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Retrospective Study of Ct Evaluation of Paranasal Sinuses Pathologies in Bhaskar Medical College and Hospital

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Abstract
Introduction: *The head and neck radiology, similar to that of other subspecialties in radiology, began with the discovery of the X-ray in 1895 by Wilhelm Konrad Roentgen (1845-1923). Another early investigator was Caldwell (1870-1918), who became fascinated by X-rays only 2 years after Roentgen's discovery. In 1903, he wrote one of the first textbooks on diagnostic and therapeutic radiology.*
Materials and Methods: *Total of 50 patients of whom 17 were males and 33 females were studied. Age group varied from 10 to 60 years. Patients were sent from out patient's clinic of ENT Department to the department of Radiology, Bhaskar Medical College and hospital. Patients were selected on the basis of their symptoms and clinical findings suggestive of a lesion involving the paranasal sinuses. All the examinations were performed on a GE 16 Slice computed tomographic scanner.*
Results: *Our study included 50 patients in the age group of 10 to 60 years with the mean age of 30 years with a female: male ratio of 1.9 : 1 with greater number of patients in the age group of 20-40 years. Most of the patients had headache 56%, followed in decreasing order by nasal discharge 52%, nasal obstruction 34% and epistaxis 8%. Most commonly diseased sinus was maxillary sinus 86%. Deviated nasal septum was noted in 24 patients which was more common towards right side. Concha bullosa was noted in 14 patients, which was unilateral in 11 patients and bilateral in 3 patients. 56% of cases had sinusitis, polyp was found in 32%, fungal sinusitis 18%, inverted papilloma 2%. During FESS, 4 patients were found to have bone involvement in the form of erosion or destruction, all 4 patients were detected to have bone involvement on CT.*
Conclusion: *CT scan evaluates both soft tissue and bony details of nose and paranasal sinuses. Due to complex anatomy, radiographic evaluation of paranasal sinuses has major limitations and hence cost-effective CT is most common and widely used investigation to study the various PNS diseases. A wide spectrum of disease affecting the sinonasal cavities can be detected by CT with high accuracy in diagnosis of inflammatory conditions and their complications. It is also a very sensitive modality for detection, accurate localization and determination of exact extent of paranasal sinus neoplasms; hence is essential for preoperative evaluation. Various important anatomical variants can also be easily detected on CT of paranasal sinuses.*
Key Words: *Head, Neck, paranasal sinuses, sinonasal cavities*

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I. Introduction

The head and neck radiology, similar to that of other subspecialties in radiology, began with the discovery of the X-ray in 1895 by Wilhelm Konrad Roentgen (1845-1923). Another early investigator was Caldwell (1870-1918), who became fascinated by X-rays only 2 years after Roentgen's discovery. In 1903, he wrote one of the first textbooks on diagnostic and therapeutic radiology. His interest in head and neck radiology is reflected by a view of the paranasal sinuses that still bears his name, "the Caldwell view," which is a depiction of the ethmoid and frontal sinuses that include both orbits. In 1914, Waters and Waldron, two British radiologists, introduced a projection that defined the paranasal sinuses and facial bones to greater advantage. At the present time, the waters view is still being used to survey sinus disease and facial fractures.[1]

An important historic achievement occurred in 1972 with the introduction of computed tomography (CT) by Godfrey Hounsfield of Great Britain. The foundation for CT was based on mathematic equations that

had been formulated in 1963 and 1964 by Cormack, a Professor of Physics at Tufts University in Boston.[2] The development of spiral CT in the past few years has allowed a shorter examination time and thinner sections, with the capability of three-dimensional reconstruction. Multi-detector row CT with a section thickness as small as 0.5 mm and acquisition capabilities of 16 images per second has very good spatial resolution.[3]

Diseases of paranasal sinuses are a major health problem. Most of the times physical examination is nonspecific and radiological evaluation has been relied on as an aid in confirming the diagnosis.[4] Traditionally, plain radiographs were the modality of choice in the evaluation of paranasal sinuses. In recent years, because of technologic advancements in imaging, CT has supplanted conventional radiography as the primary diagnostic modality and has also contributed in the change in therapeutic approach. Standard plain radiographs still have a limited role in the imaging of the paranasal sinuses and are used as the initial technique before the application of CT. The refinement of CT technology has resolved the traditionally difficult problem of identifying lesions of the paranasal sinuses. It has also allowed improved accuracy in evaluating the soft tissues about the sinuses. The improvement in tissue resolution that CT offers over plain films allows evaluation of subtle changes of soft tissues, bones and air containing spaces. The ability of CT to image the bony details as well as soft tissues is the greatest advantage over previous radiographic modalities. Furthermore, coronal and axial CT scanning has dramatically improved the imaging of the anatomy of the paranasal sinus. CT excellently displays the bony architecture and its mucosal covering as well as the narrow air channels of the osteomeatal complex. CT accurately depicts the boundaries between the paranasal sinuses, the orbits and the intracranial compartment and also the relationship between the optic nerve, cavernous sinus, carotid artery and fifth cranial and vidian nerves to the sphenoid sinuses. Contrast media helps evaluate the vascularity and contrast enhancing characteristics of lesions, giving clues to the histology and extent of abnormality.[5]

