EVALUATION OF -NASAL DISEASE BY MDCT AND TO CORRELATE HISTO-PATHOLOGICAL FINDINGS

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“EVALUATION OF SINO-NASAL DISEASES BY MDCT AND TO CORRELATE HISTO-PATHOLOGICAL FINDINGS”

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LIST OF ABBREVIATIONS

CSF - Cerebrospinal fluid

CT - Computed tomography

DNS - Deviated nasal septum

f - Female

FESS - Functional endoscopic sinus surgery

GU - Genitourinary

HPR - Histopathological report

HU - Hounsfield unit

ICA - Internal carotid artery

l - Left

m - Male

MRI - Magnetic resonance imaging

NPV - Negative predictive value

OMU - Osteomeatal unit

PNS - Paranasal sinus PPV - Positive predictive value

r - Right

Sen - Sensitivity

SER - Sphenoethmoidal recess

SNP - Sinonasal polyposis

Spe - Specificity

LIST OF TABLES

INTRODUCTION:

There is a wide range of disorders that affect the paranasal sinuses, from infections,inflammation to benign or malignant neoplasms. Sinuses are closely related to the orbit,cranial fossa & pterygopalatine fossa anatomically. Early involvement in these areas is therefore essential. Diagnostic radiography is crucial because the surrounding bony structures make clinical assessment difficult.

The anterior ethmoidal air cells, the upper two-thirds of the nasal cavity &the frontal recess can only be seen in limited detail on standard plain radiography, despite the ease with which maxillary and frontal sinus disease can be seen. Plain film is insufficient and inaccurate for diagnosing both benign and malignant diseases. It is now widely accepted that CT imaging is a viable alternative to conventional radiographs since it gives detailed information about the paranasal sinuses.

The goal of the current study is to correlate histological findings with the appropriate diagnosis of PNS illnesses. The goal of this study is to lessen surgical complications by assisting the otolaryngologist in choosing the management and surgical strategy during FESS.

AIMS AND OBJECTIVES OF THE STUDY

1. To have a thorough understanding of the PNS's architecture, anatomical variations, and pathology to assist the otolaryngologist during surgery and lower the likelihood of FESS problems.

2. To correlate CT diagnosis with histo-pathological findings.

3. To have a clear understanding of the disease's specific location and scope, which is crucial for management decisions.

4. To appropriately diagnose and stage any PNS tumour, including its site and any expansions that have migrated to neighbouring structures.

REVIEW OF LITERATURE

Hippocrates said that pus or fluid pouring from the nose cures the condition in a person with a sore place on their head and severe headaches in the fifth century B.C. This may be interpreted as sinusitis. The antrum and frontal sinus were accurately described and depicted by Leonardo Da Vinci (1452- 1519).

An accident led to the discovery of X-Rays by Wilhelm Roentgen in 1895. The diagnosis of presence of pus in the sinus was done by Scheir (1897) by radiography and confirmed the same by lavage. The radiographic basis for the diagnosis of chronic maxillary sinusitis was presented by Killan and Mosher in 1929. They came to the conclusion that an opaque antrum on an X-ray was the result of a buildup of fluid, either free or fixed in the thicker mucosa.

According to Samuel (1963), an opaque maxillary sinus should be viewed as an indication rather than a conclusive diagnosis because an opacity in the area of the maxillary sinus could be of anatomical, technical, or clinical nature. He further described the occipito-mental projection as the best suited one for the evaluation of the state of maxillary sinus. Hounsfield and Ambrose devised computerized tomography in 1960's. In comparison to sinus radiographs, coronal plane computed tomographic (CT) scanning has significantly enhanced the imaging of paranasal sinus anatomy. It is becoming more common to find mucosal anomalies and modest bone structural differences in this area.

In their investigation of 202 patients' coronal CT scans, W. E. Bolger et al. [4] (1997) paid particular emphasis to bony anatomic variations and mucosal abnormalities.According to Valerie J. Lund et al. [5] (2000), computed tomography (CT) is the industry standard for determining the severity of disease. Neither plain X-rays nor Magnetic Resonance Imaging (MRI) offer optimal information in this respect.

Bhattacharyya T, Piccirillo J, Wippold F [6] (1997) concluded that CT should be reserved for delineating the anatomy and pattern of inflammatory paranasal disease prior to surgical intervention.

Fatterpekar GM, Delman BN, SomPM [7] (2008)concluded that the localization of disease can be accurately accomplished and in almost all cases, distinction can be made between inflammatory and malignant disease. In those cases that still require biopsy, the imaging studies provide the clinician with easy visualization of the best biopsy route.

FilizNamdarPekiner [8] (2013) concluded that a detailed knowledge about anatomic variations preoperatively and evaluation of pathological findings within this cavity with gold standard CT may prove beneficial during FESS.

Turnaet al[9] (2014) concluded that it is important for the radiologist to know the anatomical variations of the paranasal sinus region in order to consider their possible pathological

consequences. Guiding the surgeon in the preoperative period is essential to avoid potential complications.

According to Kandukuri R. and Phatak S. [10] (2016), CT is the preferred imaging modality for imaging the sino-nasal area to assess a variety of congenital, inflammatory, benign, and malignant diseases as well as associated problems and to plan the patient's future care. The best method for assessing bone erosion or disintegration is computed tomography (CT).

As CT images clearly shows air spaces,opacified sinuses& fine architecturalstructureof bony anatomy.Today, CT is the test of choice for radiologically diagnosing nose and sinus pathologies. The examination of sino-nasal channel patency using multidetector computed tomography (MDCT) reveals the impact of anatomical variations, inflammatory diseases, or both, on patency. The primaryinvestigation of choice for the surgeon to perform FESS surgery is MDCT since it has the ability to visualise anatomical elements that are not visible during a clinical examination or diagnostic nasal endoscopy.

The CT scan is crucial for ruling out aggressive infections or tumours that exhibit extrasinusextension,osseous damage&local invasion. MRIs are used as adjunct to assess intracranial extension, additional sinus extension from cancer, and problems from sinusitis. When assessing sino-facial injuries,fibro-osseous lesions of the PNS& fine bone features, CT is better than MRI.

By identifying spread & severity of the disease,CT helps in the diagnosis and treatment of recurrent and chronic sino-nasal infections. Because of its 3-D high resolution,CT is the most effective at delineating the intricate sino-nasal architecture & anatomic variations that are unavailable by physical examination or endoscopy.

For pre-operative examination of the nasal cavity and paranasal sinuses, CT is the preferred test, and it is the gold standard for describing inflammatory sinus illness brought on by obstruction. Coronal CT scans and the surgical strategy are highly correlated. As a result, CT is the recommended study for Functional Endoscopic Sinus Surgery (FESS), as coronal pictures closely resemble how the sinonasal cavity appears when viewed from an endoscope's point of view.

The advent of CT helps in lowering patient mortality and morbidity by assisting in the diagnosis of anatomic variations that may result in intra-operative and post-operative FESS problems. Evaluation of sinonasal disorders now primarily involves a CT scan in addition to diagnostic endoscopy. As a result, CT has tremendous value and provides common imaging of sinonasal disorders. The goal of this study was to characterise different benign and malignant sinonasal lesions using a variety of CT parameters, correlate CT findings with histopathological findings, perform functional endoscopic sinus surgery and diagnostic nasal endoscopy, and assess the sensitivity and specificity of CT in the diagnosis of sinonasal diseases (in cases where those investigations were done).

DEVELOPMENT OF NOSE AND PARANASAL SINUSES

The cranial ectoderm above the stomatodeum is where the nose grows, and in the fourth intrauterine week, when the embryo's crown rump length is 5.6 mm, paired thickenings called the Olfactory or Nasal placodes start to show. [11,12]

MAXILLARY SINUS:

In the fourth intrauterine month, the maxillary sinus first appears as a shallow groove that spreads laterally from the infundibulum. With its bottom boundary extending about 4 mm above the nasal floor before birth, the sinus begins to invade the maxilla. Up until the age of 8–9 years old, pneumatization and expansion persist. The antral floor becomes 3–4 mm lower than the nasal cavity at the adult stage. [13,14]

Each maxillary sinus is hollow & pyramidal in shape with average volume of 15 ml.

The sinus appears triangular when viewed in a transverse section from above. The facial, orbital, nasal, and infratemporal walls make up its four sides. Alveolar, palatine, frontal, and zygomatic are its four processes. [15]

ETHMOID SINUS:

The fourth intrauterine month marks the beginning of the ethmoid, which emerge from prepared furrows between folds that form on the lateral wall of the nose. The cells are largely nasal mucosal invaginations that develop into lateral ethmoidal masses and, with continued sac expansion and bone absorption, establish themselves as a cellular labyrinth that is well pneumatized at birth. Growing slowly until the age of six, they then grow more swiftly to reach their final shape by puberty.

Between the maxilla and anterior cranial fossa, there is a complex network of tiny air cells called the ethmoid labyrinth. It spans from one side's lamina papyracea to the other's, filling the ten spaces between the two orbits. It has a pyramidal shape, with a 14 ml base that faces posteriorly. [16]

SPHENOID SINUS:

The sphenoid, which is an invagination of the spheno ethmoidal recess, can be seen as early as the third intrauterine month. It is 5 x 2 x 2 mm at birth and fully aerated by the time a person is 8 years old. [11]

The greater and lesser wings, medial, and lateral pterygoid plates of the sphenoid are all invaded laterally by the sphenoid sinus.

Each turbinate has a foramen that is approximately 7. 5 ml in size and allows the sinuses on each side to communicate with the nasal cavity at the spheno-ethmoid recess. [17]

FRONTAL SINUS:

At birth, the frontal sinus is absent; it first appears between 6 and 12 months of age.

The superior ciliary ridges and deep to them in the frontal bone are where the two frontal sinuses are located. The two sinuses often have different sizes and each has an asymmetrical pyramidal shape with an upward-pointing peak. They are divided by a thin, seldom inadequate bone septum. Men often have larger sinuses than women do. The diploic bone that makes up the anterior wall has a thickness range of 1 to 5 mm. Although the posterior wall is more compact and thinner. In a medial direction, the floor slopes backwards and lowers toward the frontonasal duct opening. the middle meatus, where the duct opens (Frontal recess area). It has a volume of roughly 6–7 ml.

HISTOLOGY OF THE NASAL AND PARANASAL MUCOSA

Three varieties of epithelium are noted inside nasal cavity.

Squamous and transitional epithelium covers the anterior thirds of the cavity.

Pseudostratified columnar epithelium covers posterior two-thirds of the cavity.

Olfactory epithelium, which is a pseudostratified epithelium that contains olfactory cellscovers superior turbinate and adjacent septum.

LYMPHATIC DRAINAGE OF PARANASAL SINUSES:

Lymph drains from the epidermis along the antero-lateral wall of the maxillary sinus to the submandibular nodes. Lymph is sent to the upper deep cervical lymph nodes from the retropharyngeal lymph nodes. The submandibular nodes are the drainage sites for the anterior and middle group of ethmoid cells.

Posterior ethmoid cells drain into retropharyngeal lymph.

From sphenoid sinus, lymph drains into retropharyngeal lymph nodes.

COMPUTED TOMOGRAPHY:[18,19,20,21]

In some aspects, a CT scan is different from a traditional radiographic study. First, instead of X-ray film, a detector crystal or banks of detectors are aligned with the X-ray tube. In contrast to conventional tomography, which exposes the entire volume being studied even though only a small layer of volume is in focus on each section, a highly collimated (very thin) X-ray beam is projected through the part being examined so that only a thin layer of the patient is exposed for slice. As a result, the amount of X-rays a patient is exposed to during a CT scan is substantially

lower than it would be during a traditional tomography. The parameters of CT scans are currently being changed to reduce radiation exposure even more.

The endoscopist's field of view is closest to the coronal plane. Additionally, the OMU is most clearly seen on the imaging plane. It is the recommended plane for direct scanning as a result. On the scanner, each patient is lying face down with their head extended. The field of view should be concentrated on the paranasal sinuses for the best visualisation of the osteomeatal channels. The soft tissue demonstration is favoured by the selection of the scanner computation algorithms. The best window parameters are 2000 for window sizes and 200 for window centering. A smaller window range is required for the demonstration of neighbouring pathological disorders (in the face). When bone deterioration was either visible or suspected, scanner "raw" data were temporarily preserved so that high-resolution bone-enhancing reconstruction could be used.

When a patient is unable to lie on their back, axial scans are taken (from the palate through the frontal sinus), and an indirect coronal reconstruction is created using those scans. In addition to the initial scanning plane, coronal indirect reconstruction is done with a focus on the anterior ethmoid region. The preferred plane is still the coronal plane.

CT ANATOMY:[22,23]

Ethmoidal Labyrinth:

The ethmoidal labyrinth is made up of many air cells, as can be observed on the coronal image. They resemble a mucosa-lined honeycomb that is almost vertically orientated and thinly septated. These air cells are vertically positioned and are narrower in the front and wider in the back.

