTIC LESIONS:

	MALIGNANT	BENIGN
PRIMARY SINUS NEOPLASM	5	2
CONTIGUOUS SPREAD FROM RELATED STRUCTURES	5	1
TOTAL -12	10	03

DISCUSSION

A total of 50 patients referred for PNS lesions were studied using CT scan, out of which 30 patients were males while 20 were females.

Axial & coronal as well as sagittal sections were taken. In patients who were unable to tolerate the position for coronal scans, only axial scans were obtained and coronal reformatted images were obtained subsequently. In patients who were to undergo FESS, only coronal sections of the PNS with thin slices in the region of the OMC were taken.

We used 40ml of omnipaque (iohexol) a non ionic water soluble contrast medium for opacification of the mass lesions of PNS to assess then vascularity and exact extent in adult patients. The contrast administration was very useful to differentiate fluid from soft tissue due to tumor invasion. This correlated with the findings discussed by Bilanink L. T. and Zimmerman RA¹².

In our study, 1 patients developed minor reactions to ionic contrast like nausea, itching etc, which was treated by injection metoclopramide, ranitidine and hydrocortisone. None of our patients experienced a major reaction and there was no morbidity or mortality from contrast reaction.

INFLAMMATORY LESIONS:

The viral rhinitis is thought to be secondary to rhino virus, para influenza and influenza virus. The anatomic changes within paranasal sinuses are completely reversible. There is usually mucosal thickening within the nasal fossa and turbinates as well as mucosa of PNS.

The most common incidental finding within the maxillary sinuses is a rounded soft tissue density. Pathologically, this finding may represent a mucus retention cyst, polyp, serous retention cyst. In our study, 45 patients were diagnosed to have inflammatory sinus disease, out of which 24 patients had sinusitis, 2 patients had mucocoeles and 19 patients had polyps.

Multiple sinuses were affected in patients of sinusitis and spread to contiguous sinuses was common. Pansinusitis was noted in 3 patients. These patients with inflammatory sinusitis showed mucoperiosteal thickening. These findings were in accordance with J. Charles et al²²

In our study, thin coronal sections were taken in the region of Osteo Meatal complexes. These were very useful for the exact depiction of fine bony details as well as the anatomic variants and "are of great help

to the surgeons for planning FESS. This has been documented by Hahnel³ et al⁴⁸.

In our study, the commonest CT findings in sinusitis were those of fluid level and total opacification of sinuses. These were in accordance to the CT findings of Lindback M et al⁶⁷. The commonest symptoms in these patients were nasal discharge, headache and tenderness. The maxillary sinus was the most frequently involved sinus. These findings were in accordance with those of Mudgil SP et al⁷².

The incidence of the anatomic variants in patients with sinus disease was concha bullosa in 18 patients. Haller cells in 13 patients, DNS in 14 patients, paradoxical turbinates in 4 patients, aerated anterior clinoids in 10 patients. Our findings were comparable with those of Arslan H et al⁷, Sanchez Fernandez JM et al⁸⁹ and Tatli MM et al¹⁰⁵ who stated that sinus abnormalities were present in nearly 69% of patients with inflammatory sinus disease.

In our study, 2 patients had a simple polyp, 3 patient was diagnosed to have an antrochoanal polyp and 3 patient had opacified sinuses with sinonasal polyposis.

CT findings were those of confluent soft tissue filling the nasal cavity with sinus opacification. Our findings correlated with those of Timothy L. Larson¹⁰⁹.

Out of 3 patients with mucocoeles, 2 patients had frontal mucocoeles and one patient had a sphenoidal mucocoele. Expansion of the sinuses with pressure dehiscence of the sinus walls was noted in all patients. Proptosis was noted in one patient of frontal mucocoele. Our findings correlated with those of Oshnishi et al⁷⁸, Perugini et al⁸⁰ who described that expansion of the frontal mucocoele occurs into the upper medial portion of orbit and is associated with displacement of the orbital roof inferiorly and laterally. The CT findings of the patient with a maxillary mucocoele revealed a large non enhancing soft tissue density lesion causing expansion of the maxillary antrum with pressure erosion of the sinus walls and extension into the nasal cavity. These findings were consistent with those described by Ornerod et al¹⁹.

