



OCCURRENCE OF MALIGNANT TUMORS OF PARANASAL SINUSES IN KARNATAKA

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ABSTRACT

Introduction: malignancy of paranasal sinuses is wide spread. Paranasal sinuses are in close anatomical relationship with skull viscera. Clinical assessment get hampered by surrounding bony structures, diagnostic radiology is of paramount importance. While conventional plain X ray film demonstrates limited pathologies. CT imaging provides excellent information of the paranasal sinuses and its pathologies then standard radiographs.

Materials and Methods: In this hospital based, prospective co relational descriptive clinic radiological study, All the patients underwent endoscopy or FESS following CT evaluation and findings were correlated.

Results: CT diagnosis had higher sensitivity, specificity, positive predictive value and negative predictive value in diagnosing anatomic variants of PNS, involvement of the bone by PNS lesions was always demonstrated by the CT accurately.

Interpretation and Conclusion: Pathological conditions of PNS are common and have a varied presentation in all the age groups. These are difficult to diagnose accurately on conventional plain films. CT imaging provides detailed information regarding involvement, location, extent of malignancy of paranasal sinuses and is an excellent alternative to standard radiographs.

Key Words: Computed tomography (CT), Paranasal sinus (PNS), Functional endoscopic sinus surgery (FESS), malignancy of paranasal sinuses

INTRODUCTION:

Malignancy of paranasal sinuses include wide spectrum. Plain film is inaccurate and inadequate in the diagnosis of neoplastic conditions of PNS. Imaging of the PNS has progressed from the realm of conventional radiographs (plain films) almost exclusively into the realms of computed tomography (CT) and magnetic resonance imaging (MRI). Technological advances in these two imaging modalities have provided more precise differential diagnosis and greater detail about the anatomic extent of the malignancy of PNS. These provide sufficient information for diagnosis and surgical planning in the PNS malignancy.

NEOPLASMS OF PARANASAL SINUSES^{1,2,3.}

Incidence: The incidence of tumors of paranasal sinuses is around 0.2%. They constitute 3% of cancers of upper respiratory tract. Among 5050 tumors of the upper respiratory tract reported by Asch et al from Armed Forces Institute of Pathology (U.S.A.), 530 cases occurred in paranasal sinuses and nasal cavity. John G. Batakis observed that the incidence of carcinomas of paranasal sinuses is around 1 % of all human

malignancies.

Mass and Nectous (1986) reviewing the descriptive epidemiology of neoplasms of paranasal sinuses and nose noted that the highest occurrence is in Japanese population in whom unexplained excess risk is confined to maxillary sinus. Up to 80% of all paranasal sinus cancers arise in the maxillary sinus. Ethmoid sinus is uncommon. But osteoma occurs in this sinus more frequently than in any other sinuses. Sphenoid sinus has the least incidence of tumors.

Sex ratio: Average female to male ratio revealed by various reports is 1:2 (F:M).

Age^{31,32} : Malignant lesions are rare before the age of 35 years, although a greater incidence of sarcoma and adenocarcinoma are seen in younger age group. In Maeheths series (1905) maximum incidence of malignant tumors were in the 6th decade of life.

Predisposing factors:

Many theories have been suggested to explain the aetiology of tumors of paranasal sinus. Regarding the origin of osteoma, many theories are existing.

Embryogenic, infectious, traumatic factors all account for its origin. A higher incidence among males favours a traumatic cause. Thus persistence of embryonal periosteum in areas where endochondrial and membrane bone meets would explain the frequency with which Osteomas occurring at the junction of ethmoid and frontal bones. Regarding the origin of inverted papilloma, viral aetiology was suggested by Jarvi (1994). Some extrinsic factors also suggested are atmospheric pollution, textile industries, steel factories etc. B. Majumdar (1984) reported high incidence (22%) of inverted papilloma among steel factory workers. The carcinogens suggested by James, Suen, and Cugen include.

Carcinogens⁴

- Wood dust (furniture industry)
- Shoe industry (shoe making)
- Textile workers
- Radio chemicals
- Radium dial (painters)
- Mustard gas
- Nickel refining

Other factors: Chronic sinusitis Cigarette smoking Alcoholism.

Pathological Classification Of Tumors In Paranasal Sinuses^{35,36}

Benign tumors:

I Epithelial tumors:

1. Papilloma.
Squamous papilloma
Inverted papilloma.
2. Adenoma.

II. Connective tissue tumors:

- Fibroma. Osteoma.
- Localized compact osteoma
- Localized cancellous osteoma
- Fibrous dysplasia. Angioma. Chondroma
- Schwannoma, Neurofibroma
- Myxoma
- Giant cell reparative granuloma
- Acinic cell tumor
- Odontogenic tumors.