Boundaries:

Laterally -lamina papyracea

Superiorly - orbital plate of the frontal bone

Medially - perpendicular plate of ethmoid

Inferiorly- middle turbinate

OSTEOMEATAL COMPLEX:[24, 25]

It is formed by complex anatomic region at junction of muco-ciliary drainage from frontal, anterior ethmoid and maxillary sinuses. It incorporates the maxillary sinus, ostium, infundibulum, uncinate process, hiatus semilunaris, ethmoid bulla, middle turbinate and middle meatus.

FRONTAL RECESS:[26]

Mucocillary drainage of the frontal sinus is made possible by the frontal recess. Drainage may go into the middle meatus directly, into the ethmoidal infundibulum more laterally, or into the area above the ethmoidal bulla more posteriorly.

Nasolacrimal Duct:

The inferior turbinate's attachment point is close to where the Nasolacrimal Duct, a straight coursing tube, rises from the lacrimal fossa. The duct is approximately superoinferiorly orientated in the coronal view, with the inferior component positioned 3 to 5 degrees medial to the superior portion.

Sphenoid ostium and spheno ethmoidal recess:

The easiest way to assess these is on an axial or sagittal scan. The anterosuperior part of the sphenoid sinus is where the ostium is situated. The posterior ethmoidal cells and the sphenoidal ostium drain into the spheno ethmoidal recess.

VITAL RELATIONS OF PARANASAL SINUSES:[27, 28]

1. Orbit: The "lamina papyracea" divides the orbit from the ethmoid labyrinth. The cranial regions of the lamina are particularly susceptible to natural dehiscences. As a result, the infection might advance from the ethmoid to the orbit.

2. Optic Nerve: This lies in close apposition to the lateral aspect of posterior ethmoid and sphenoid sinuses. The optic canal connects the posterior ethmoid to the two roots of the lesser sphenoid wings, and its length ranges from 5.5 to 11.5 mm (average: 9.22 mm). About 50% of the time, the optic ring's distal opening borders the furthest-reaching ethmoid cells, and 25% of the time, the sphenoid sinus. In 25% of cases, an air space is almost entirely around the nerve. The "optic bulge" on the superolateral wall of the sphenoid is a result of the optic nerve as it travels through the body. In excessively pneumatized sphenoid cells, it is more obvious.

3.Internal carotid artery (ICA): ICA can bulge into the sphenoid producing a carotid eminence.

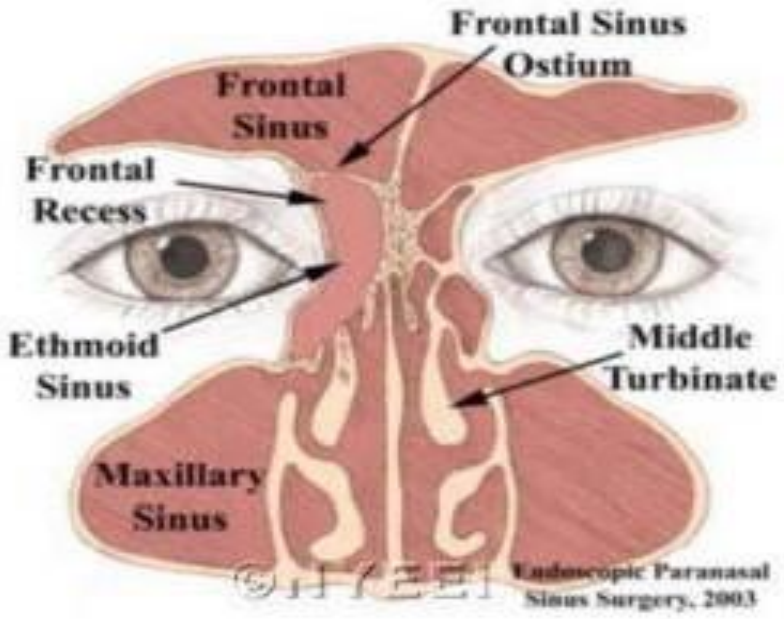

Fig 1 : Paranasal Sinuses

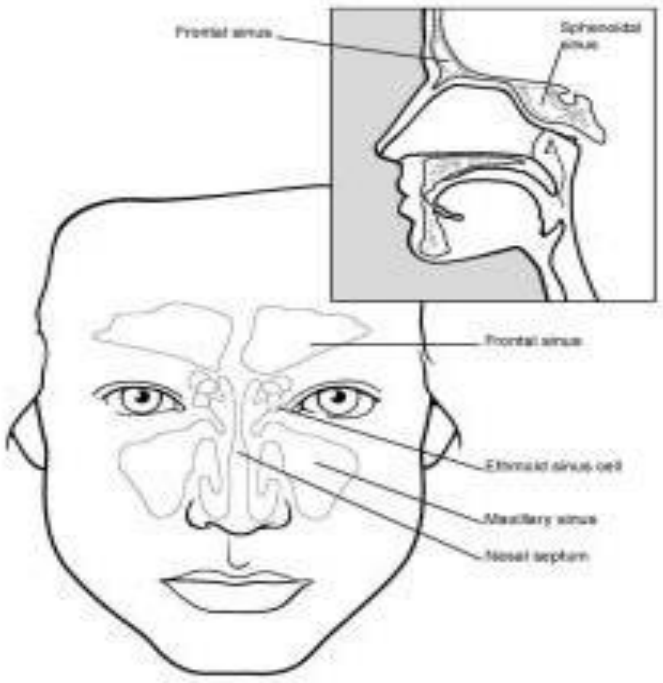

Fig 2 : Anterior and Lateral view of Paranasal sinuses

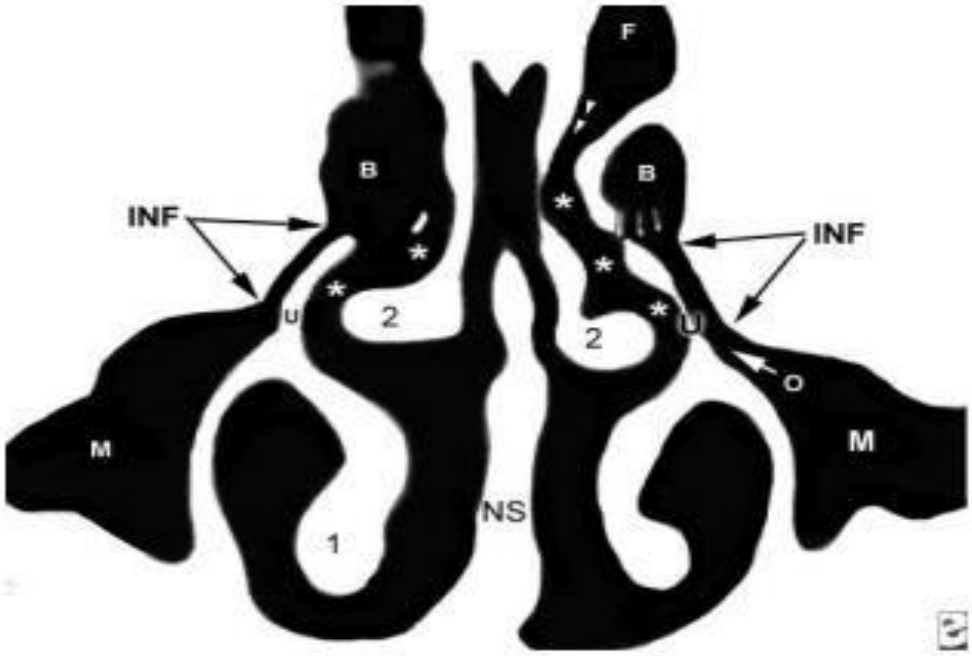

Fig 3 : Osteomeatal Unit : 1. Inferior turbinate, 2. Middle turbinate, INF-Infundibulum, M-Maxillary Sinus, F-Frontal sinus, U-Unscinate process, B-Bulla ethmoidalis, O-Maxillary sinus ostium, * - Frontal recess

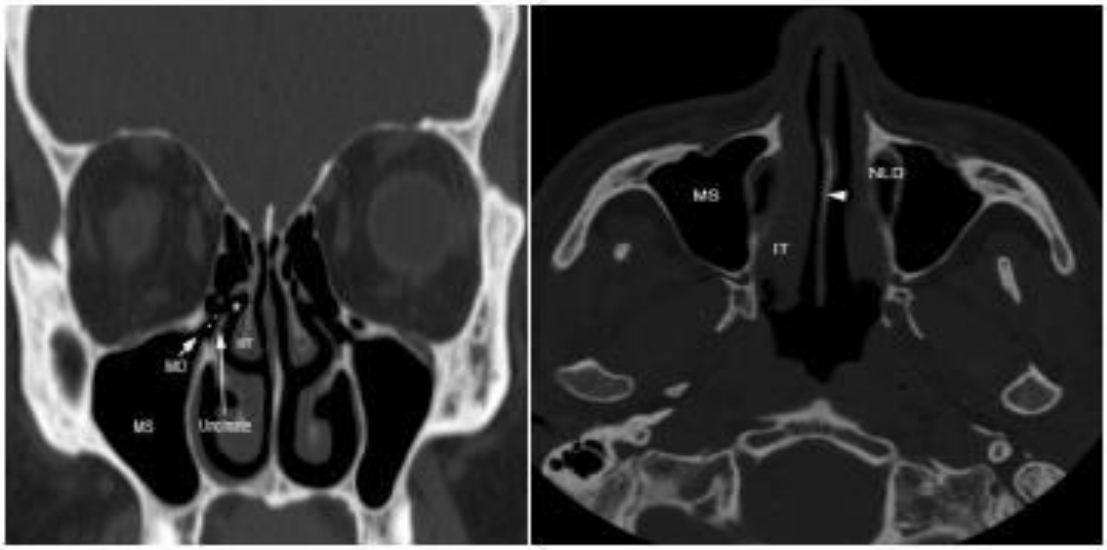

Fig 4 : Coronal and Axial CT images showing maxillary sinus. (Doted lines indicate maxillary sinus ostium)

CLINICALLY RELEVANT ANATOMIC VARIANTS OF PARANASAL SINUSES :

Prior to FESS, which aims at restoring the regular drainage of mucociliary channels, computed tomography (CT) is the method of choice for evaluating inflammatory sinus illness.

In order to direct the surgeon, it becomes crucial that the radiologist comprehends the anatomy of drainage channels and the common anatomical variations in this area. The functional drainage channels may be compromised by these polymorphisms, endoscopic surgery may be more dangerous, and illness locations may be very difficult to reach.

The objective is to draw attention to the sinonasal architecture and variations which areclinically significant.

The Agger Nasi Air Cell: Latin name for "nasal mound" refers to ANC, which is the most consistently present and anterior of the ethmoidal air cells and is present anteriorly to middle turbinate at itsvertical attachment to the skull base. The frontal sinus ostium size and the recess contour both significantly depend on the extent of ANC pneumatization, which varies. The beak of the maxilla's frontal process lies anteriorly and superiorly and is noticeable and extends into the frontal recessposteriorly,a narrow ostium is created in cases of tiny ANC. On the other hand, if the ANC is big, the beak will be short, resulting in a broader ostium but possibly greater inferior blockage.

The fronto-ethmoidal (Kuhn) Cells: The fronto ethmoidal region has a variety of auxiliary air cells that may or may not be present. It's crucial to determine how the frontal sinus's drainage system flows around the cells. Kuhn air cells or the fronto ethmoidal air cells can becategorized into four types based on the quantity and extent of their extension into the frontal sinus. They are all situated superiorly to the ANC.

Type 1 (most prevalent): Singular cell that is superior to the ANC and does not enter the frontal sinus (remains below the "beak").

Type 2: 2 or more cells that may or may not extend into the frontal sinus are located above the ANC.

Type 3: A solitary frontal cell that projects into the frontal sinus and is located above the ANC.

Type 4: Situated only in the frontal sinus, hence one of the rare configurations (communication with the ethmoidal air cell can be demonstratedif they are visualized in three planes).

The likelihood that the optic nerve or/and carotid artery will be exposed (or almost exposed) in the pneumatized cell is increased by the presence of Onodi cells.

VARIATIONS IN UNCINATE PROCESS CONFIGURATION:

The intersection of the orbit's floor and medial wall is opposed by the atelectaticuncinate process, which may even be fused to it. This is typically accompanied by a hypoplastic and opaque antrum, which may be linked to a drop of the orbital floor, raising the possibility of orbital trauma. The nasal septum,ethmoidalbulla,middle turbinatewhich provides a passage for anterior OMU drainage, determine if the uncinate process is horizontal or vertical. An enlarged ethmoidal bulla is almost invariably connected to the horizontal uncinate process. Additionally, the uncinate procedure can be hooked or pneumatized.