FUNGAL INFECTIONS:

The most common and most important fungal diseases include mucormycosis, histoplasmosis, candidiasis and aspergillosis.

The radiographic features of fungal disease involving paranasal sinuses are opacification of sinuses as well as sclerotic bony reaction.

Invasion of orbits, cavernous sinuses and ophthalmic veins is common. Intra cranial extension via emissary veins may extend to meninges and eventually lead to cerebral abscess.

In our study, out of the 5 patients diagnosed to have fungal infections, 3 patients were uncontrolled diabetics and 2 patients were immunocompromised. Our findings correlated with those of Perolada Valmana M et al¹⁹ and Ferguson Bj³⁵.

NEOPLASTIC CONDITIONS:

The mucosa of sinonasal cavity is ciliated columnar epithelium containing mucous secreting glands called Bowman's glands, this unique mucosa is of ectodermal in origin and gives rise to a distinct class of lesions with a hyperplastic zone of basement membrane enclosing epithelium known as papillomas. These findings were consistent with those described by Wayne Scott Kubal¹¹²

Fungiform papillomas make up approximately half of all papillomas. These nearly always arise from nasal septum, are usually solitary and unilateral, and may have irregular surface much like that of other papillomas, but are not considered premalignant.

These are common in middle aged men. Characteristically arise from lateral nasal wall in the region of the root of the middle turbinate, and may extend laterally into the PNS mainly maxillary sinuses. Most common presenting symptoms are anosmia, nasal obstruction and epistaxis.

Squamous cell carcinoma of sinonasal cavity arises most commonly from maxillary sinus primarily seen males in 6th and 7th decade of life.

Olfactory neuroblastoma and esthesioneuroblastoma is uncommon tumour that originates from neural crest cells and from

olfactory mucosa. The incidence curve for this disease has bimodal shape with first peak in the 2nd decade of life and 2nd peak in the 6th decade.

The mass may be relatively slow growing for a malignant tumour and may cause some expansion and remodeling of the bony structures. The tumour has propensity to intracranial extension through dura in the region of cribriform plate. These findings were consistent with those described by Burke¹⁶.

Lymphomas represent most common sarcomas involving sinonasal tract, majorities are Non-Hodgkin type of lymphomas. Non-Hodgkin lymphoma is 2nd most common malignancy of head and neck following Squamous cell carcinoma. The nasal cavity and maxillary sinus are the most common sites of origin.

In our study, 7 patients were diagnosed to have neoplastic conditions, out of which 5 patients suffered from malignant lesions and 2 had benign lesions.

Out of 5 patients with malignant lesions, 5 patients had primary sinus neoplasms. The primary sinuses involved in malignancy were maxillary sinus in 2 patients, ethmoid in 2 patients, frontal in 1 patient, while sphenoid sinus in 0 patient. These findings were comparable with those of Kondo Met al⁵⁹ who stated that 65% of the sinus malignancies originate in the maxillary antrum. Spiro JD et al¹⁰⁰ noted the incidence to be 60%; followed by nasal cavity in 26%; ethmoid sinus in 10% frontal and sphenoid sinus in 2% cases.

CT study showed a moderately enhancing mass arising in the sinus with destruction of bony walls to a variable extent and spread of the mass infiltrating the surrounding structures.

Histopathological examination of 1 patient showed presence of squamous carcinoma, and histopathological correlation was not possible in other patient. According to Hasso⁵⁰, 95% of sinus malignancies are squamous cell carcinomas. He described the CT features of these lesions as a mass having irregular margins and variable enhancement and bone destruction. Our findings correlated well with these findings.

Administration of intravenous contrast was useful to show early extension into the infratemporal fossae and intraorbital and intracranial extension. This was in accordance with the findings of Mancuso et al⁶⁹.

In our study, 3 patients had intracranial extension of malignancy, while 2 patients had orbital complications. In our study 3 patients were found to have nodal metastases to the cervical nodes which were diagnosed by including the sections through the neck region. Nodal metastasis is one of the gravest prognostic signs. One patient was diagnosed to have an olfactory neuroblastoma (esthesioneuroblastoma). The CT findings revealed a heterogeneously enhancing soft tissue density mass extending into the ethmoidal and frontal sinuses and the medial portion of the orbit with destruction of the roof and medial wall of the orbit. Our findings were consistent with those described by Weber et al¹¹⁴ and Burke et al¹⁶.