B. Malignant tumors:

1. Epithelial tumors:

- Squamous cell carcinoma
- Basal cell carcinoma
- Lymphoepithelioma
- Adenocarcinoma
- Spindle cell and clear cell carcinoma
- Olfactory neuroblastoma
- Malignant melanoma
- Minor salivary gland tumors (Malignant)

- Adamantinoma

II. Connective tissue tumours:

- Sarcoma.
- Fibrosarcoma
- Osteosarcoma
- Lymphosarcoma
- Myxosarcoma
- Haemangio endotheliosarcoma
- Hemangio pericytoma
- Chondrosarcoma
- Malignant lymphoma
- Plasmacytoma

III. Teratomas and terato carcinosarcoma

IV. Metastatic tumors to sinonasal tract.

7,8,9,10,11

V. Tumors involving the sinuses by contiguity.

- Angiofibroma
- Chondroma
- Meningioma
- Pituitary tumors
- Nasopharyngeal carcinomas
- Olfactory neuroblastomas

BENIGN TUMORS:^{3,4.}

Epithelial tumors:

Papilloma (Fig 32): The commonest epithelial (Benign) tumors in the paranasal sinus and lateral wall of nasal cavity is the papilloma arising from schneiderian membrane, which is lining respiratory epithelium of nose and paranasal sinuses. Often behaving as a neoplasm, the schneiderian papillomas probably arise from a proliferation of reserve or replacement of cells located at the basement membrane of mucosa. This proliferation leads on to inverting, fungiform or combination of both growth patterns. Papilloma in the lateral wall may involve multiple sites, sinuses, floor and roof of nasal cavity and nasolacrimal duct and their association with squamous cell carcinoma is well documented. Other terminologies used for this papilloma are:

1. Ringertz tumor.
2. Inverted papilloma.
3. Schneiderian papilloma.

Generally, they are bulkier and firmer than nasal polyps, but lack its translucency. They grow into architectural patterns. 1. Papillary and exophytic 2. Inverted, with an inwardly invaginating epithelial growth into underlying stroma. The later type is more often seen in lateral wall and sinuses. The predominant epithelial growth of the inverted form of papilloma is directed into underlying stroma instead of being a surface proliferation. The common sites of occurrence are: Lateral wall of nose - 68%. Ethmoidal and maxillary sinuses - 27% Sphenoid

and ethmoidal- 5%.

Computed Tomography (CT):

They appear as soft tissue attenuation masses. Fungiform type nearly always arise from the nasal septum and are usually solitary and unilateral, and may have the typical irregular veracious surface. Unlike the inverted, fungiform papillomas are not considered premalignant.

Inverted papillomas characteristically arise from the lateral nasal wall in the region of the root of the middle turbinate and may extend laterally into the paranasal sinuses, especially the maxillary sinuses and less commonly the ethmoid sinuses. Calcification may be seen in some cases.

Adenoma :

Occurs in sinuses, but are rare. It remains capsulated, usually symptomless, but if they arise from the lateral wall of the nose it produces nasal obstruction.

CT:

These are soft tissue masses of around 20-40 HU associated rarely with bone expansion, and on contrast enhancement these tumors show well defined capsule, and no evidence of bone destruction seen.

Connective tissue tumors:

Fibroma :

These are relatively benign lesions of connective tissue covered by hypoplastic epithelium. This tumor has no infiltrative or destructive capability and does not metastasize.

Imaging: Soft tissue mass which does not enhance with contrast, and walls of the sinuses are normal. No evidence of bone destruction is seen. No evidence of calcification or necrotic areas are seen.

2. Osteoma (Fig 31) :

70% of the osteomas are in the frontal sinuses, 25% in ethmoid sinuses, and 5% in maxillary and sphenoid sinuses. Handuosa (1952) reported in 35 patients, and recorded the site of origin in relation to various skull bones as determined by the histological appearance of the tumor after removal. They may be:

Ivory: Composed of hard compact bone.

Spongy: Where a cortical plate surrounds mature cancellous bone with a lamellar structure of a mixture of two osteomas, usually found as asymptomatic lesion in adults (15-35 years average) as an incidental radiological findings. Larger lesion may produce pain, and critically placed tumors may be associated with mucoceles. Local bone destruction from pressure can result in pneumocele, meningitis or brain abscess. These are very slow growing and benign. Theories of origin include embryonal, infection and traumatic factors. Higher incidence is in males. Dive and Bussy (1962) recognized a

triad symptoms consisting of soft tissue masses, bone lesions, and colonic polyps called Gardner's syndrome.

CT: These are obvious on plain film and CT examination. Small tumors may even obstruct the sinus and lead to C.S.F. rhinorrhoea. On CT these tumors appear equal to bone density.