THE ETHMOIDAL BULLA: It is a variable-sized anterior ethmoidal air cell that can be found directly behind the uncinate process' free edge. The ethmoid infundibulum connects the hiatus semilunaris, which is the gap between the anterior aspect of the bulla and free border of the uncinate process.

THE COMMON MIDDLE TURBINATE VARIANTS :

Concha Bullosa: Concha bullosas are bilateral pneumatizations of the inferior bulbous region of the turbinate that affect between 24 and 55% of people. Pneumatization that has progressed above the OMU complex is referred to be a lamella cell or a conchal neck air cell. The bullosa, though modest, is not clinically relevant; however, a large concha bullosa, which is frequently accompanied with septal deviation, may impede the antrum's drainage pathway by twisting the uncinate process and constricting the infundibulum.

Paradoxical Turn: About 26% of persons have the middle turbinate, which can have lateral convexity (a paradoxical turn). Once more, minor paradoxical turbinates are not clinically important; nevertheless, if they are large, they are typically linked to septal deviation and may make it more difficult to access the OMU.

INFRAORBITAL (HALLER) AIR CELLS :They develop into the orbital floor and are situated inferior to the ethmoidal bulla. Particularly if infected, they may restrict the maxillary sinus ostium.

MAXILLARY SINUS (ANATOMICAL VARIANTS): The accessory sinus ostium, sinus hypoplasia, and sinus septations are the anatomical variations of the maxillary sinus. The maxillary alveolus, palate, and infraorbital region may all be affected by the typical maxillary sinus (or recesses).

If the maxillary sinus septum is not recognised, it may result in insufficient antrum drainage. Septum of the maxillary sinus may be fibrous or bony, and it frequently extends from the lateral wall to theinfraorbital canal. About 10% of people have an auxiliary ostium, also known as a posterior fontanel, which is situated posterior to the native ostium.

Often the antrochoanal polyps extend through the accessory sinus ostium insteadof the native ostium, hence it is crucial to recognise them. Additionally, occasionally there is an inferior to

superior flow of mucus from native ostium into the accessory ostium, which results in recurrent sinusitis. If the accessory ostium is found, the native ostium should be surgically connected to it.

THE NASAL SEPTUM:

The nasal septum have three anatomical variations: septal deviation (which can be acquired or developmental), septal spur, and pneumatization. The rate of septal deviation ranges from 20-79%, and it frequently has no bearing on clinical outcomes. The middle turbinate may be displaced by septal deviation, which will constrict the middle meatus and make access for surgery more challenging. The septum may have a concha bullosa of the middle turbinate, a focally deviated inferiorly septum at the chondrovomeral junction, or a more broad-based curvature. The ethmoidal infundibulum or middle meatus may be narrowed by septal spurs, which can be frequently observed in conjunction with septal deviation and, if prominent, may also make surgical access challenging. [29]

DISEASES OF PARANASAL SINUSES:

The nose and its paranasal sinuses are the common entry point into the human body, the entrance and checkpoint for the entire respiratory system. As a result, they are often susceptible to infections. Like other bodily components, they are susceptible to neoplastic diseases. [30,31]

INFLAMMATORY CONDITIONS:

A. ACUTE SINUSITIS: The length of the sinusitis determines its classification. Acute mucosal inflammation of any or all paranasal sinus walls occurs along with symptoms that can last up to 4 weeks. Suppurative or non-suppurativeinflammation are both possible.

Etiology: Through the ostium or submucosal lymphatics, bacterial infectionscan traverse to the sinuses. The most prevalent bacteria cultured were Aerobes –Strep Viridans - 27%, Strep Pneumoniae - 11.7%, Staph Aureus -9.4%, and Hemophilusinfluenzae 4.5%. There were relatively few healthy nostrils that were sterile. Anaerobes: 14.9% Actinomyces

B.CHRONIC SINUSITIS: It is a chronic inflammatory process affecting the mucosa of various groups of paranasal sinuses.

Etiology: When a patient with long standing sinusitis is first evaluated, it becomes challenging to pinpoint the precise reason for the infection's persistence. It could simply be a case of using the wrong antibiotics or receiving insufficient treatment. The sinus outflow could be physically blocked, which would make resolving the issue difficult. Physical obstruction can have variable appearances including obstructed sinus ostium due to edematous mucosa, sinus obstructed by a

chronic scar tissue to inadequately sized sinus ostia, septal deflection causingobstruction, or abnormalities of theturbinate such asparadoxically bent middle turbinate to a concha bullosa or to less common causes of obstruction leading to chronic sinusitis after mucocele, osteoma, cystic fibrosis and other anatomical variations like DNS, tonsillar adenoid hypertrophy, nasal polyps & cleft palate.

Acute and Chronic Sinusitis (Clinical Features):

Symptoms:

a) Headache isone of the most common and significant sign of sinusitis. Edema and congestion in and around the sinus ostia are the causes of headaches that start in the noseaccording to Wolff. Sinus headaches are typically unilateral and more severe on one side. When you lean forward and close your eyes, the sinus headache that is the source of those symptoms gets worse.

b) Pain: The head is dimly filled with deep-seated pain. The deep sinuses, including the ethmoid and sphenoidal sinuses, are typically the site of pain.

Radiological findings in acute and chronic sinusitis:

It is not possible todifferentiate acute and chronic sinusitis radiologically.

Views to be taken are:

1. Caldwell's view
2. Water’s view
3. Lateral view
4. Submento-vertical view

Sinus Findings on X-ray:

1. Increased thickness of the lining membranes
2. Opacity of entire sinus
3. Fluid level within the sinus
4. Changes in the bony wall

Computerized tomographic findings:

Severity of sinus diseases was graded byGlicklich et al. As per this validated grading system it is classified as

Grade: 0: <2 mm mucosal thickening ofwall of any sinus.

Grade 1 : All unilateral disease or anatomic abnormalities.

Grade 2 : Bilateral disease limited to the ethmoid or Maxillary sinuses.

Grade 3 : Bilateral disease with involvement of at least one sphenoid or frontal sinus.

Grade: 4 :Pansinus disease.

Five Major Recurring Patterns of inflammatory disease identified on CT: [32]

1. **Infundibular pattern :**The disease only affects the maxillary sinus, and obstruction is seen in ipsilateral infundibulum and maxillary ostium. The ipsilateral frontal sinus and anterior ethmoid air cells,andosteomeatal unit are all healthy. 26% is the incidence. (a)The infundibulum's mucosal edoema is one of the causes; (b) Polyps;(c) anatomical variants such as Haller's cells; (d) an unusually large uncinate process which enchroaches on the infundibulum

2. **The Osteo meatal unit or The OMU pattern:**The middle meatus' blockage is the key contributing factor. The middle meatus-draining maxillary, anterior, middle, and ipsilateral frontal sinuses will be affected. They all exhibit participation in inflammation. The OMU pattern may or may not be complete. This pattern is defined as any involvement including the maxillary, frontal, anterior and middle ethmoidal sir sinuses. Mucosal swelling,hypertrophiedturbinates, polyps ,adhesions ,nasal tumours and anatomical variants including septal abnormalities,concha bullosa, and curiously bent middle turbinates are among the lesions predisposed to blockage. 25% is the incidence.

3. **The Spheno- Ethmoidal Recess Pattern:** Inflammatory pathologies of noseusually result in occlusion of the sinus ostiumincludingposterior ethmoid and sphenoidal sinuses of the same side in the spheno ethmoidal recess (SER). 6% is the incidence. The main etiology for obstruction of spheno-ethmoidal recess issuperior meatus anterior to the sphenoid sinus.

4. **Sino nasal polyposis or SNP:**It presents as an inflammatory disorder that causes polypoid nasal and paranasal sinus mucosa. The pattern of SNP on Computed Tomography includes characteristics from the other four patterns with extra SNP-specific characteristics. It can be aggressive at times and tends to come back. It was seen that the mucosa was pathologically edematous and hyperplastic and had formed into polypoids. On CT, there are two significant findings and several minor ones. 90% of patients with soft problem density have polypoid masses in the nasal cavity, which are often bilateral and hypodense in the middle turbinate area. Infundibular hypertrophy is the second important need. Instead of erosion, bones undergo remodelling or attenuation. diffusenasoethmoid soft tissue component along with absence of the typical number and size of ethmoid trabeculae, and deossified nasal septum are all signs of an aggressive type. It can be distinguished from malignancy by the thin, hypodense mucosal rim that is present. In SNP, secondary fungal infection typically shows no signs of anatomical expansion, necrosis, bone damage, or vascular thrombosis.

5. **Sporadic or unclassified pattern**: This includes mucoceles ,retention cysts, and mild mucoperiostial thickening.

C. MUCOCELES:

These are the most typical paranasal sinus expansile lesions. According to radiographic definition, paranasal sinuses are enlarged, mucoid-filled cavities.

Causes are:

- Allergic
- Osteoma
- Inflammatory
- Trauma
- Complications of previous surgery.

Due to the lengthy fronto nasal duct's susceptibility to occlusion by swollen mucosa, they are most frequently observed in the frontal sinuses (60%) where they are most common.

More frequently (25%) than maxillary mucoceles (10%) and sphenoidal mucoceles (1.2%) are ethmoidal mucoceles.

Clinical Features: The concerned sinus is showing signs of enlargement and a mass effect. Proptosis and diplopia could be present. Unless it is diseased, pain is uncommon.

CT findings:A mucocele appears on a CT scan as an enlarged sinus filled with homogenous material that is generally low in attenuation (15 HU), with some areas having higher attenuation from concentrated secretions. Other characteristics specific to the affected sinus may also be detected in addition to this. The sinus content is rebuilt into the sinus bone, which may also be focally thinned or eroded. The overall CT image shows bone remodelling and preservation.

D. INFLAMMATORY POLYPS

Inflammatory polyps are pedunculated outgrowths made of cellular& edematous mucosa that is composed of normal epithelium and originates from nasal fossa and PNS.

They are most commonly present in the nasal cavityand may be entirely filled with soft tissue, and the ethmoidal air cell complex.

CT Findings: Depicts an enlargement of the fossa of nasal cavity packed bypolypoid masses ofsoft tissue densitywith high attenuation in the centre and a low attenuation rim around the edges. It's possible to notice opacified sinuses that extend into orbits. Bilateral involvement, which is characteristic, usually sets it apart from cancer.

E. RETENTION CYST

A cyst is a small, dome-shaped growth that develops on the paranasal sinus wall. In terms of pathology, cysts can be either secretory (mucus retention cysts) or non-secretory (degenerative cysts). Predominantly the cysts are small and not the result of any previous infections.

CT findings: Appear as round,smooth, dome-shaped or convex, soft tissue density on a CT scan. One study indicates that 10% of the population has these cysts. [33,34]

F. FUNGAL INFECTIONS:[35,36,37]

PNS can be affected by a variety of fungal infections. These include histoplasmosis, aspergillosis,mucormycosis, and candidiasis which are the most prevalent and significant ones. Mucormycosismost commonly affects the immunosuppressed hosts. 50–75% of the individuals have diabetes that is either poorly or completely uncontrolled. The invasive and quickly spreading pathogenic organisms spreads from the nasal cavity to PNS. They frequently invade the blood vessels. The cavernous sinuses, ophthalmic veins, and orbits are frequently invaded. Due to fungi's propensity to bind manganese,calcium and other heavy metals, the disease may progress in immunocompromised patients who havehaematological malignancies with acquired immunodeficiency syndrome.

CT findings: The symptoms usually range from a mucosal inflammation which is non-specific, with or without involvement of adjacent bone, to an radio-opaque sinus with a central hyperdense mass in the form of mycetoma&focal bone erosion andreactive thickening in nearby walls and bones of sinus. On Computed Tomography imaging, a central high density intra-sinus mass which is separated from the sinus walls by zone of secretions ofmucoid density suggests the existence of a sinus mycetoma. However, in cases of sinus bleeding or in sinuses loaded with extremely dry proteinaceous secretions, identical observations may be observed.

NEOPLASMS OF PARANASAL SINUSES

Incidence: Around 0.2% of cases involve paranasal sinus tumours. They make up 3% of upper respiratory tract malignancies. There were 530 cases of paranasal sinus and nasal cavity cancers among the 5050 upper respiratory tract tumours reported by Aschh et al from the Armed Forces Institute of Pathology in USA. According to John G. Batakis, about 1% of all human malignancies are paranasal sinus carcinomas.

When analysing the descriptive epidemiology of the paranasal sinuses neoplasms, Mass and Nectous (1986) found that the Japanese population had the highest incidence, with unexplained increased risk limited to the maxillary sinus. The maxillary sinus is where up to 80% of all paranasal sinus malignancies start. It's rare to have an ethmoid sinus. But compared to other sinuses, this one experiences osteoma more frequently. The occurrence of malignancies in the sphenoid sinus is the lowest.

Sex ratio: The average male to female ratio revealed by various sourcescame out to be 2:1 (M:F).

