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Role of Computed Tomography in evaluation of sinonasal masses

KEYWORDS

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ABSTRACT Nasal cavity and paranasal sinuses contain masses including inflammatory, infectious, benign and malignant neoplastic masses. Effort was made to solve diagnostic dilemma by focusing on imaging characteristics of various sinonasal masses on CT. 56 patients with sinonasal pathologies were evaluated prospectively over period of 15 months. Detailed imaging characteristics and extents of lesion were noted on CT. Findings were confirmed on histopathological examination. Nasal obstruction was most common symptom (84%). Inflammatory masses were most common masses(62.5%); least common were malignant neoplastic(5.3%). Bone invasion was present in 23.2% cases.Most common mass was inflammatory polyp (57%). Most common sinus involved was maxillary sinus.

Early diagnosis with detailed imaging charactristics and extensions of sinonasal masses is made on CT. CT helps to distinguish between inflammatory-infectious, benign and malignant neoplastic masses and also in deciding management and prognosis of sinonasal masses.

Introduction:

Nasal cavity and paranasal sinuses may contain wide variety of masses within which includes inflammatory-infectious, benign and malignant neoplastic masses. These may cause symptoms varying from simple nasal obstruction to metastatic invasion.

Primary nasal malignancies consist of 0.2% - 0.8% of all the malignant tumors and 3.6% of the malignant upper airway tumors [1]. Effort was made to solve the diagnostic dilemma by focusing on specific imaging characteristics of various sinonasal masses on CT.

Materials and methods:

56 patients of all age groups presenting with sinonasal pathologies were evaluated prospectively over a period of 15 months from Jan 2015 to April 2016. Detailed imaging characteristics and extents of the lesion were noted on CT (Siemens dual slice somatom spirit and GE Revolution ACT 16 slice CT). Findings were confirmed on histopathological examination.

Technique:

Patient position:

Supine for axial sections , Prone for coronal sections

Angulation:

Parallel to hard palate for axial sections , Perpendicular to hard palate for coronal sections

Thickness:

2.5 mm for both coronal & axial sections. Thin reconstruction of 1.25 mm for both axial and coronal sections-

Extent:

Coronal –anterior margin of frontal sinus to posterior margin of sphenoid sinus Axial – hard palate to upper margin of frontal sinus [Boundaries of the scan may be increased in relevant cases.]

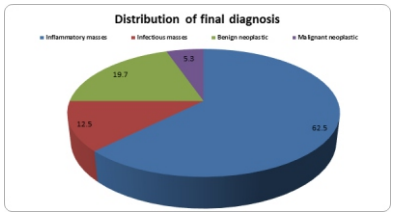
Exposure: 120 kVp , 130 mAs, 12-15 seconds scan time.

Contrast agent: Contrapaque 300 was used, at a calculated dose of 300 mg/kg weight as a single intravenous bolus injection after serum creatinine level was estimated.

Results:

- Out of 56, 35 were male (67.5%) and 21 were female(22.5%). Headache (92.8 %) was most common symptom followed by nasal obstruction(89.2 %). Other symptoms were nasal discharge (53.5 %), eepistaxis(17.8 %) and swelling (3.3 %)
- Maxillary sinus(68.8 %) was most commonly involved sinus followed by anterior ethmoid (50 %), posterior ethmoid (46.4 %) , frontal (35.7 %) and sphenoid sinus (17.8 %).
- Bone invasion was present in 23.2% cases.

Inflammatory masses were most common masses(62.5%); least common were malignant neoplastic(5.3%) as shown in graph 1.



Graph 1 Distribution of final diagnosis

- In 8 cases(14.2%), HPR diagnosis was different from CT diagnosis

Table 1: CT findings:

• Category / CT characteristics	• Attenuation	• Enhancement	• Bony changes
• Inflammatory	• Low	• Minimal / nil	• Nil
• Infective	• Heterogeneous	• Moderate	• Remodeling
• Benign neoplastic	• Low	• Mild *	• Scalloping/ bowing
• Malignant neoplastic	• Heterogeneous	• Moderate	• Erosions

- *except juvenile nasopharyngeal angiofibroma which showed

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intense enhancement.