The aims and objective of this study is to determine the role and efficacy of CT scan in diseases of paranasal sinuses and study of various physiological variants.

II. Materials And Methods

Total of 50 patients of whom 17 were males and 33 females were studied. Age group varied from 10 to 60 years. Patients were sent from out patient's clinic of ENT Department to the department of Radiology, Bhaskar Medical College and hospital. Patients were selected on the basis of their symptoms and clinical findings suggestive of a lesion involving the paranasal sinuses such as head ache, nasal obstruction, nasal discharge, anosmia, postnasal discharge and epistaxsis. All the examinations were performed on a GE 16 Slice computed tomographic scanner.

Patients were scanned in two sections- axial and coronal. For axial section patient was placed in supine position and scan plane was oriented parallel to hard palate and extended from hard palate up to upper margin of frontal sinus. Coronal sections were performed by placing the patient in prone position and scan plane were oriented perpendicular to hard palate and extended from posterior margin of sphenoid sinus up to anterior margin of frontal sinus.

Thickness of the slices for both axial and coronal sections was 5mm. 3mm slices were also taken at osteomeatal unit on coronal sections. Tube current 440 mAs, Tube voltage is 120 kV, scan time was 2.7 sec. IV contrast agent (Omnipaque 350) used if indicated at a calculated dose of 300mg/kg weight as a single intravenous bolus injection after serum creatinine level was estimated. Contrast enhanced lesion visualized in soft tissue window using raw data process.

Reconstructed images were viewed using a window length of 400 and a wide window of maximum possible. The features evaluated were site, size, characterizations, involvement of adjacent structures, vascular involvement.

III. Results

Our study included 50 patients in the age group of 10 to 60 years with the mean age of 30 years with a female: male ratio of 1.9 : 1 with greater number of patients in the age group of 20-40 years. Most of the patients had headache 56%, followed in decreasing order by nasal discharge 52%, nasal obstruction 34% and epistaxis 8%. Most commonly diseased sinus was maxillary sinus 86%. Deviated nasal septum was noted in 24 patients which was more common towards right side. Concha bullosa was noted in 14 patients, which was unilateral in 11 patients and bilateral in 3 patients. 56% of cases had sinusitis, polyp was found in 32%, fungal sinusitis 18%, inverted papilloma 2%. During FESS, 4 patients were found to have bone involvement in the form of erosion or destruction, all 4 patients were detected to have bone involvement on CT.

Table 1: Age Chart

Age	No of cases	% Cases
5-10	1	2.00
11-20	7	14.00
21-30	19	38.00
31-40	11	22.00
41-50	7	14.00
51-60	3	6.00
>60	2	4.00

Table 2: Sex Distribution

Sex	Number of patient	Percentage
Female	33	66%
Male	17	34%
Total	50	100

Table 3: Chief Complaints Chart

Chief Complaints	No of patients	Percentage
Headache	28	56%
Nasal Discharge	26	52%
Nasal Obstruction	17	34%
Epistaxis	4	8%

Table 4: Sinus Diseased

Sinus	Number	Percentage
Maxillary	43	86%
Ethmoid	40	80%
Frontal	27	54%
Sphenoid	24	48%

Table 5: DNS

DNS	Number	Percentage
No DNS	26	52%
To right	13	26%
To Left	11	22%

Table 6: Concha bullosa

Concha Bullosa	Number	Percentage
No	36	72%
Unilateral	11	22%
Bilateral	3	6%

Table 7: Comparison of CT and final diagnosis

Findings	CT Diagnosis		Final Diagnosis	
	Number	Percentage	Number	Percentage
Sinusitis	28	56%	28	56%
Polyp	16	32%	16	32%
Fungal Sinusitis	9	18%	9	18%
Neoplasm (benign)	1	2%	1	2%