Age[38,39] **:**Although sarcoma and adeno-carcinoma are more common in the young adults, malignant tumours are uncommon before the age of 35. The sixth decade of life was when malignant tumour incidence peaked in Maeheth's study (1905).

Predisposing factors: The origin of paranasal sinus tumours has been the subject of numerous theories. Numerous ideas exist regarding the cause of osteoma.

Infections,embryogenic as well as traumatic factors all are causes for this. Traumatic causes are more prevelant in males. Thus, osteomas frequently developing at the intersection of the ethmoid and frontal bones could be explained by the persistence of embryonal periosteum at the junction where membrane bone and endochondrium meet. In 1994 Jarvi suggestedaboutthe origin of inverted papillomas and viral aetiology. Some of the other various extrinsic factors are textile industries,atmospheric pollution, steel factories. A high incidence of almost 22% of inverted papilloma in steel factory workers was reported by B.Majumdar in 1984. The carcinogens suggested by James,Suen and Cugen include [40]shoe industry (shoe making),textile workers,radio-chemicals,wood dust (furniture industry),painters working with Radium dial,mustard gas&nickel refining

Other factors: Chronic Sinusitis;CigaretteSmoking;Alcoholism.

Classification Of Tumors In Paranasal Sinuses:[41,42]

Benign tumors:

I Epithelial tumors:

1. Papilloma- Squamous papilloma Inverted papilloma.

2. Adenoma.

II. Connective tissue tumors: Osteoma,Localized Compact Osteoma,Fibroma, Fibrous dysplasia,Chondroma,Schwannoma ,Localized cancellous osteoma,Angioma,Odontogenic tumors,Neurofibroma, Myxoma,Acinic cell tumor,Gaint cell reparative granuloma.

B. Malignant tumors:

I. Epithelial tumors:

Squamous cell carcinoma,Lymphoepithelioma,Basal cell carcinoma,Adenocarcinoma,Olfactory Neuroblastoma,SpindleCell and Clear Cell Carcinoma,Malignant melanoma,Adamantinoma,Minor salivary gland tumors (Malignant),

II. Connective tissue tumours:

Osteosarcoma, FibrosarcomaMyxosarcoma, Sarcoma,Hemangio-pericytoma,ChondrosarcomaPlasmacytoma,,Lymphosarcoma ,Haemangio-endotheliosarcoma,Malignant lymphoma/

III. Teratomas and teratocarcinosarcoma

IV. Metastatic tumors to sinonasal tract.[43,44,45,46]

V. Tumors involving the sinuses by contiguity.

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

BENIGN TUMORS:

Epithelial tumors:

Papilloma : Usually develops from the schneiderian membrane, which lines the respiratory epithelium of the nose &PNS, is the most prevalent benign epithelial tumour in the PNS & lateral wall of the nasal canal. The schneiderianpapillomas, which frequently exhibit neoplastic characteristics, most likely result from the replacement or prolioferation of cells at the basement membrane of mucosa. Following this proliferation, the growth pattern may invert, fungiform, or combine the two growth patterns. The relationship between papilloma in the lateral wall and squamous cell carcinoma is well known. It may affect the sinuses,the floor & roof of nasal cavity, and the nasolacrimal duct, among other places. Various othernames used for papilloma include:

1. Inverted papilloma.

2. Ringertz tumor.

3. Scheneiderian papilloma.

In general, they lack the translucency of nasal polyps but are larger and tougher. As they develop, architectural patterns emerge. 1. Exophytic and papillary 2. Inverted, with an epithelial growth that is invaginating the stroma beneath it from the inside. The later kind is more frequently observed in the sinuses and lateral wall. The inverted papilloma's primary epithelial development is not a surface proliferation but rather is directed into the underlying stroma. The lateral wall of the nose accounts for 68% of all occurrence locations. maxillary and ethmoidal sinuses: 27% 5% for sphenoidal and ethmoidal.

Computed Tomography (CT) findings

They resemble lumps of soft tissue attenuation. Fungiform type tumours almost invariably develop from the nasal septum,are typically single and on same side, and occasionally show the typical surface irregularity. Fungiform papillomas are thought to be predominantly benign, in contrast to inverted papillomas. It is typical for inverted papillomas to develop near the middle turbinate's root from the lateral nasal wall & to spread into the paranasal sinuses laterally, particularly the maxillary sinuses and less frequently the ethmoid sinuses. In some instances, calcification can be present.

Adenoma :

Occurs in sinuses but is not common. Normally symptomless, it remains capsulated, but if it emerges through the lateral nasal wall,causing nasal blockage.

CT findings

On post contrast imaging, these tumoursappear as well defined, capsulated lesions showing no signs of damage tobone. They are soft tissue masses that are 20–40 HU in size and sporadically associated with bone enlargement.

Connective tissue tumors:

1 Fibroma :

These connective tissue lesions are coated in hypoplastic epithelium and are often benign. This tumour does not invade or cause damage, and it does not spread.

Imaging: Normal sinus walls and soft tissue mass that does not brighten with contrast. There is no visible indication of bone loss. There is no sign of calcification or necrotic regions.

2. Osteoma :

The frontal sinuses include 70% of the osteomas, the ethmoid sinuses 25%, the sphenoidal &maxillary sinuses 5%. Handuosa in the year 1952, noted location of tumor's origin with respect to different skull bones based on the histological characteristics of the tumour upon resection in 35 patients. They could be: Ivory: Hard, compact bone; Spongy: Mature cancellous bone that is surrounded by a cortical plate and has a lamellar structure made up of two osteomas; typically detected in adults (15–35 yrsof age) as an accidental radiological result.

Larger lesions may hurt, and tumours that are in a dangerous position may be accompanied with mucoceles. Pneumocele, meningitis, or a brain abscess can all develop from local bone degeneration brought on by pressure.

These are benign and grow extremely slowly. Some origin theories focus on embryonic, infectious, and traumatic elements. Males experience a higher incidence. Gardener's syndrome was identified by Dive and Bussy in 1962 as a trifecta of symptoms that included soft tissue tumours, bone lesions, and colonic polyps.

CT findings These are clear on ordinary film and a CT scan. Even small tumours have the potential to block the sinus and cause C.S.F. rhinorrhea. These tumours look as dense as bone on a CT scan. An osteoma is shown on a CT scan to be homogenously hyperdense, frequently lobulated, and smoothly delineated, as well as frequently residing within an enlarged paranasal sinus. The preferred method for evaluating osteoma is computed tomography (CT).

Osteofibromaor Ossifying Fibroma or Fibrous Osteoma:

A benign& slowly expanding,largely encapsulated tumour is an ossifying fibroma. This tumour was first described in British literature in 1865. Women are afflicted more frequently than men, and it more frequently affects people between the ages of 3 and 40. The teeth's roots are typically in close proximity to the lesions' origin. The mandible, which has a strong affinity for the molar teeth, appears to be the bone that is affected most frequently.

The stroma of the tumour is highly vascularized and contains varying levels of calcified minerals. Calcification can take the form of spicules and atypical bone formations. These are non-invasive, slow-growing &dont spread.

Chondroma and Chondrosarcoma:

Chondromas develop from nests of early cells. They might grow anywhere. But the most typical location is the ethmoidal sinus. They can cause blockage and deformity and are frequently asymptomatic when discovered. It is easy to distinguish a chondroma from the surrounding tissue.

They do not metastasis and grow slowly. However, there is a chance for growth with bone loss and malignant degeneration into chondrosarcoma. Excision in its entirety is necessary.

Imaging:

Early osseous fibromas have a single, cystic appearance and exhibit osteolysis without a noticeable periosteal response. Lesions are radiopaque and have a consistent radiolucent rimming at later stages of development. The tumour and the nearby healthy bone may occasionally be separated by a sclerotic boundary. Non-homogeneity on a CT scan is caused by alternating sclerotic bone areas and less dense matrix. Even on plain films, chondroma/chondrosarcomas exhibit radiologically distinctive amorphous calcification and create destructive soft tissue mass lesions despite their slow growth. Meningioma symptoms can resemble sharply marginated lytic bone alteration with stippled calcification.

In contrast to muscle, chondromas appear heavily calcified on CT scans, frequently in a whorled pattern(with a core hypodensity)& are topped by a non-calcifedsoft tissue mass.

D. Inflammatory Polyps:

Soft tissue density polypoid masses are visible on the CT image of the expanding nasal fossa. has a high concentration in the centre and a low concentration at the edges. It's possible to notice opacified sinuses that extend into orbits. Bilateral involvement, which is characteristic, usually sets it apart from cancer.

Angiofibroma (Juvenile nasopharyngeal angiofibroma or JNA)

It is a benign vascular tumour that nearly always affects guys in their pre- or adolescent years. It has an incidence of 1 in 50,000 and make up < 0.1 % of head and neck tumours (Waliman et al., 1981). Twenty to thirty percent of individuals have intracranial extension.

These tumours are aggressive polypoid masses that are extremely vascular and non-encapsulated histologically. Angiofibroma is strongly suggested by the trifecta of epistaxis, nasal obstruction, and nasopharyngeal bulk.

Imaging:

The nasopharyngeal portion at the pterygo-palatine fossa or spheno-palatine foramen has been thought to be the origin site for the tumor. About 90% patients with pterygopalatine fossa involvement also havefat planes between the pterygoid plates and the back of the maxillary sinus being eliminated in addition to andifference in size or enlargement of it. The tumour may protrude anteriorly &upwards into the maxillary sinus,nasal cavity, sphenoidal& ethmoidal sinuses, as well as superiorly through the foramen rotundum & the pterygoid canal through the SOF into cranial fossa.

A polypoidal,infiltrating, noticeably hyper-enhancing mass that only affects the nasopharyngeal region without extending is shown on a CECT scan. These lesions show a strong early enhancement during post-contrast dynamic imaging,which is indicativefor these highly vascular masses. The internal maxillary artery and ascending pharyngeal artery are the two main feeding channels that should be visualised during angiogram, which is the ideal procedure to execute.

MALIGNANT TUMORS OF PARANASAL SINUSES:

Only ~3% of the head and neck tumours are malignant tumours of the paranasal sinuses. The maxillary sinuses account for 50–65% of sino–nasal malignancies, ethmoid sinuses for 10–25%, and the nasal cavity for 15%–30%. Of all paranasal sinus cancers, the maxillary antrum accounts for 80%, withyearly incidence of roughly 1 in 1 lakh in the United States and Europe. [43,44,45,46,47]

80% of all cancers are squamous cell carcinomas. There are also additional neoplasms in this area, such as plasmacytoma, melanoma, and lymphoma.

The early quiet or misinterpreted signs of these tumours, which permit extension before identification, are strongly related to the mortality& poor prognosis of sinus tumours. In that respect,it may be claimed that sinus carcinomas don't exhibit a clear sign of pressure until they have left the sinus where they originated. More than 90% of paranasal sinus cancers show evidence of invasion through at least one sinus wall.

SQUAMOUS CELL CARCINOMA IMAGING

The tendency of these lesions to cause bone damage even if the lesion is relatively small is their main pathogenic and consequently imaging feature. A tiny area of bony abnormalities and apparent destruction becomes significant because nearby secretions within occluded sinuses and squamous cell carcinoma and other carcinomas have similar densities. In addition to the cranial cavity in rare instances, maxillary sinus malignancies frequently extend to the pterygopalatine,orbit,ethmoid sinus & infratemporal fossa. It is important to take note of the degree of invasion on radiographs, especially the orbital and cranial invasion, since this will define the extent of the surgery and whether orbit exenteration is required.

In addition to resolving the borders of the soft tissue density mass and the deterioration of the bone, CT in the axial and coronal planes also reveals the tumor's expansion into the neighbouring sinuses and surrounding compartments. To distinguish a tumour from inflammatory diseases or other abnormalities within the sinuses, contrast is useful. These tumours typically show relatively little enhancement after contrast. However, IV contrast enhancement is helpful, especially when orbital and intracranial invasion are suspected. Rescans are helpful for evaluating the outcomes of radiotherapy and chemotherapy. However, MRI is more helpful in this regard.

Malignant melanoma:

Malignant melanomas account for 0.5 to 1.5% of cases. They develop in the nasal cavity and paranasal sinuses. The fifth decade has the highest occurrence at these locations. It is unusual for patients under the age of 30 to present. There isn't much of a sex predilection. These cancers are produced by melanocytes, which are commonly present in the mucosa and submucosa. The maxillary antrum is the normal site for additional nasal tissue.

Melanomas of sino-nasal origin do not have any diagnostically significant signs or symptoms. Epistaxis is thepredominant complaint (~80% of cases), but discomfort and oedema are usually uncommon.

Malignant melanomas of the PNS typically manifests as a polypoidaltumour that may be solitary or multicentric. These tumours could contain lots of pigment

More over two thirds of the melanomas will show easily recognizable melanin. The rest is melanocytic. Diagnostic mistakes are possible when melanin is insufficient. These include metastases, lymphoma, rhabdomyosarcoma, angiosarcoma, and anaplastic carcinoma.