CT reveals an osteomas to be smoothly demarcated, frequently lobulated, homogenously hyperdense, and often lying within expanded paranasal sinus. CT is the procedure of choice for the evaluation of osteoma.

Ossifying fibroma or fibrous osteoma or osteofibroma:

Ossifying fibroma is a benign, gradually expansile and fairly encapsulated tumor. This tumor was reported as early as in 1865 in British literature. More commonly occurs between 30-40 years of age with women more often than men are affected. The lesions usually arise in close proximity to the root of the teeth. The most commonly involved bone appears to be the mandible, with high affinity to the molar teeth.

Tumor is well vascularized stroma containing various amounts of calcified materials. Calcification may appear as irregular bony structures and spicules. These are slow growing and non invasive, and do not metastasize.

Chondroma and chondrosarcoma:

Chondromas arise from primordial cell nests. They may develop at any site. But ethmoidal sinus is the most common location. Often asymptomatic and found incidentally, they may cause obstruction and disfigurement. A chondroma is seen well demarcated from surrounding tissue.

They are slow growing, and do not metastasize. But expansion with loss of bone, and malignant degeneration into chondrosarcoma may occur. Gross total excision is required.

Imaging:

Ossifying fibroma in its early stage appears to be solitary, cyst like and osteolytic, without a prominent periosteal reaction. At a later stage of maturation, lesions are radiopaque and surrounded by a uniform radiolucent rimming. Occasionally sclerotic border may separate the lesion from the adjacent normal bone. On CT scan non-homogeneity is due to regions of sclerotic bone alternating with less dense matrix.

Chondroma/chondrosarcomas are slow growing, but form destructive soft tissue mass lesions with radiologically characteristic amorphous calcification even on plain films. Sharply marginated lytic bone change with stippled calcification can mimic that of meningioma. On CT, chondromas have values that are similar to muscle, and shows densely calcified mass, often showing a whorled pattern (with central hypodensity) and capped by soft tissue mass that is not

calcified.

D. Inflammatory Polyps:

CT shows expansion of nasal fossa filled with soft tissue density polypoid masses. With central high density and peripheral rim of low attenuation. Sinuses also opacified with extension into orbits may be seen. Characteristically, bilateral involvement usually distinguishes it from malignancy.

Angiofibroma (Jwank nasopharyngeal angiofibroma)

It is a benign vascular tumor occurring almost exclusively in pre-pubescent or pubescent males. It accounts for less than 0.05% head and neck tumor (Waliman et al 1981). Its incidence being 1 in 50,000 (Chandler et al, pharyngeal angiofibromas, staging and management, *Annals of Otolaryngology Rhinology Laryngology* 93:323-320) Intracranial extension has been observed in 20-30% patients. These tumors are highly vascular and non encapsulated polypoid mass that is histologically benign but highly aggressive. The triad of epistaxis, nasal obstruction and presence of a nasopharyngeal mass strongly indicates an angiofibroma.

Imaging:

The site of origin of the tumor is thought to be the nasopharyngeal region at the pterygopalatine fossa or sphenopalatine foramen. Involvement of pterygopalatine fossa is seen in approximately 90% of patients as asymmetry in the size or widening of this structure, and an obliteration of the fat plane between the pterygoid plates and the back of the maxillary sinus. The tumor may extend anteriorly and superiorly into the maxillary sinus, nasal cavity, sphenoid and ethmoid sinuses, or superiorly into the cranial fossa through foramen rotundum and pterygoid canal through superior orbital fissure. Contrast enhanced CT examination reveals a polypoid and infiltrating, markedly enhancing mass that involves the nasopharynx without extension. On dynamic scanning they reveal intense early enhancement characteristic of highly vascular lesions. Ideally angiography should be performed to demonstrate the major feeding vessels which are more often the internal maxillary artery and ascending pharyngeal artery.

MALIGNANT TUMORS OF PARANASAL SINUSES:

Malignant tumors of Paranasal sinuses are rare, comprising about 3% of all head and neck tumors. Approximately 50-65% of sino-nasal malignancies arise within the maxillary sinuses, 10-25% in ethmoid sinuses and 15-30% in the nasal cavity of all Paranasal sinuses cancers about 80% arise in maxillary antrum with an annual incidence of about 1 in 1 lakh in USA and Europe. ^{8,9,12,13,14.}

Squamous cell carcinoma accounts for 80% of all

malignancies. Other neoplasms in this region include lymphoma, melanoma, plasmacytoma and others. The lethality and poor prognosis of carcinoma of the sinuses are directly related to early silence or misleading signs and symptoms of these cancers, which allow extension before discovery. In that respect it may be said that carcinomas of sinus do not show significant evidence of their pressure until they have broken out of sinus of origin. More than 90% of paranasal sinus carcinomas will manifest with invasion through at least one wall of the involved sinus.