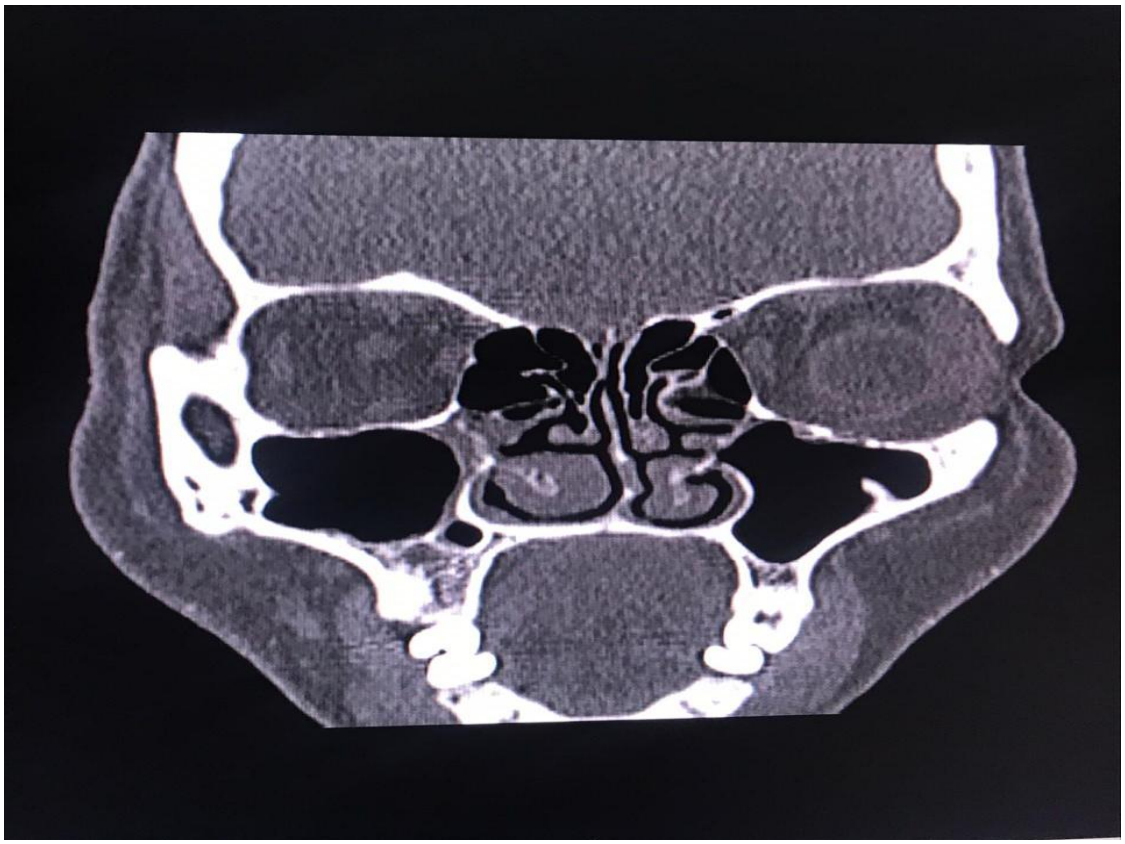

Figure 1

Coronal CT scan shows DNS to the left, hypertrophied right inferior nasal turbinate and obliterated right OMC due to mucosal thickening. Incomplete bony septum is seen arising from lateral wall in the left maxillary sinus.