CT findings:

Malignant melanoma has a varied and non-specific CT appearance. The tumour lacks a distinctive density or enhancing pattern. A soft tissue mass or mucosal infiltrate makes up these malignancies (20-40 HU). aggressive bone breakdown is less usually correlated with bone growth.

Ameloblastoma:

Less than 0.1% of sinus tumours have it. The maxilla and the remaining substantial portion of the mandible contain 20% of them. They can be found in the antrum region, around the molars, and in other places. The pterygomaxillary fossa, ethmoidal sinuses, and orbit are frequently invaded by the tumour.

Imaging

A radiolucent lesion with one or more loci may be an ameloblastoma. With no additional periosteal bone development, the unilocular variation exhibits a round to oval structure with defined boundaries and sometimes minor marginal sclerosis. Additionally, varying degrees of bony growth with occasionally a scalloped margin are seen. Other issues include dental displacement, erosion of the tooth apex, and lamina dura loss.

The low attenuation cystic and isodense regions present in the CT results of ameloblastoma represent the solid elements of this tumour. The low density cystic lesions usually range from little to enormous.

Extramedullary plasmacytoma:

Thetumour typically manifests itself as a solitary polypoid mass in older persons. Bone can occasionally be affected by plasmacytoma as a single radiolucent lesion. In a capillary network, histology reveals sheets containing plasma cells with varying levels in maturity. Differentiating between amelanotic melanoma, lymphoma, lymphosarcoma, and anaplastic cancer is necessary. Primary extramedullary plasmacytoma has a highly varied and unpredictable clinical course. The group with the best prognosis is aggressive, frequently local recurs, and progresses to multiple myeloma or plasma cell leukopenia. Bone invasion is a bad prognostic indicator in addition to local recurrence. Highly radiosensitive plasmacytomas exist.

Imaging

On a CT scan, a plasmacytoma of the sino-nasal tract is shown somewhat as a well-defined lesion that frequently displays variable properties, linked to erosion and bone remodelling, and

shows moderate to strong enhancement following intravenous contrast injection.On a CT scan, they show mild to noticeably enhancing masses that can calcify, grow& be linked to bone degradation. It is very challenging to discern between a benign and malignant hemangioma.

Sarcomas:

Osteogenic Sarcomas& Chondrosarcomas are usually more frequently found in the mandible is than maxilla or any other of the para-nasal sinuses. Two percent of all primary malignant neoplasms are osteogenic sarcomas.

Sarcomas on a CT scan exhibit identical muscle values, densely calcified mass that frequently has a whorled pattern(with a central low attenuation) & anon-calcified soft tissue mass.

Lymphoma:

Lympha incidences in the para-nasal sinuses is extremely rare. NHL's typically develop in the nose & Paranasal sinus in patients with disseminated lymphoma,which is common in African Americans. The Epstein-Barr virus is thought to be the culprit. It frequently affects kids between the ages of 4 and 8 years old. The most frequent site is the maxilla.

Imaging:

On a CT scan, sinusitis, polyposis, benign neoplasms, and lymphomas of the para-nasal sinuses might all look very same. They are frequently perceived as hefty masses, and there might be alterations that signify growth, erosion, or infiltration.

Metastatic lesions:

It is uncommon for primary tumours to spread to the sinus canals. Renal cell carcinoma is the most typical primary tumour, followed by lung,prostate,breast, testicular & GI malignancies. The metastatic tumours of PNS tend to expand near the sinus marginsinstead of causingthickening of mucosa. Clinical characteristics of metastasis to the PNS are nearly identical to those of a primary malignant tumourat the same location. The majority of these metastases are to the bone and are primarily hematogenic.

The walls of the sinonasal canals may be remodelled or destroyed by metastases from RCC and melanomas,whichappear as avidly enhancing soft attenuation masses on CT scans. Similar to other lesions, prostate lesions frequently cause sclerotic bone with abnormally uneven borders and tiny or significant soft tissue components.

Metastasis from the GIT, distal GUT, bladder, lung& breast are typically bone destroying&aggressive in nature.

Harrisions classification of sinus malignancies: Category Description

- T1 –No evidence of bony erosion; Limited to antral mucosa
- T2 - Bony destruction; however no involvement of facial skin,orbit,ethmoid orpterygopalatine fossa.
- T3 –Orbital, ethmoidal or facial skin involvement.
- T 4 - Spread to naso-pharynx, sphenoid sinus,cribriform plate or pterygopalatine fossa.

American joint committee classification (1983):

The most common categorisation is this one. The tumor's location in relation to the degree of invasion is described by the T part of the TNM. Other lymph nodal descriptions for upper aerodigestive tract tumours are indicated by the letter N. Distant metastases is indicated by the letter M.

Despite the fact that the majority of sino-nasal tract malignancies are symptomatic, most of these symptoms are non specific such as nasal blockage, headaches, proptosisorvisual derangement, epistaxis &nasal discharge, among others&many of these lesions may be discovered incidentally on plain radiographs or Computed Tomography scans that are being done for other reasons.

Therefore, in addition to paying close attention to the imaging findings itself, the radiologist should bear in mind the different variations that can be possiblеduring evaluation any mass lesion of sino-nasal tract such as age, clinical presentation, and duration. He will then be in a position to assist the concerned clinician with the diagnosis and subsequent management through meticulous examination and elimination.

MATERIAL AND METHODS

Source of data:

1. Patients referred to Radiology department, Shri B.M.Patil Medical College,Vijayapura

2. Patients who are admitted in Department of ENT, Shri B.M.Patil medical college,Vijayapura

CT examinations of those who fulfilled the critera were studied.

Period Of Study: January 2021 to June 2022

Study Design: Hospital-Based Cross Sectional Study.

Inclusion criteria:

1. All patients (males and females) with clinically diagnosed sino-nasal diseases, who are referred to Radiology department from ENT department.

2. All patients who give their willful consent for the procedure.

Exclusion criteria:

1. Post operative cases of known sino-nasal diseases.
2. History of trauma.
3. Pregnant women with sino-nasal diseases.
4. Patients who refuse to give consent.

Investigation Done In The Study:

For 93 patients with clinically suspected PNS disorders who were referred from the departments of otorhinolaryngology and head and neck surgery, both axial and coronal CT scan studies (done with GE, spiral CT machine) were performed.

TECHNIQUE

Patients were positioned supine for axial sections and supine with neck extended for coronal slices.

Anglulation: Perpendicular to hard palate for coronal sections; parallel to hard palate for axial sections

Thickness of5 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 frontalsinus
- 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 :Following the estimation of the blood creatinine level, Omnipaque 350 was administered, if necessary, at a calculated dose of 300 mg/kg body weight as a single intravenous bolus injection.

Any polypoidal or mass lesions were removed, and in some cases, a biopsy was collected for histological analysis and fungi culture.

Histopathological reports and the results of the CT PNS were compared. Utilizing statistical analysis software, Microsoft Word and Excel were used to create graphs, tables, and other output.

With reference to mucosal thickness, polypoidal/mass lesions, involvement of nearby bones and soft tissue, and histo-pathological abnormalities, the sensitivity and specificity of CT results were calculated as standard. Finally, using the Chi-square test, the histopathological and CT diagnoses were associated.

RESULTS

93 patients who received CT PNS were included in a prospective hospital-based cross-sectional study that was conducted and correlated with the histo-pathological reports.

Table 1: Age-wise distribution of patients studied

The majority of patients (32.2%) and those between the ages of 21 and 30 (27.9%) were in the 30–40 year range. The youngest and oldest patients ranged in age from 15 to 79.

Age	Number (n=84)			Percentage
	Females	Males	Total	
15-20	4	5	9	9.6%
21-30	12	14	26	27.9%
30-40	14	16	30	32.2%
40-50	8	5	13	13.9%
50-60	5	3	8	8.6%
60-70	2	2	4	4.3%
70-80	2	2	4	4.3%

Graph 1: Age-wise distribution of patients studied

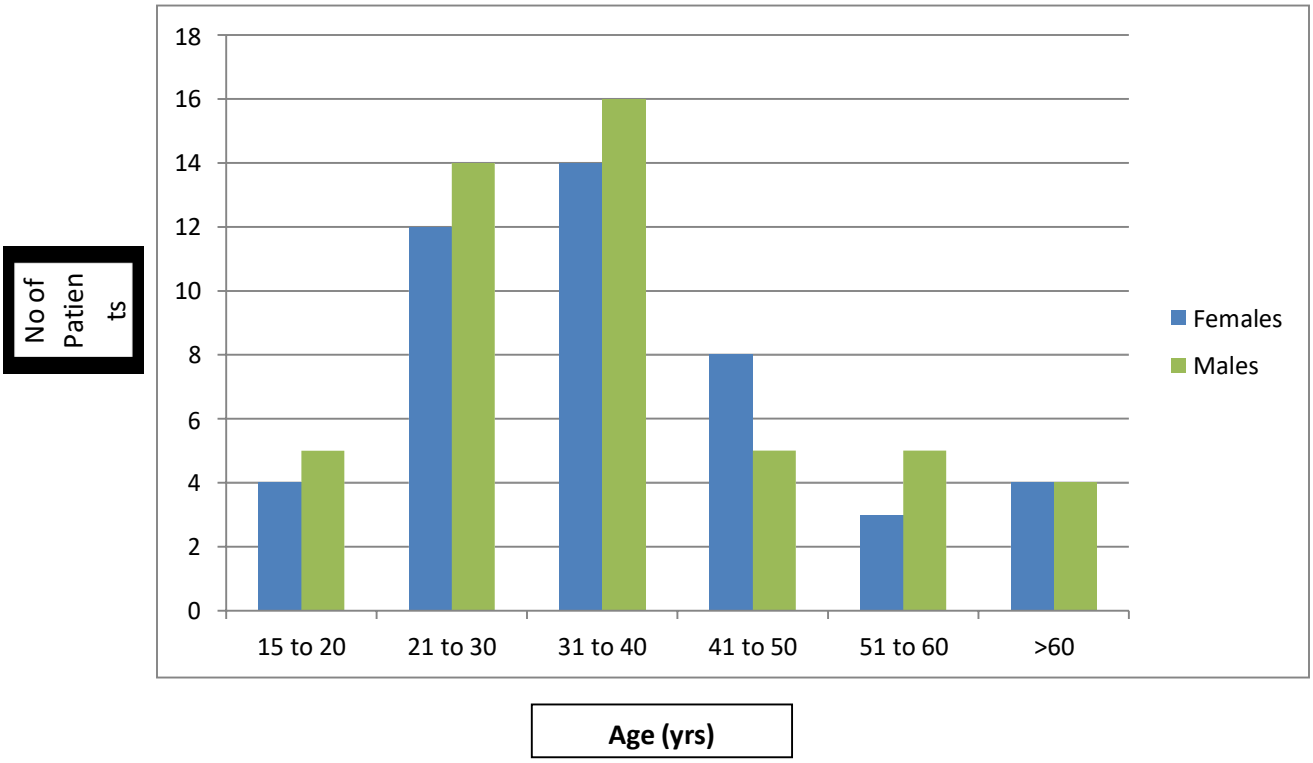

Table 2: Sex-wise distribution of patients studied

It was found that the majority of patients in this study (51.6%) were female (48). 48.4% of the population were men (45). The ratio of women to men is 1.06.

Sex	Number of Patients	Percentage
Female	48	51.6
Male	45	48.4
Total	93	100

Graph 2:Sex-wise distribution of patients studied

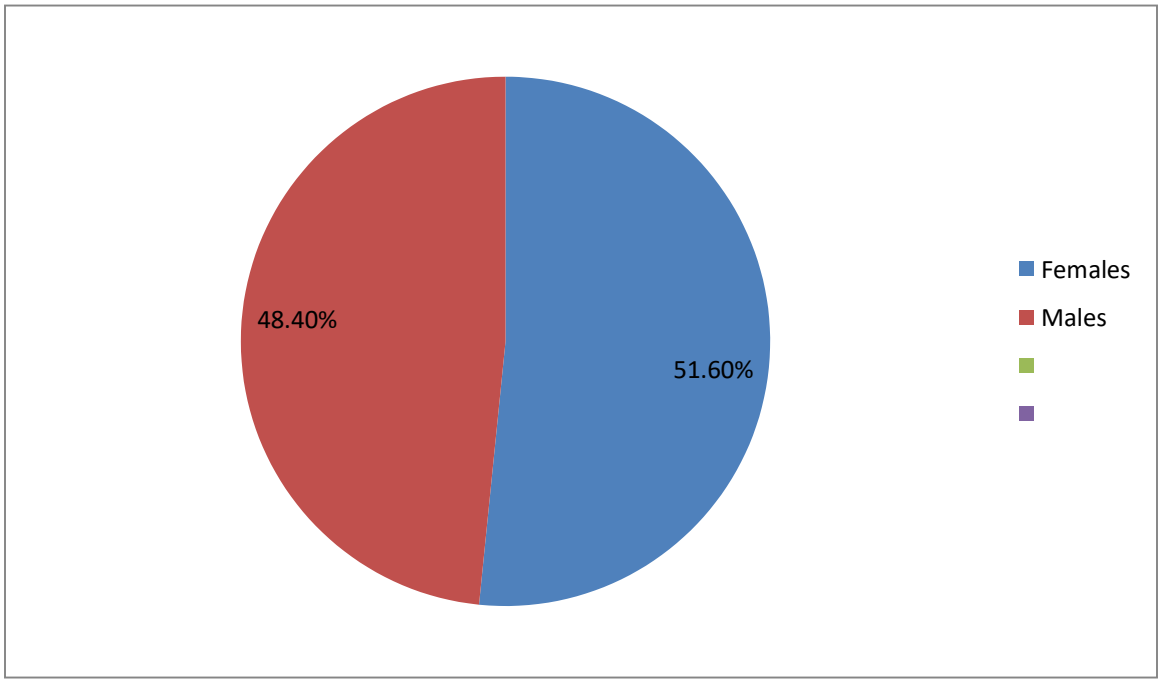

Table 3 : Chief Complaints

Headache was the most common complaint among patients (55.9%), then nasal obstruction (50.6%), epistaxis (28%) and nasal discharge (25.2%) in that order. Swelling in the face was the least common complaint (4.7%).