SQUAMOUS CELL CARCINOMA IMAGING (Fig 33)

The primary pathological and therefore imaging features of these lesions is propensity to destroy bone even in the presence of a relatively small demonstrable mass. Because of the similarity in the density of squamous cell carcinoma and other carcinomas to adjacent secretions within obstructed sinuses, a small region of bony abnormality and apparent destruction is important. Maxillary sinus carcinomas have a propensity for extension into the orbit, ethmoid sinus, pterygopalatine and infratemporal fossa and rarely cranial cavity. Radiologically it is important to note the extent of invasion, especially orbital/cranial, as the extent of surgery and whether orbit exenteration is required depends on this extent.

CT in axial and coronal planes resolve not only the boundaries of the soft tissue density mass and bone destruction but reveal the extension of the tumor into the adjacent sinuses and surrounding compartments. The use of contrast is useful for differentiating tumor from inflammatory conditions or other masses within the sinuses. After contrast these tumors tend to enhance very little. IV contrast enhancement is however useful, particularly in suspected intracranial and orbital invasion. Rescans are useful for assessing the results of chemo and radiotherapy. MRI is however more useful in this respect.

Malignant melanoma:

Between 0.5 to 1.5% of malignant melanomas arise from nasal cavity and Paranasal sinuses. At these sites the highest incidence is in fifth decade. Presentation of patients who are younger than 30 years is unusual. There is no significant sex predilection. These tumors arise from melanocytes, which are usually present in the mucosa and submucosa. The maxillary antrum is the common extra nasal site.

Signs and symptoms of sinonasal melanomas are non-diagnostic. Epistaxis is frequent (over 80% patients), pain and swelling are less frequent complaints. The typical malignant melanoma of Paranasal sinuses

appear as freshly polypoid mass, solitary or multicentric" These tumors may be heavily pigmented (appearing black or achromatic appearing pink tan). Over 2/3 of the melanomas will manifest readily identifiable melanin. The remainder is amelanotic. When melanin is sparse errors in diagnosis is possible. These include anaplastic carcinoma, angiosarcoma, lymphoma, rhabdomyosarcoma and metastases.

CT:

CT appearance of malignant melanoma is variable, and nonspecific. The tumor has no characteristic density or pattern of enhancement. These tumors consist of a soft tissue mass or mucosal infiltration within it (20-40 HU). Often associated with bone expansion and less frequently with aggressive bone destruction.

Ameloblastoma:

It is less than 0.1 % of sinus tumor. 20% of these occur in the maxilla and the remaining major part of mandible. They are found in the molar area, adjacent to the antrum and at other sites. The tumor commonly extends into the pterygomaxillary fossa, ethmoidal sinuses and orbit.

IMAGING:

Radiographically:

The ameloblastoma may be a unilocular or multilocular radiolucent lesion. The unilocular variety reveals a round to oval configuration with distinct borders and occasional slight marginal sclerosis, but no new periosteal bone formation. Bony expansion of various degrees, sometimes with a scalloped margin is also observed. Loss of lamina dura, erosion of the tooth apex, and displacement of the teeth are also encountered. The CT findings of ameloblastoma consists of low attenuation cystic areas inter mixed with isodense areas, reflecting the solid components of this lesion. The size of the low attenuation cysts varies from small to large.

Extramedullary plasmacytoma:

This tumor usually appears in elderly adults as a single polypoid mass. Occasionally plasmacytoma involves bone as an isolated radiolucent lesion. Histology reveals sheets of plasma cells of variable maturity in a capillary network. Amelanotic melanoma, lymphoma, lymphosarcoma and anaplastic carcinoma must be differentiated. The clinical course of primary extramedullary plasmacytoma is highly variable and not predictable. The most favourable group is aggressive with repeated local recurrence and develop into multiple myeloma or plasma cell leukemia. In addition to local recurrence bone invasion is a poor prognostic sign. Plasmacytoma is highly radiosensitive.

Imaging:

On CT, plasmacytoma of sinonasal tract appears as a fairly well defined mass which often has expansile characteristics and is associated with bone remodeling as well as erosion with moderate to marked enhancement after IV contrast administration.

On CT, they appear as moderate to markedly enhancing masses, which may show calcification and may enlarge and associated with bone erosion. It is extremely difficult to distinguish a benign from a malignant hemangioma.

Sarcomas:

Osteogenic sarcoma and chondrosarcomas of facial skeleton are encountered more commonly in the mandible than in the maxilla. Osteogenic sarcomas account for 2% of all primary malignant neoplasms.

Imaging:

On CT, sarcomas have similar values of muscle and shows densely calcified mass often showing a whorled pattern (with central hypodensity) and capped by soft tissue mass that is not calcified.