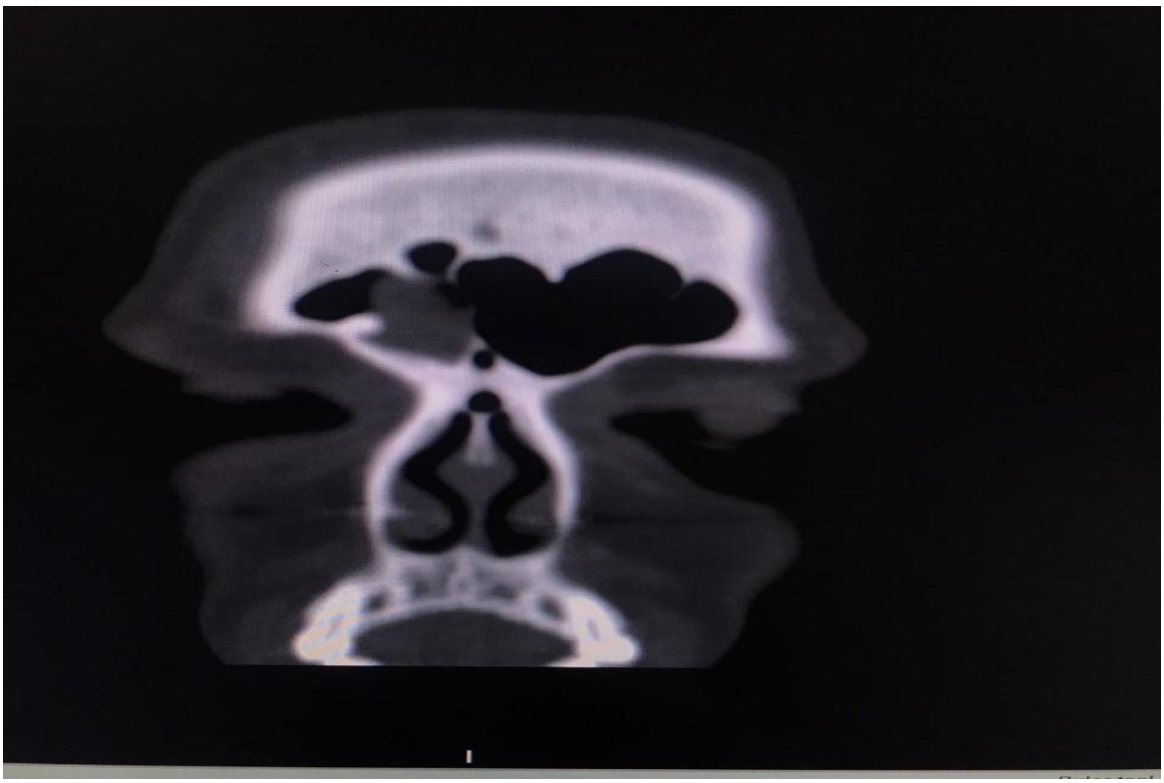

Figure 2: Right frontal sinusitis with osteoma

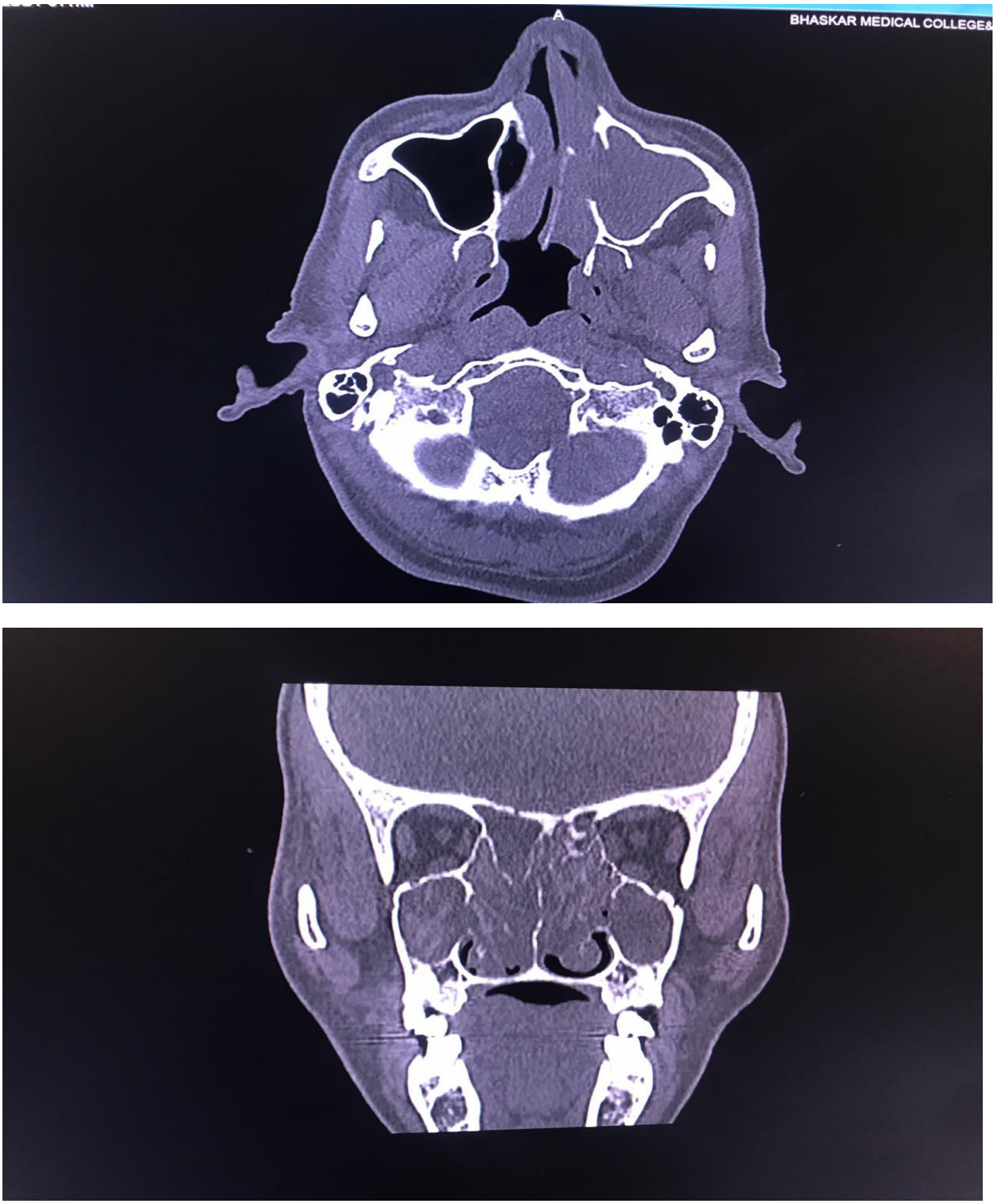

Figure 3: Axial and Coronal sections of CT PNS showing Antro-choanal polyp - soft tissue density lesion in the left maxillary