Chief Complaints	Number of Patients (n=93)	Percentage
Headache	60	55.9%
Nasal obstruction	54	50.6%
Epistaxis	30	28%
Nasal discharge	27	25.2%
Swelling	5	4.7%

Graph 3 : Chief Complaints

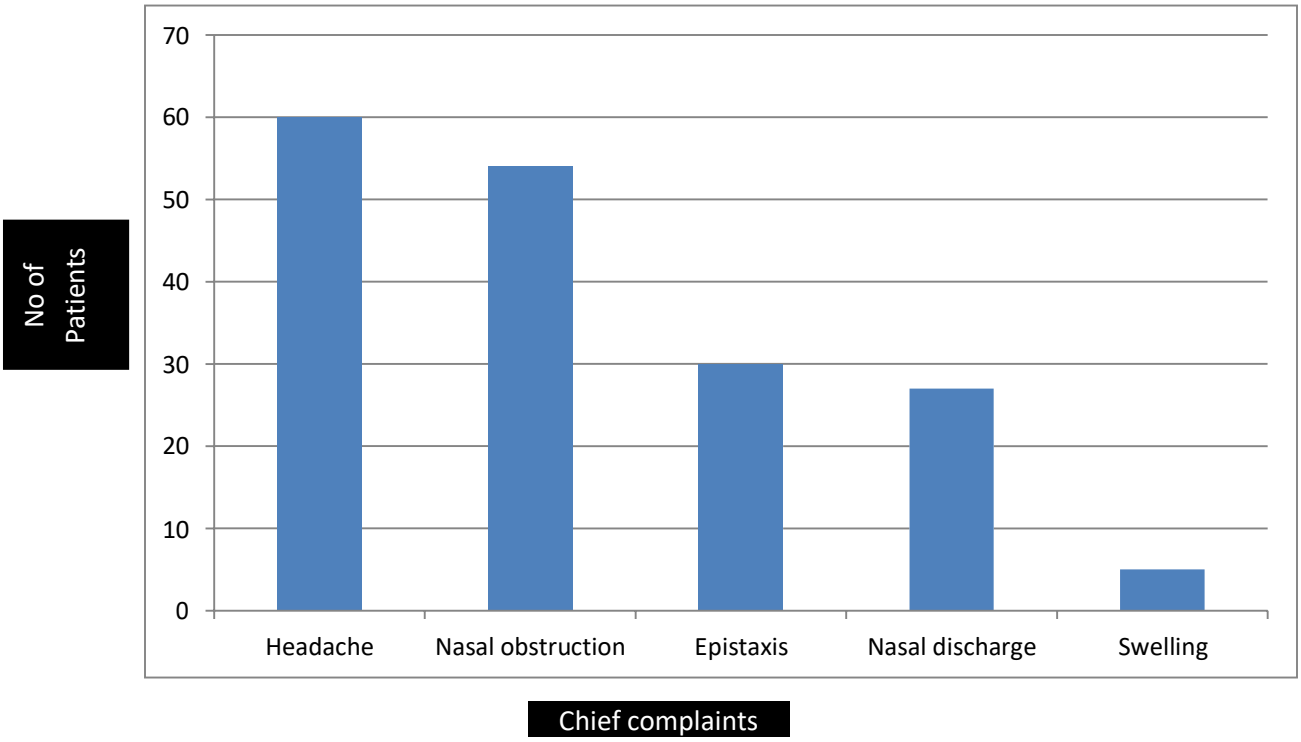

Table 4: Sinus Diseased

The maxillary sinus was shown to be the most often affected sinus in this investigation, followed in descending order by the posterior ethmoid, anterior ethmoid, frontal, and sphenoid sinuses.

Sinus	Number of Patients (n=93)	Percentage
Maxillary	85	92%
Posterior ethmoid	70	75%
Anterior ethmoid	67	72%
Frontal	38	41%
Sphenoid	23	25%

Graph 4: Sinus Diseased

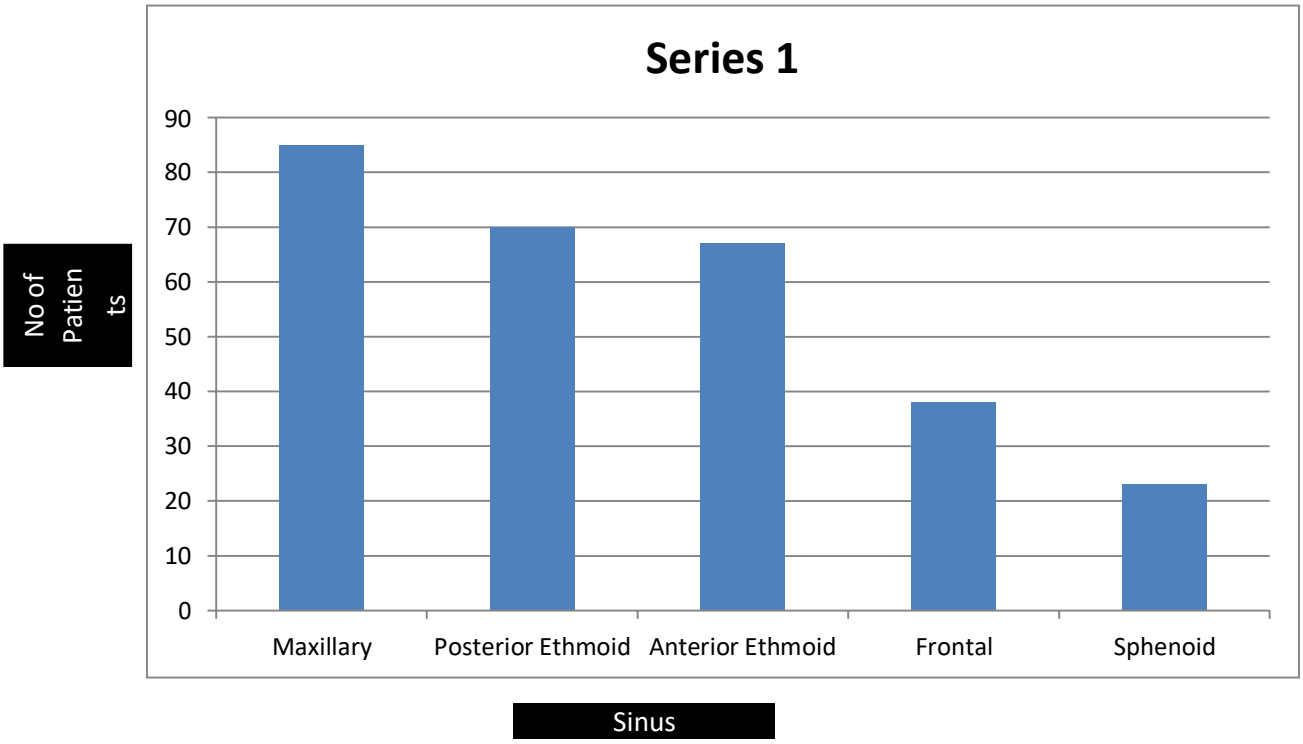

Table 5 :CT Findings

HPR	Number (n=93)	Percentage
Fungal sinusitis	43	46.2%
Inflammatory polyp	28	30.4%
Angiofibroma	10	10.7%
Mucocele	9	10.7%
Squamous cell carcinoma	3	2%

Graph 5: Histopathological Reports

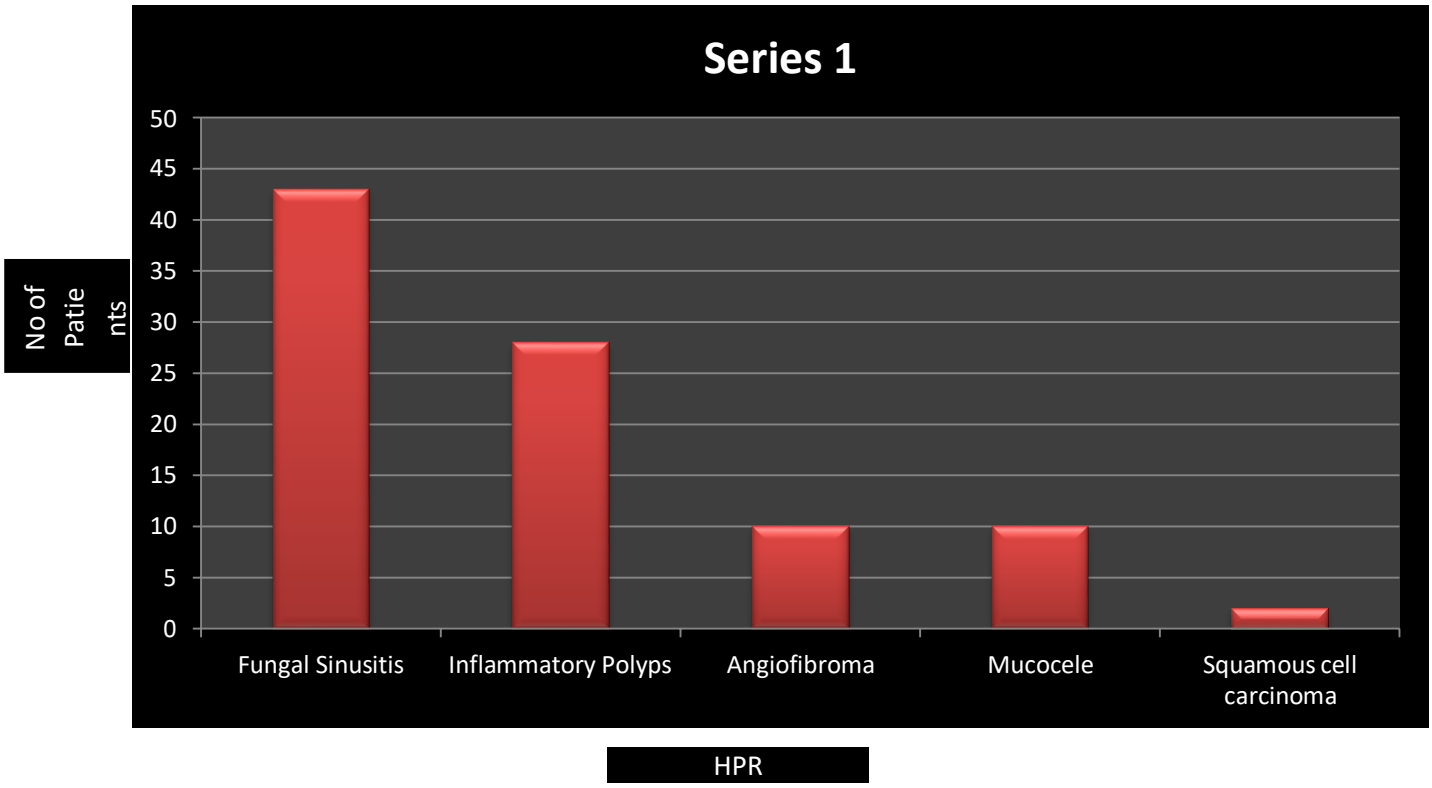

Table 6: Comparison of CT findings and HPR findings

Findings	CT		HPR (n = 93)	
	No	%	No	%
Fungal sinusitis	43	46.2%	35	37.6 %
Polyp	28	30.4%	26	27.9%
Angiofibroma	10	10.7%	9	9.6%
Mucocele	9	10.7%	8	8.6%
Other Neoplasms	3	3.2%	3	3.2%

Table 7a : Correlation of CT with HPR Findings - an Observation

Parameters	True Positive	False positive	False negative	True Negative
Fungal sinusitis	35	8	0	50
Polyp	26	2	0	65
Angiofibroma	9	1	0	83
Mucocele	8	1	0	84
Other Neoplasms	3	0	0	90

Table 7b : Correlation of CT with HPR Diagnosis -an evaluation

Parameters	Sen (%)	SPp (%)	PPV (%)	NPV	Accuracy	P value
Fungal sinusitis	100	86.21	81.4	100	91.4	0.000
Polyp	100	97.01	92.86	100	97.85	0.000
Angiofibroma	100	98.81	90	100	98.92	0.000
Mucocele	100	98.82	88.89	100	98.92	0.000
Other Neoplasms	100	100	100	100	100	0.000

DISCUSSION

Recent research by several authors has found that MDCT is the best imaging technique for displaying everything from mild inflammatory conditions to malignant neoplasms in the paranasal sinuses. Plain X-ray and MDCT exhibit weak association, according to prior studies. Plain films are no longer recommended for assessing PNS illnesses since they are unreliable.