Image gallery:

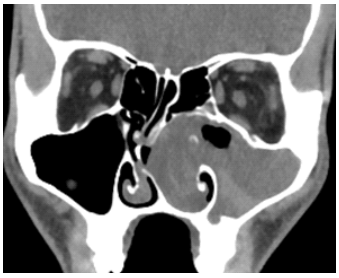

Figure 1 CECT coronal reformatted image showing well define mass lesion in left maxillary sinus extending into left nasal cavity. CT & HPE diagnosis – inflammatory polyp.

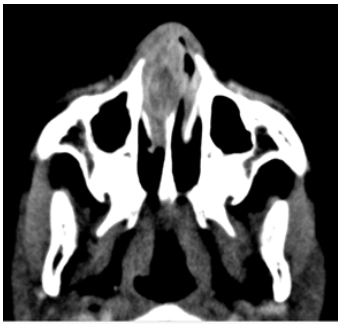

Figure 2-Axial CT showing well defined polyploidal lesion in right nasal cavity.CT diagnosis- polyp. HPE diagnosis- foreign body with surrounding

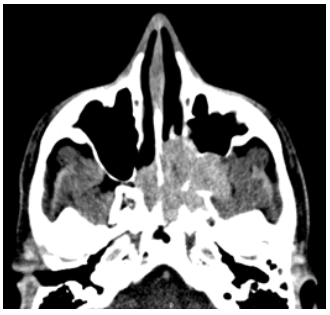

Figure 3 CECT image shows intensely enhancing lesion involving left pterygomaxillary fissure and extending into posterior part of left nasal cavity and left maxillary sinus. CT & HPE diagnosis - angiofibroma

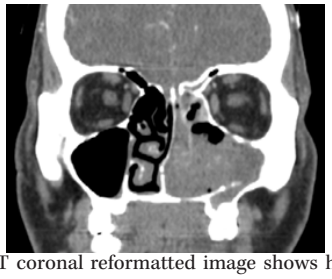

Figure 4 CECT coronal reformatted image shows heterogenously enhancing soft tissue lesion in left nasal cavity and maxillary sinus with adjecent bony erosions.

CT diagnosis- neoplastic etiology, HPE diagnosis – transistional cell carcinoma

Discussion:

Etiological factors of the nasal cavity tumors include prolonged irritant dust inhalation, smoking, nickel, chrome, radium, isopropyl alcohol, toxic gases such as the mustard gas. Nasal cavity malignant lesions are rare, but the similar clinical features of the benign and malignant lesions in the beginning may delay the diagnosis [2].

Inflammatory diseases are important as differential diagnosis of sinonasal masses as destruction and erosions of the organ mimic the malignant lesions and may be misdiagnosed [2, 3]. Cases with recurrent, prolonged, unilateral blockage despite the medical therapy and diplopia, proptosis, cranial nevre paralysis must receive paranasal cross-sectional scans [4].

Cross-sectional imaging of the nasal cavity and adjunctive anatomical boundaries must be performed to describe the localization, configuration or the possible invasion of the lesion. In the nasal cavity lesions; the paranasal sinuses, orbits, intracranial fossa, pterygomaxillary and pterygopalatine fossae and the infratemporal cavity must be evaluated in detail.

Nasal cavity/paranasal sinus derived tumors are approximately 70% benign and 30% malignant [1]. Benign lesions like nasal polyps have both the chronic inflammation and resorption of the sinunasal structures, so the loss of the marginal sharpness is frequent. Internal linear septal contrast enhancement is pathognomic in the postcontrast cross-sectional scans [2]. Retention cysts and mucoceles may have different characteristics of signals in the CT or MRI up to their content and are not typical [2]. Among these lesions, the most frequent malignant lesion is the squamous cell carcinoma and the most benign lesion is the osteoma. Imaging characteristics, in in various masses of nasal cavity are as described below:

Osteoma and similar sclerotic dense lesions in the X-ray; first a radiography then the CT provides detailed information about the contour, localization and the nature of the lesion [5].

Inverted papilloma arises from the lateral nasal wall and is frequently unilateral. 2% - 15%. Cases undergo malignant transformation. Osseous changes, remodelling more than destruction are visualised on CT. In cases of larger antrochoanal masses, it is difficult on imaging to comment on site of origin of the lesion. Choanal polyps are seen as the lesions originated from the sphenoid or maxillary ostiums and spread in the nasal cavity, causing narrowing the nasal passage.