Lymphoma:

The actual involvement of the nose and Para nasal sinuses are rare. Lymphomas arising in the nose and Para nasal sinuses are of the Non-Hodgkins type and frequently observed in patients who have disseminated lymphoma common among African people. Epstein barr virus is supposed to cause it. It is commonly seen in children between 4-8 years of age. Maxilla is the commonest site.

Imaging:

On CT, lymphoma of the nose and Para nasal sinuses may mimic the much more common entities of sinusitis, polyposis, and benign and malignant neoplasms. They are often seen as bulky masses and there may be changes to indicate expansion, erosion or infiltration.

Metastatic lesions:

Metastasis of primary tumor to sinonasal cavities is rare. Most common primary tumor is renal cell carcinoma followed by tumors of the lung, breast, prostate, testes and gastrointestinal tract. The metastatic tumors to the Paranasal sinuses have a tendency to enter their expansion about the margins of the sinus rather than a mucosal thickening. The majority of metastases to the Para nasal sinuses are to the bone and are mainly hematogenic, and clinical features are almost similar to that of a primary malignant tumor of the affected sinus or nose.

Imaging:

On CT scans, metastases from renal cell carcinoma and melanomas appear as markedly enhancing, soft tissue

masses that may remodel or destroy the walls of the sinonasal cavities. Prostatic lesions, like elsewhere, often result in sclerotic bone with abnormal irregular margins associated with small or large soft tissue components. Metastases from the lung, breast, bladder, distal GU tract and gastrointestinal tract are usually aggressive and bone destroying.

Harrisons classification of sinus malignancies: Category Description

- T₁ - Limited to antral mucosa without evidence of erosion of bone.
- T₂ - Bony erosion but without involvement of facial skin, orbit, ethmoid or pterygopalatine fossa.
- T₃ - Involvement of orbit, ethmoids or facial skin.
- T₄ - Extension to nasopharynx, sphenoid sinus, cribriform plate or pterygopalatine fossa.

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American joint committee classification (1983):

This is the most widely accepted classification. This is based on TNM classification. The T portion of TNM describes the tumor in terms of position in relation to extent of invasion. The N designation is for other lymph nodal description for tumor of upper aero digestive tract. M stands for distant metastasis.

Diagnosis of tumors of Para nasal sinuses: Clinical features

Although most of the tumors of the sinonasal tract are

symptomatic. Most of these symptoms are non-specific such as swelling and pressure effects of the concerned area and other associated features like nasal obstruction, headache, visual disturbance or proptosis, epistaxis and nasal discharge etc., and some of these lesions may be incidental findings on plain radiographs or CT scan done for other reasons. Hence while evaluating any mass lesion of the sinonasal tract, the imaging physician should keep in mind the various entities that are possible like age, clinical presentation, duration, while focusing attention on the imaging features itself. By careful assessment and elimination, he will then be in a position to aid the concerned clinician regarding the diagnosis and further management.

OBJECTIVES OF THE STUDY

1. To accurately diagnose the disease of PNS.
2. To correlate the clinical diagnosis with CT diagnosis.
3. To know the detailed anatomy, anatomic variations and pathology of PNS which help the otolaryngologist during surgery, thereby reducing the risk of FESS complications. (Screening sinus CT).
4. To know the exact location and extent of the disease of PNS that is very important in deciding the management.
5. To diagnose accurately and in staging of any neoplasm of PNS, its site and extension of tumour spread into the surrounding structures.

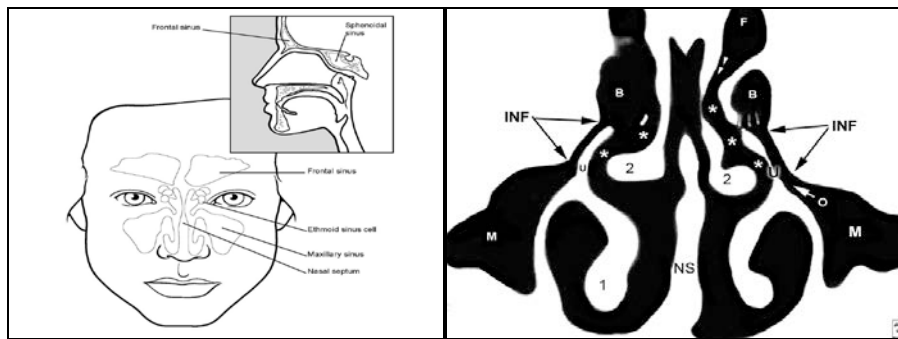


Figure 2: Anterior and Lateral view of Paranasal sinuses

Figure 3: Osteomeatal Unit : 1. Inferior turbinate, 2. Middle turbinate, INF-Infundibulum, M-Maxillary Sinus, F-Frontal sinus, U-Unscinate process, B-Bulla ethmoidalis, O-Maxillary sinus ostium, * - Frontal recess