sinus extending through widened OMC into the nasal cavity. Note also DNS to the left.

Figure 4: Bilateral maxillary, ethmoid and sphenoid sinusitis

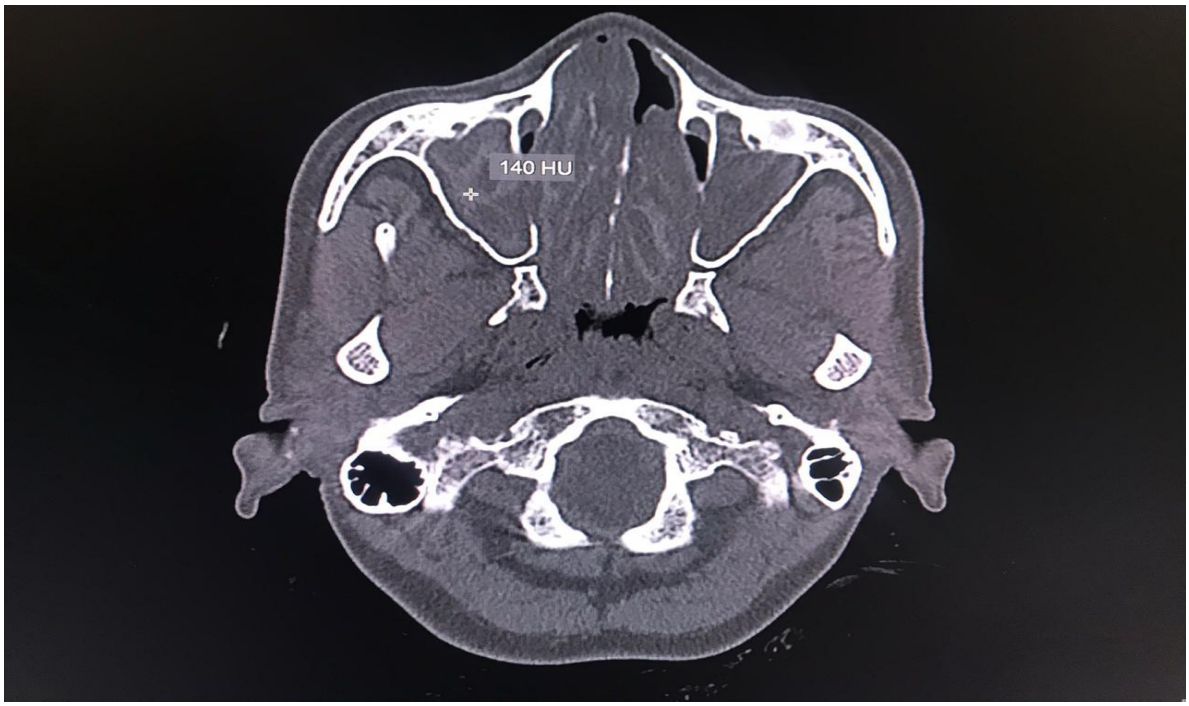

Figure 5: Fungal pansinusitis with antrochoanal polyposis.