Retention cysts and **mucoceles** may have different characteris- tics of signals in the CT or MRI up to their content and are not typical [2].
Pleomorphic adenoma is a rare benign mixed tumor of the salivary glands and arises mainly in the major salivary glands, pleomorphic adenoma arising with- in the nasal cavity has rarely been reported in the literature. The punctate calcification in the CT is specific for the lesion.

Angiofibroma originates from the sphenopalatine foramen and involving both the pterygopalatine fossa and the posterior nasal cavity [6]. CT shows diffuse-homogeneous and intense contrast enhancement without any necrotic or cystic degeneration and is pathognomical [6].

Hemangioma is highly vascularized benign lesion and involvement of the nasal cavity is exceedingly rare. [7].

Majority of malignant nasal cavity tumors are **squamous cell carcinoma**(80%) and often originates from the maxillary sinus (25% - 58%). 10% of the malignant tumors are adenocarcinoma and adenoid cystic carcinoma. Other malignant tumors are extremely rare like transistional cell carcinoma. They invade or infiltrate other structures [1].

Local osteolytic, perineural or perivascural invasion or metastatic invasions to the lungs identified cross-sectionally addresses the malignant potential of the tumor. Such lesions must be evaluated with thin section multi-planar images which obtained by

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reconstruction in bony-tissue algorithm. Such images permit to detailed evaluation of the medial orbital roof, cribriform plates, fovea ethmoidalis, planum sphenoidale and posterior frontal sinus wall. [8].

Lymphomas are in the malignant group that constitute less than 1% of the nasal cavity tumors. They are often seen in the maxillary or ethmoid sinuses [9, 10]. They are often non-Hodgkin lymphomas, mostly B cell lymphomas.

Primary nasal cavity originated **malignant melanomas** are neural crest tumors which constitutes less than 1% of all malignant melanomas. They arise mostly from the nasal septum and turbinates. Melanoma must be suspected if a mass is identified from the septum or a pathological focal activity is observed in the nasal cavity during whole body PET/CT scans. Diagnosis can be made with MRI, by defining the hyperintensity of the melanin pigment cantaining tumoral tissue [11].

Olfactory neuroblastoma (also called **Esthesioneuroblastoma**) is a rare cancer which develops in nerve tissue associated with the sense of smell. When diagnosed in its early stages, esthesioneuroblastoma can often be treated successfully with surgery, radiation or chemotherapy [12]. The lesion is often centered near the cribriform plate on CT and MR sections. CT is useful for defining bone destruction, whereas MR imaging best delineates soft-tissue extension. [12,13].

Metastatic lesions present with soft tissue causing bony destructions.. Generally a lesion of this kind might be renal cell carcinoma, lung or breast carcinoma metastasis and it is difficult to differ from the midline aggressive tumors. However, if suspected, the PET/CT scans may identify the primary focus and differentiate the lesion [1].

Today in the sinonasal pathologies, after the clinical examination, contrast enhanced CT or MRI or PET/CT is the preferred technique for evaluation of sinonasal masses including metastasis. Bony changes are well seen on CT and soft tissue is better visualised by the MRI.

Additionally, PET/CT adds functional status of a lesion semiquantitatively allowing to measure the tumor glucose consumption. Especially invasion of the orbital roof, cribriform plate, fovea ethmoidalis, posterior maxillary sinüs wall, pterygopalatine fossa, erosion of the sphenoid sinus wall represent the locally aggressive nature and extranasal invasion of the tumor.

On the other hand, usually the ostia of the sinuses are blocked in the sinunasal tumors, so superimposing sinusitis, inflammatory soft tissue deposits and the retention cysts may not provide evident differentiation in the density in CT, they may only be detected by the contrast enhanced multiplanar MRI.

Radiological findings:

- **Bone changes –**
- Destruction – aggressive process
- Bowing – slow process
- Foramen enlargement – growth along the nerve
- Sclerotic wall – chronic process
- Enlargement – Bony dysplasia
- **Opacification / decreased aeration -**
- Low uniform density – retained secretions
- Non uniform – tumour vs inflammed mucosa
- **Masses –**
- Soft tissue , foreign body ,califications.

In summary, early diagnosis with detailed imaging charactristics and extensions of sinonasal masses is made on CT. CT helps to distinguish between inflammatory-infectious, benign and malignant neoplastic masses and also in deciding management and prognosis of sinonasal masses.

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