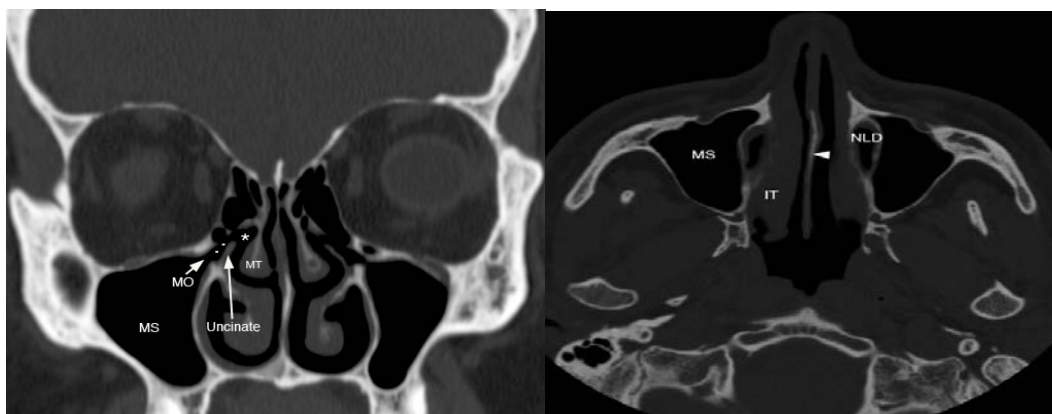


Figure 4 : Coronal and Axial CT images showing maxillary sinus. (Dotted lines indicate maxillary sinus ostium)

METHODOLOGY

This study was a prospective study of 104 patients with disease of PNS. The study was done as per the mentioned Aims and Objectives.

Source of Data:

The main source of data for this study was 104 patients referred from Department of Otorhinolaryngology, Department of Head and Neck Surgery, Adichunchanagiri Institute of Medical Science, B.G. Nagara, Mandya District with clinically suspected paranasal sinus diseases. This consisted prospective correlational descriptive clinical study of 104 patients with pathological lesions of paranasal sinuses between December 2008 to May 2010.

Inclusion Criteria:

1. Patients presenting with history of headache, nasal obstruction, nasal discharge, anosmia, postnasal discharge, epistaxis.
2. Clinically diagnosed / suspected sinusitis, benign / malignant neoplasms.
3. Patients undergoing functional endoscopic sinus surgery (FESS).

Exclusion Criteria:

1. All other lesions mimicking paranasal sinuses diseases.
2. Patients with maxillofacial / head trauma.
3. Pregnant women.
4. Children less than 5 years of age.
5. Psychiatric patients.
6. Non cooperative patients.

INVESTIGATION DONE IN THE STUDY

Both axial and coronal CT scan study (Done with GE, spiral CT machine) was done for 104 patients referred from Department of Otorhinolaryngology and Department of Head and Neck Surgery, Adichunchanagiri Institute of Medical Sciences, B.G. Nagara., with clinically suspected PNS diseases.

TECHNIQUE

- Patient position
 - Supine for axial sections
 - Supine with neck extended for coronal sections
- 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.

- 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- 2000 HU
 - Window level – 350HU
 - Soft tissue window :
 - Window width – 90 HU
 - Window level – 40HU
 - Contrast agent: Omnipaque 350 was used if indicated, at a calculated dose of 300 mg/kg weight as a single intravenous bolus injection after serum creatinine level was estimated.
 - Informed consent obtained from the patient if i.v contrast was administered (Annexure C)
 - CT findings were entered in the proforma (Annexure A)
 - Lund Mackay scoring was done in case of inflammatory lesions (Annexure B)
 - After the CT PNS patients consent was taken for endoscopic sinus surgery (Annexure C)
- Diagnostic nasal endoscopy was carried out in most of the cases 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. Statistical analysis was done using statistical software, Microsoft Word and Excel have been used to generate graphs, tables etc. 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 correlated with CT diagnosis using Chi-square test.