Note the pathognomonic hyperdensities within the soft tissue density in the sinuses and nasal cavity and the widened OMC

IV. Discussion

CT has replaced conventional radiographs as imaging modality of choice for assessment of paranasal disease. CT determines exquisite details of anatomy, anatomic variants, distribution and extent of disease.[6]

ANATOMIC VARIANTS:

Nasal Septum: Nasal septum may be focally deviated inferiorly at the chondrovomeral junction or have a more broad based curvature. Septal spurs are frequently encountered in association with septal deviation and if prominent may also make surgical access difficult and narrow the middle meatus or ethmoidal infundibulum. Pneumatised septum is usually due to extension of air from the sphenoid sinus or crista galli and is usually not significant but may narrow the sphenoethmoidal recess (SER).[7]

Concha Bullosa: Pneumatisation of the inferior bulbous portion of the turbinate. If the pneumatisation is above the level of OMU complex, it is called lamella cell.

Paradoxical Middle Turbinate Turn: The middle turbinate may have a lateral convexity. If large it may impair access to OMU.

Maxillary Septum: It is fibrous or bony and often extends from the infraorbital canal to the lateral wall and if not recognized may lead to inadequate drainage of the antrum.

Sphenoid Septum: It is the presence of multiple septa within the sphenoid than the main septa. It is stated that multiple accessory septa are seen more commonly on the right side of main septa.

Inflammatory Polyp: These are pendunculated out growths of edematous mucosa covered by normal epithelium, arising from paranasal sinus. It is mostly related to hypersensitivity states, non-allergic asthma and cystic fibrosis.[8]

Mucoceles: These are most common expansile lesions of paranasal sinuses. It is airless mucoid filled, expanded paranasal sinuses. Causes may be inflammatory, allergic, trauma, osteoma or complication of previous surgery.

Fungal Infection: The most common fungal diseases are mucormycosis, histoplasmosis, Candidiasis and aspergillosis. The causative organisms are invasive and tend to spread rapidly from the nasal cavity to the paranasal sinuses. They have propensity for involving the blood vessels, orbits, cavernous sinuses and ophthalmic veins.

BENIGN NEOPLASMS:

Papilloma: Inverted papilloma is uncommon benign epithelial tumor of the Sino-nasal region, accounting for 0.5% to 4 % of primary nasal tumors. Although benign, it has a high recurrence rate, local aggressiveness, multicentricity and association with synchronous or metachronous Squamous cell carcinoma. They are seen in 40-60 years age with a predeliction for males (M:F ratio of 3.5:1).

These tumors are most commonly seen on lateral wall of the nasal cavity and the medial wall of maxillary sinus as soft tissue density polypoid mass lesion with some enhancement.

A characteristic feature of many inverted papillomas is focal hyperostosis, often cone-shaped, at the origin of the tumour.[9] This is useful not only in suggesting the diagnosis, but also it aids in surgical planning as the location of tumor origin determines the extent of surgery required.

Adenoma: These are capsulated, usually symptomless, but if they arise from the lateral wall of the nose it produces nasal obstruction.

Angiofibroma: This tumour is highly vascular and non-encapsulated polypoid mass that is histologically benign but highly aggressive. The triad of epistaxis, nasal obstruction and presence of a nasopharnygeal mass strongly indicates an angiofibroma. It occurs mostly in pre-pubescent or pubescent males. Intracranial extension is seen in some cases.

MALIGNANT TUMOURS:

Malignant tumours of paranasal sinuses are rare and 50-65% of nasal malignancies arise within maxillary sinus. Squamous cell carcinoma accounts for 80% of all malignancies. Other neoplasms in this region are 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. The carcinomas of sinuses do not show significant evidence of their pressure until they have broken out of sinus of origin. Most of the sinus carcinoma will manifest with invasion through at least one wall of the involved sinus.[10]

V. Conclusion

CT scan evaluates both soft tissue and bony details of nose and paranasal sinuses. Due to complex anatomy, radiographic evaluation of paransal sinuses has major limitations and hence cost-effective CT is most common and widely used investigation to study the various PNS diseases. A wide spectrum of diseases affecting the sinonasal cavities can be detected by CT with high accuracy in the diagnosis of inflammatory conditions and their complications. It is also a very sensitive modality for detection, accurate localization and determination of exact extent of paranasal sinus neoplasms; hence is essential for preoperative evaluation. Various important anatomical variants can also be easily detected on CT of paranasal sinuses.

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