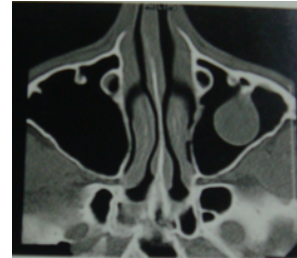
In our study only one patient had a primary carcinoma of the frontal sinus. He presented with chief complaints of forehead pain, epistaxis and orbital disturbances. These findings correlated well with those of Osguthorpe J D, Richardson M⁷⁷ who stated that frontal malignancies comprise of only 2% and patients present with similar symptoms.

SUMMARY AND CONCLUSIONS:

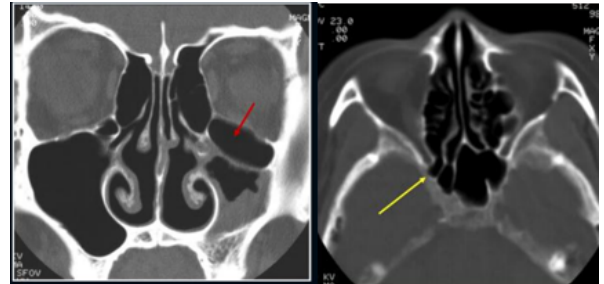
In this study a total of 50 patients of PNS lesions were studied using axial and coronal CT scan. (30 male patients and 20 female patients.) The scan plan was modified wherever necessary. HRCT coronal sections were obtained in patients who were subject to FESS. Contrast was administered in patients with suspected mass lesion to know the exact extent and the vascularity of the lesions. Omnipaque (iohexol) nonionic water soluble contrast medium, was used for scanning in adult patients. Inflammatory conditions of the PNS were diagnosed in 45 patients, fungal infection in 5 patients, neoplasms in 7 patients, trauma in 5 patients, fibrous dysplasia in 1 patient. In patients with inflammatory conditions, sinusitis was diagnosed in 24 patients,

polyps in 19 patients and mucoceles in 3 patients. The patients with mucoceles showed expansion of the sinuses with pressure dehiscence of the sinus walls. Most of the patients with inflammatory sinusitis showed blockage of the OM complexes due to inflammatory soft tissue or anatomic variants. The incidence of anatomic variations was common in patients with inflammatory sinusitis, these findings were accordance with J. Charles et al²² and of Mudgil SP et al⁷² Out of 5 patients with fungal infections of the PNS, 3 patients were uncontrolled diabetics while two patients had an immunocompromised status. Our findings correlated with those of ProladaValmanaM et al¹⁹ and Ferguson B³⁵.

IMAGES



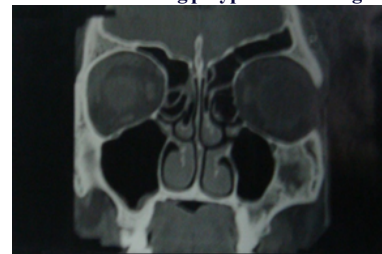
1. PEDUNCULATED POLYP



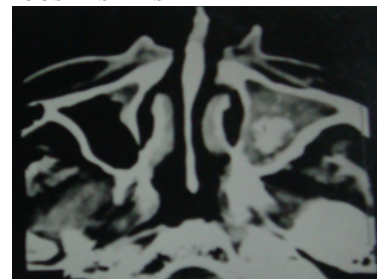
2. Haller cell and onodii cells



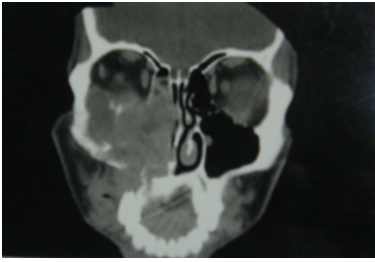
3. Rt. Anterior ethmoid showing polyps and blockage



4. Left FIBROUS DYSPLASIA



5. FUNGAL BALL : ASPERGILLOMA occupying the left maxillary antrum with nodular calcification within it



6.CARCINOMA OF MAXILLARY SINUS with destruction of the walls and intraorbital extension of tumor.

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