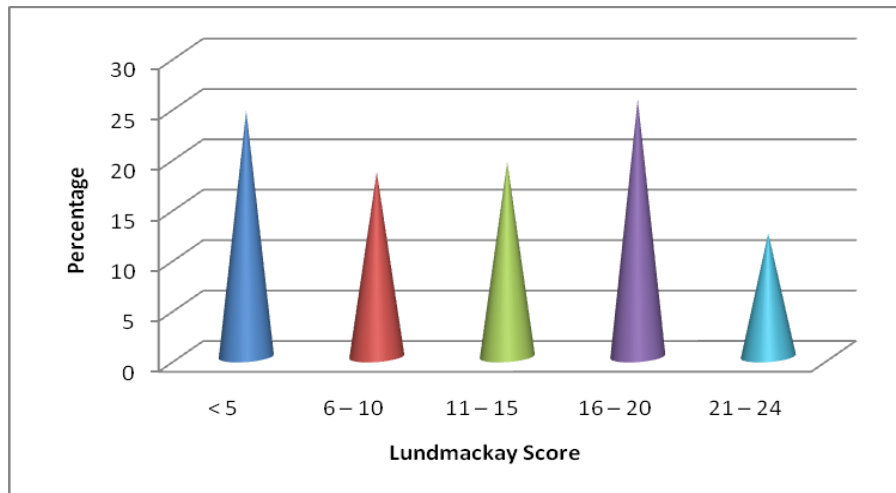
RESULTS

A prospective correlational descriptive clinical study of 104 patients who underwent CT PNS was done and correlated with the final diagnosis after FESS and HPR.

Table 1: Lundmackay Score

Lundmackay Score	Number	Percentage
< 5	24	24.4
6 – 10	18	18.3
11 – 15	19	19.3
16 – 20	25	25.5
21 – 24	12	12.2
Total	98	100.0

Of 104 patients, Lund Mackey scores was assessed in 98 patients. Maximum number (25.5%) of patients had Lund Mackey scores between 16-20 and minimum number (12.2%) of patients had scores between 21-24.

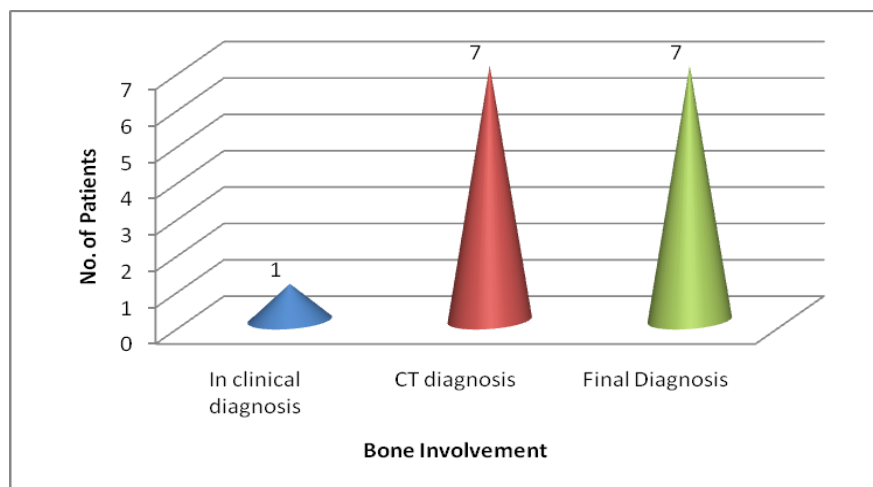


Graph 1: Lundmackay Score

Table 2: Bone Involvement

Bone Involvement	Number (n=104)	Percent	Sensitivity	Specificity
In clinical diagnosis	1	0.96	14.3	100
CT diagnosis	7	7.00	100	100
Final Diagnosis	7	7.00	-	-

Out of the 7 patients found to have bone involvement in the form of erosion or destruction on endoscopy / FESS, CT detected in all the 7 patients but on clinical examination found only in 1 patient. CT had higher sensitivity and specificity whereas clinically sensitivity was very low.



Graph 2: Bone Involvement (n=7)

DISCUSSION

In the recent past, it is accepted that CT is the best imaging method of demonstrating simple inflammatory disease to neoplasms in the paranasal sinuses. Previous studies have shown poor correlation of plain X-ray with CT. Plain films are unreliable and no longer routinely indicated for the evaluation of paranasal sinus disease.

Clinical assessment be used to evaluate acute sinus infection and CT used for the investigation of persistent and chronic sinus disease refractory to medical therapy. CT evaluates the osteomeatal complex anatomy, which is not possible with plain radiographs. Removal of disease in osteomeatal complex region is the basic principle of FESS, which is best appreciated on CT scan.

Table 3: Symptoms:

Symptoms	Asruddin ¹⁵	Present study
Headache	40%	53.8%
Nasal discharge	70%	50.0%
Nasal obstruction	68%	42.3%

Symptoms with which patients presented were recorded during clinical examination. The most common symptom was headache in 58 patients consisting of 53.8%, followed in descending order by nasal discharge (50.0%) and nasal obstruction (42.3%). The least common symptom was epistaxis and swelling in facial region seen in 3 patients each (2.9%). The other symptoms with which they presented were facial pain, sneezing and dyspnoea. Patients presenting with history of maxillofacial / head trauma was excluded in the study.