Clinical examination is used to assess acute sinus infections, and MDCT is then utilised to investigate recurrent and chronic sinus disease. Plain radiographs are unable to analyse the complex osteo-meatal architecture, which is assessed by MDCT.

Study was conducted to assess the relationship between the histo-pathological findings of the para-nasal sinuses and the CT findings. After receiving a referral from a clinical examination and doing an MDCT evaluation on 93 patients, histo-pathology reports were compared.

Age of incidence (years):

The patients in the current study ranged in age from 15 to 79 years, with 30 out of the 93 cases having the highest number of casesranging from 31 and 40 years.

Our research is consistent with a study conducted in India in 2000 by Vekatachalan et al., who used computer tomography to examine 210 consecutive sinusitis cases. The patients' ages ranged from 7 to 66, with the majority being in the 31 to 40 age bracket, which is similar to my study's sample size. In a similar vein, 104 consecutive cases of panasal diseases were investigated by Gliklich et al. in 2004. The mean age was 41.2 years, with a range of 15 to 73 years. [48]

Sex distribution (%):

In our study about 48.4% were males and 51.6 % were females.

Similar results were found in a study by Sanjeev M. et al. (2016), which included 100 patients and had a 49% female predominance and a slightly higher 51% male predominance. A study on sinusitis by Venkatachalan et al. (2000) found a small male prevalence of 58% and a female predominance of 42%.

Symptoms:

In our study, headache was the most common patient complaint (55.9%), then nasal obstruction (50.6%), epistaxis (28%) and nasal discharge (25.2%) in that order. Facial swelling was the least common complaint (4.7%).

The patients also displayed face pain and dyspnea as additional symptoms. We did not include patients who had previously experienced head or maxillofacial injuries in our study.

Similar findings were found in a study by Nair et al. (2015) in which 100 sinusitis patients underwent CT. Of those patients, 49% had nasal discharge, which was one of the most prevalent symptoms. [49]

In 147 and 183 cases, respectively, the most prevalent symptoms in a research by Venkatachalan (2000) et al. were headache and nasal obstruction.

Fungal sinusitis:

In our study the total number of cases (HPR proven) of fungal sinusitis was 35 out of 93 cases (46.2 %).

According to our study, calcification was present in 25% of instances of fungal sinusitis, which is consistent with research by Jagan v et al (2016). [50]

The most common pitfall while using CT to diagnose PNS illnesses is fungal sinusitis. In our study, 43 patients were examined, of which 35 (81%) had accurate diagnoses and the rest had incorrect diagnoses based on CT scans. When using CT to identify fungus-related sinusitis, the sensitivity and specificity were both % respectively.

In the literature, Zenreich SJ et al. (2006) reported a sensitivity of 76% for fungal infections.

There were a few reported cases asfalse positives as the attenuation is also increased in cases of inspissated secretion, bacterial infection, calcification & other processes. False negatives are seen because some will not exhibit a density increase. However, CT is crucial for determining the extent of fungal sinusitis's invasiveness, including whether it has migrated to nearby structures or has eroded or destroyed bone.

Polyp:

After sinusitis, the number of patients (HPR confirmed) with polyp in our study was 26 out of 93 cases (30.4%), making it the second most frequent pathology. Antrachoanal polyps, which were discovered in 20 cases in patients between the ages of 21 and 40, were the most prevalent polyps, while ethmoidal polyps were discovered in 6 cases in patients above the age of 40.

R N. Das et al. (2014) reported similar findings, reporting 35 cases of polyp. An antrachonal polyp was discovered in 15 of the patients, the majority of whom were younger patients. However, ethmoidal polyps were most frequently discovered in this study, perhaps because a larger proportion of older age groups were included.

Neoplasms:

The total number of neoplasms in our investigation was 3, of which 2 were epithelial tumours and 1 was non-epithelial. The maxillary sinus and ethmoid sinus were the two sinuses in our study that were affected by malignancies.

A similar study by Saurabh et al (2016)conducted a study of occurrence of paranasal sinuses tumors in Karnataka.

Similar to this, Khan et al. (2006) [51]stated that the most prevalent malignancy observed in the study was squamous cell carcinoma, which accounted for 37.5% (13) of all the malignancies analysed. Squamous cell carcinoma was the most common malignancy diagnosed in the study.

Langomn et al (2010)[52] reported that 60 % of the malignancies occur in the maxillary sinus.

One case of fibrous dysplasia of the maxillary sinus was identified in our study with diagnostic accuracy of 100%.

J Philips et al (2015) [53] reported that fibrous dysplasia is the most common fibro-osseous lesions.

In our study, 2 cases of juvenile nasal angiofibroma were diagnosed, both were males presenting with nasal obstruction and epistaxsis.

When examining benign tumours of the paranasal sinuses, K Narayana S et al. (2004) [54] found that juvenile nasal angiofibroma was the most prevalent benign tumour (26.66%) in the nose and paranasal sinuses in 30 individuals, which is similar to our study.

CT and HPR correlation:

When the comparison table is viewed, the relationship between the CT diagnosis and HPR may be observed.

For fungal sinusitis, CT had a sensitivity of 100% and a specificity of 86.21%.

When the CT diagnosis is correlated with the HPR data, polyps have a sensitivity of 100% and a specificity of 97.01%.

For Angiofibromas, CT shows sensitivity of 100% and specificity of 98.81%.

Similarly for Mucoceles, CT showed sensitivity of 100% and specificity of 98.82%.

For diagnosing various other benign and malignant lesions, CT offers 100% sensitivity, specificity, positive predictive value, negative predictive value, and accuracy.

In each instance, the P value is less than 0.001, demonstrating the significance of the findings. This high sensitivity and specificity for benign and malignant masses may have emerged as a result of the small number of masses evaluated.

In order to diagnose and add significant findings for the better management of patients with paranasal sinus diseases, CT is crucial.

CONCLUSION

When imaging the paranasal sinuses to assess chronic illnesses and their accompanying consequences, CT is the imaging method of choice.

CT may fail to distinguish between fungus-induced sinusitis and thick secretions. However, in people who are not at risk, a CT scan may indicate fungal sinusitis.

CT is the preferred imaging technique for assessing bone erosion or degeneration.

Planning the patient's future care often benefits from a CT examination of the PNS in symptomatic patients.

The PNS diseases' progression and involvement of nearby structures can all be staged using CT.

CT does, however, have certain potential downsides and drawbacks, such as complex projections, artefacts brought on by extremely dense structures in and around the PNS, motion artefacts, and limited soft tissue distinction. Even radiation exposure during a CT exam has a limit on how frequently it may be used, how often it can be repeated, and how it can be used on minors and pregnant women.

Due to these factors, MRI is playing a bigger part in several of these fields. With an equivalent spatial resolution, the soft tissue contrast discrimination is better than with CT images. Additional benefits of MRI include the lack of ionising radiation, the capacity to image in any plane without losing spatial resolution, the ability to show vasculature without the use of contrast agent, and the relative lack of artefacts when compared to CT.

Both CT and MRI have their own relevance and play complementary roles to each other in diagnosing the diseases of paranasal sinuses due to their distinctive qualities for better depicting bone details and soft tissue contrast, respectively.

SUMMARY

This hospital-based cross-sectional study included 93 patients with symptoms of sinusitis who had paranasal sinus CT imaging in both the coronal and axial regions, followed by histo-pathological correlation.

Majority of the patients were in the range of second to fourthdecades of their life with male:female ratio of 1.07.

Headache was the most frequent complaint they reported, followed by nasal blockage, epistaxis, and nasal discharge.

The most frequent type of inflammation found in patients with CT PNS was fungal sinusitis.

When used to diagnose fungal sinusitis, CT had a sensitivity and specificity of 77.8% and 97.9%, respectively. However, there was excellent sensitivity and specificity for the detection of polyps.

Because there were less aggressive or malignant lesions evaluated in this study, CT had the best statistical findings in evaluating neoplastic lesions. On the other hand, the poor clinical evaluation of these lesions suggests that a CT scan is essential for diagnosing paranasal sinus disorders and for checking for any bone erosion or destruction that could affect nearby structures.

The real benefit of CT is in pinpointing the precise location, size, and involvement of the lesion and surrounding structures.

This study demonstrated the advantages of CT evaluation over clinical evaluation of symptomatic patients for the diagnosis and management planning of paranasal sinus disorders.

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APPENDIX-VI

CONSENT FORM

EVALUATION OF SINO-NASAL DISEASES BY MDCT AND TO CORRELATE HISTO-PATHOLOGICAL FINDINGS

GUIDE : DR. SHIVANAND.V.PATIL

P.G. STUDENT : DR. SHAURYA KAUSHAL

PURPOSE OF RESEARCH:

I have been informed that the purpose of this study is Evaluation Of Sino-Nasal Diseases By MDCT And ToCorrelate Histo-Pathological Findings

PROCEDURE:

I understand that I will undergo history, clinical examination, CT scanning and histopathological examination

RISKS AND DISCOMFORTS:

I understand that there is no risk involved in the above study.

BENEFITS:

I understand that my participation in this study will help to assess the Evaluation Of Sino-Nasal Diseases By MDCT And To Correlate Histo-Pathological Findings

CONFIDENTIALITY:

I understand that the medical information produced by the study will become a part of hospital record and will be subjected to confidentiality and privacy regulations of hospital. If the data is used for publications the identity of the patient will not be revealed.

REQUEST FOR MORE INFORMATION:

I understand that I may ask for more information about the study at any time.

REFUSAL OR WITHDRAWL OF PARTICIPATION:

I understand that my participation is voluntary and I may refuse to participate or withdraw from study at any time

INJURY STATEMENT:

I understand in the unlikely event of injury to me during the study I will get medical treatment but no further compensations. I will not hold the hospital and its staff responsible for any untoward incidence during the course of study.

Date:

Dr. Shivanand.V. Patil(Guide)Dr.Shaurya Kaushal(Investigator)

STUDY SUBJECT CONSENT STATEMENT:

I/my ward confirm that Dr. Shaurya Kaushal has explained to me the purpose of this research, the study procedure that I will undergo and the possible discomforts and benefits that I may experience, in my own language.

I/my ward have been explained all the above in detail in my own language and I understand the same. Therefore I agree to give my consent to participate as a subject in this project.

_____ _____

(Participant) Date

_____ _____

(Witness to above signature) Date

CASE PROFORMA

1. Name:

2. Age/Sex

3. Hospital No.:

4. Relevant complaints &history:

5. CT Findings:

6.Radiological Diagnosis.