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 7 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 14.3% sensitivity and 100% specificity. This is where the CT has definite advantage over the MRI. When malignant mass causing bone destruction, CT and MRI can be used as complimentary to each other without the bias to one modality.

CT and Endoscopy/FESS correlation:

Endoscopic findings were almost all correlated with CT findings except in fungal sinusitis. The findings of CT were

similar to endoscopy/FESS findings in 99(95.2%) of patients and different in 5(4.8%) 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:

When the comparison table is viewed there is a best correlation between the CT diagnosis and final diagnosis but poor correlation between the clinical diagnosis and final diagnosis.

On correlating clinical diagnosis with final diagnosis, In diagnosing malignant lesions of PNS was also difficult which had sensitivity of only 50%. For diagnosing malignant lesions CT has 100% sensitivity, specificity, positive predictive value and negative predictive value with 100% accuracy. P value in all instances was < 0.05 i.e. <0.01, indicating the significance of the findings. This high sensitivity and specificity for benign and malignant masses could be due to small number of masses evaluated.

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

INVERTED PAPILLOMA



Figure 32 : Isodense soft tissue mass occupying the right maxillary, right nasal cavity, right ethmoid sinus, right frontal sinus and right sphenoid sinus is seen. The lesion is enlarging the osteomeatal complex and is involving the right nasopharynx → CT features favour INVERTED PAPILLOMA.

NASOPHARYNGEAL CARCINOMA

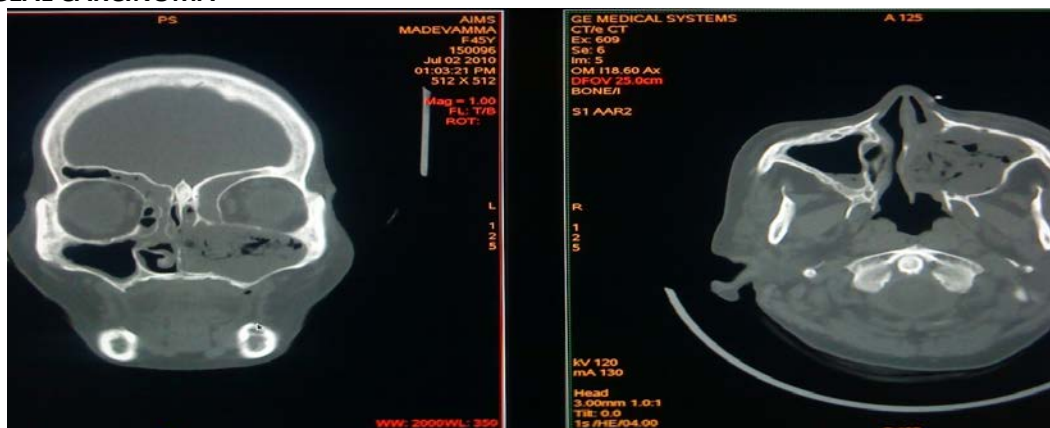


Figure 33 : Heterogenous mass lesion in the left maxillary sinus with erosion of superior, medial and inferior walls of maxillary sinus and extending into the left orbit and nasal cavity is seen → CT features favour MALIGNANT NASOPHARYNGEAL MASS (MAXILLARY SINUS CARCINOMA)

CONCLUSION

1. CT is the modality of choice to assess the clinically relevant anatomic variations of sinonasal region.
2. CT is the modality of choice in imaging the paranasal sinuses for evaluating the chronic diseases and associated complications.
3. Fungal sinusitis and dense secretions are potential pitfall on CT to differentiate them. But CT may suggest fungal sinusitis in whom it is not suspected.
4. CT is the modality of choice in evaluating the bone erosion or destruction.
5. CT evaluation of PNS in symptomatic patients helps in planning the further management of the patient.
6. CT helps in staging the PNS disease and its extension and involvement of surrounding structures.

However, CT has certain potential drawbacks and disadvantages like complex projections, artifacts induced by very high density structures in and around PNS, by the patient movement, limited soft tissue resolution. Even radiation exposure in CT examination limits frequent usage, test repeatability and its use in children and pregnant women.

For these reasons, MRI is taking an increasingly important role in many of these areas. The soft tissue contrast discrimination is greater than with CT images, with an equivalent spatial resolution. Further advantages of MRI include the ability to image in any plane without loss of spatial resolution, the ability to demonstrate vessels without the need for contrast medium, no ionizing radiation, and the relative freedom from artifacts compared with CT.

Both CT and MRI with their unique features for better depiction bone details and soft tissue details respectively, carry their own importance and play a complimentary role to each other in identifying the pathological conditions of paranasal sinuses.

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