7.Histo-pathological examination findings:

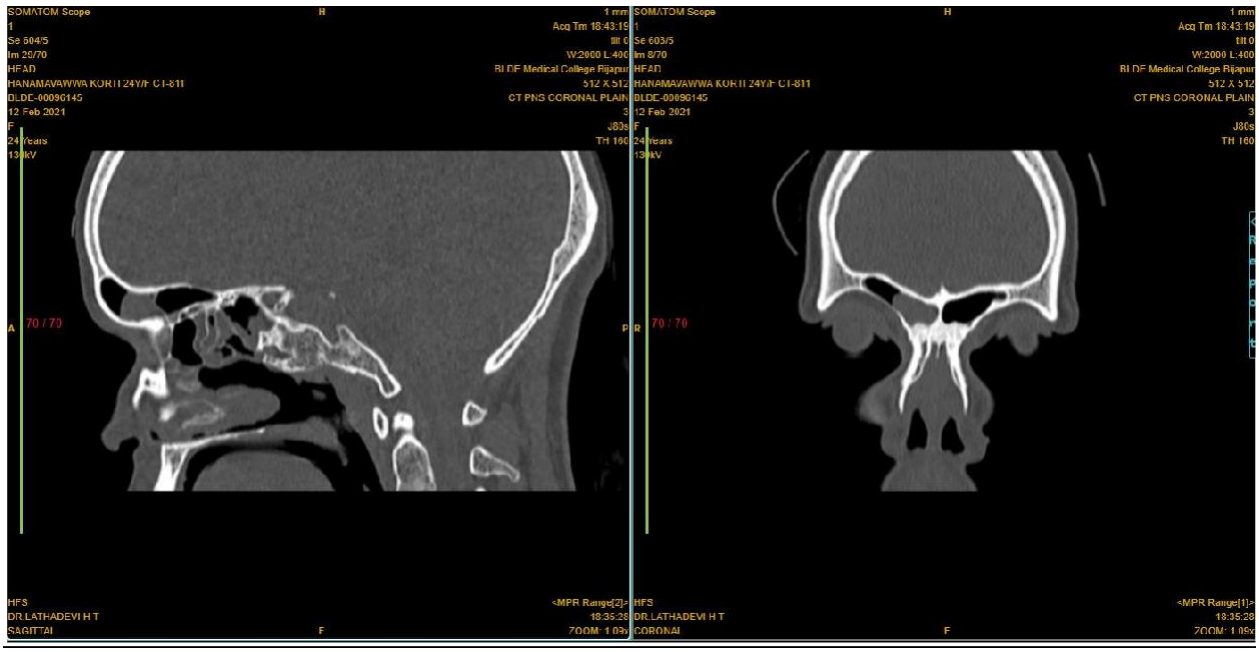
MASTER CHART

S. No	Age	Gender	Chief Complaints	Frontal	Ethmoid	Maxillary	Sphenoid	CT Fungal Sinusiti	CT Inflammatory polyp	CT Angiofibroma	CT Mucocele	CT Other Neoplasm	HPR (Fungal Sinusiti	HPR (Inflammatory Polyp	HPR (Angiofibroma	HPR (Mucocel	HPR (Other Neoplasms)
1	36	F	Nasal Obstruction, Epistaxis, Discharge	B/L	B/L	LT	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
2	38	F	Headache	Absent	Absent	RT	B/L	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
3	25	F	Headache	B/L	Absent	B/L	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
4	75	M	Headache	Absent	B/L	LT	LT	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
5	50	F	Epistaxis	RT	LT	B/L	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
6	29	M	Headache	Absent	B/L	LT	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
7	46	M	Headache	Absent	RT	RT	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
8	28	M	Nasal Obstruction, Epistaxis	B/L	LT	LT	B/L	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent
9	45	F	Headache, Epistaxis	Absent	B/L	B/L	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
10	47	F	Nasal Obstruction, Epistaxis	RT	RT	RT	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
11	20	M	Headache,Epistaxis	B/L	Absent	LT	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent
12	39	F	Nasal Obstruction, Epistaxis	RT	LT	B/L	LT	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
13	22	F	Headache	Absent	RT	RT	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent
14	44	F	Headache	Absent	RT	B/L	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
15	40	F	Nasal Obstruction	B/L	B/L	RT	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent
16	40	M	Headache, Nasal Obstruction	Absent	LT	RT	B/L	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
17	16	M	Headache, Nasal Obstruction, Epistaxis	RT	Absent	LT	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
18	49	F	Nasal Obstruction, Epistaxis	RT	LT	B/L	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent
19	33	F	Nasal Obstruction, Epistaxis, Discharge	Absent	B/L	RT	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
20	38	F	Headache	B/L	LT	LT	B/L	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent
21	28	F	Headache, Nasal Obstruction, Epistaxis	Absent	LT	B/L	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
22	49	M	Nasal Obstruction, Discharge	B/L	B/L	RT	LT	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
23	30	F	Nasal Obstruction, Discharge	Absent	RT	B/L	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
24	39	F	Headache	RT	Absent	LT	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent
25	38	M	Nasal Obstruction, Epistaxis	RT	RT	B/L	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
26	19	F	Headache	B/L	Absent	RT	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent
27	32	F	Headache	Absent	RT	B/L	LT	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
28	45	M	Headache	Absent	RT	RT	Absent	Absent	Present	Absent	Absent	Present	Absent	Present	Absent	Absent	Absent
29	29	F	Headache, Epistaxis, Discharge	B/L	LT	RT	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
30	32	F	Headache, Nasal Obstruction, Epistaxis	RT	Absent	B/L	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
31	19	F	Headache	Absent	RT	B/L	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent
32	33	F	Headache	Absent	RT	RT	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
33	39	M	Headache	B/L	B/L	RT	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent
34	20	M	Headache, Epistaxis, Discharge	Absent	LT	B/L	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
35	36	F	Headache, Nasal Obstruction, Epistaxis	Absent	Absent	RT	Absent	Present	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
36	23	M	Headache	Absent	B/L	LT	B/L	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
37	31	F	Headache	Absent	Absent	B/L	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent	Absent	Absent
38	41	M	Headache	B/L	RT	LT	RT	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
39	48	F	Headache	Absent	LT	B/L	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent
40	37	F	Headache	Absent	Absent	LT	LT	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
41	30	M	Headache, Nasal Obstruction, Discharge	Absent	RT	RT	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
42	34	M	Headache	Absent	LT	B/L	LT	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent

43	22	F	Headache, Nasal Obstruction, Discharge	B/L	RT	LT	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
44	46	F	Headache	Absent	Absent	B/L	RT	Present	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
45	24	M	Headache, Nasal Obstruction, Epistaxis	B/L	Absent	RT	Absent	Present	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
46	66	M	Nasal Obstruction, Epistaxis, Discharge	Absent	LT	LT	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
47	26	M	Headache, Discharge	Absent	RT	B/L	B/L	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
48	78	F	Discharge	Absent	B/L	RT	Absent	Absent	Present	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
49	20	M	Nasal Obstruction, Epistaxis, Discharge	Absent	Absent	B/L	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
50	36	M	Headache, Discharge	Absent	B/L	LT	RT	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
51	21	M	Headache, Discharge	Absent	LT	B/L	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent
52	34	M	Nasal Obstruction, Epistaxis	Absent	Absent	LT	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
53	23	F	Headache, Nasal Obstruction	LT	RT	RT	RT	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
54	72	F	Nasal Obstruction, Epistaxis, Swelling	Absent	RT	B/L	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
55	28	M	Headache, Nasal Obstruction	Absent	LT	LT	Absent	Absent	Present	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
56	47	F	Nasal Obstruction, Epistaxis	B/L	Absent	B/L	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
57	19	F	Headache, Nasal Obstruction	Absent	LT	LT	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
58	34	M	Nasal Obstruction, Epistaxis, Swelling	Absent	RT	B/L	RT	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Present
59	29	M	Headache, Nasal Obstruction	B/L	Absent	RT	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
60	44	F	Nasal Obstruction, Epistaxis	Absent	LT	LT	Absent	Present	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
61	35	M	Headache, Nasal Obstruction	RT	B/L	B/L	RT	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
62	74	M	Nasal Obstruction, Epistaxis, Discharge	LT	RT	LT	Absent	Absent	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Present
63	39	M	Headache, Nasal Obstruction	Absent	LT	B/L	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
64	58	M	Nasal Obstruction, Discharge, Swelling	RT	Absent	RT	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent
65	26	F	Headache	Absent	LT	B/L	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
66	33	M	Headache, Nasal Obstruction, Epistaxis	Absent	Absent	LT	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent	Absent	Absent	Absent
67	26	M	Headache	RT	RT	Absent	RT	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
68	68	M	Nasal Obstruction, Discharge	Absent	Absent	B/L	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
69	15	M	Headache, Nasal Obstruction, Discharge	Absent	Absent	RT	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
70	55	M	Nasal Obstruction, Discharge	RT	RT	LT	B/L	Present	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
71	32	M	Headache, Nasal Obstruction, Discharge	LT	RT	B/L	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
72	30	F	Headache, Nasal Obstruction	Absent		RT	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent
73	60	F	Nasal Obstruction, Discharge	B/L	B/L	LT	B/L	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
74	24	M	Headache	Absent	LT	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
75	60	F	Nasal Obstruction, Discharge	LT	B/L	LT	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
76	60	F	Headache, Nasal Obstruction, Swelling	Absent	LT	LT	LT	Absent	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Present
77	58	F	Headache	Absent	B/L	B/L	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
78	40	M	Nasal Obstruction, Epistaxis	RT	B/L	B/L	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent
79	16	M	Headache, Nasal Obstruction	Absent	LT	Absent	B/L	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
80	65	F	Headache	LT	B/L	RT	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
81	40	M	Nasal Obstruction, Discharge	LT	LT	B/L	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
82	29	M	Headache, Nasal Obstruction, Epistaxis	Absent	LT	RT	Absent	Present	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
83	54	F	Nasal Obstruction	RT	B/L	B/L	B/L	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
84	33	M	Headache	Absent	LT	LT	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
85	39	M	Nasal Obstruction	RT	Absent	B/L	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent
86	23	F	Headache, Nasal Obstruction	Absent	B/L	LT	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
87	57	F	Nasal Obstruction, Discharge	LT	LT	B/L	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
88	33	M	Headache	Absent	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
89	38	F	Nasal Obstruction, Discharge	RT	RT	LT	Absent	Present	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
90	40	F	Headache	LT	B/L	B/L	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
91	68	F	Nasal Obstruction, Discharge, Swelling	Absent	LT	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent
92	27	M	Headache	LT	RT	LT	Absent	Absent	Present	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
93	26	M	Nasal Obstruction, Discharge	Absent	RT	Absent	Absent	Present	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent

IMAGE GALLERY

Case 1: Frontal Sinus Polyp

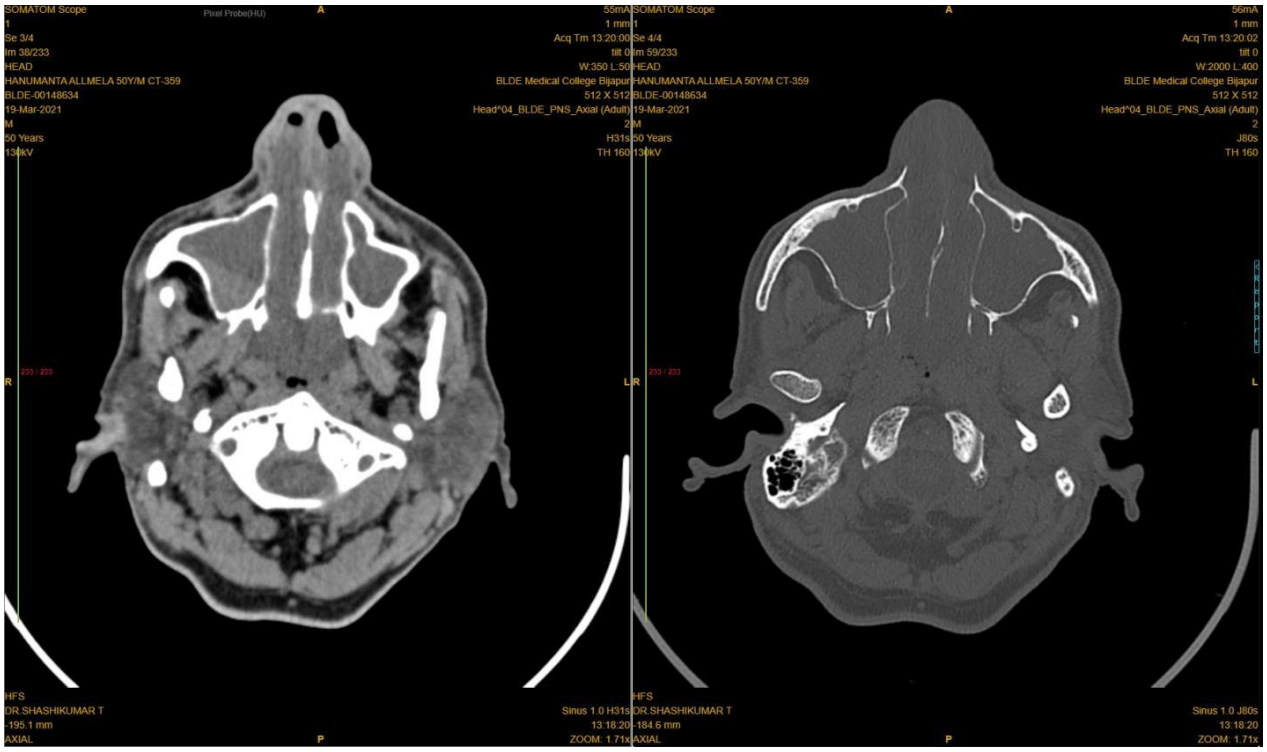


Above is a case of a 24 year old female who presented with facial swelling.

On CT, a well definedpolypoidal mass along with mucosal thickening in bilateral ethmoid, sphenoid and bilateral maxillary sinuses with soft tissue in bilateral nasal cavities was diagnosed.

The diagnosis of a polyp was made on CT which was proven on HPR.

Case 2: Sino-Nasal Polyposis

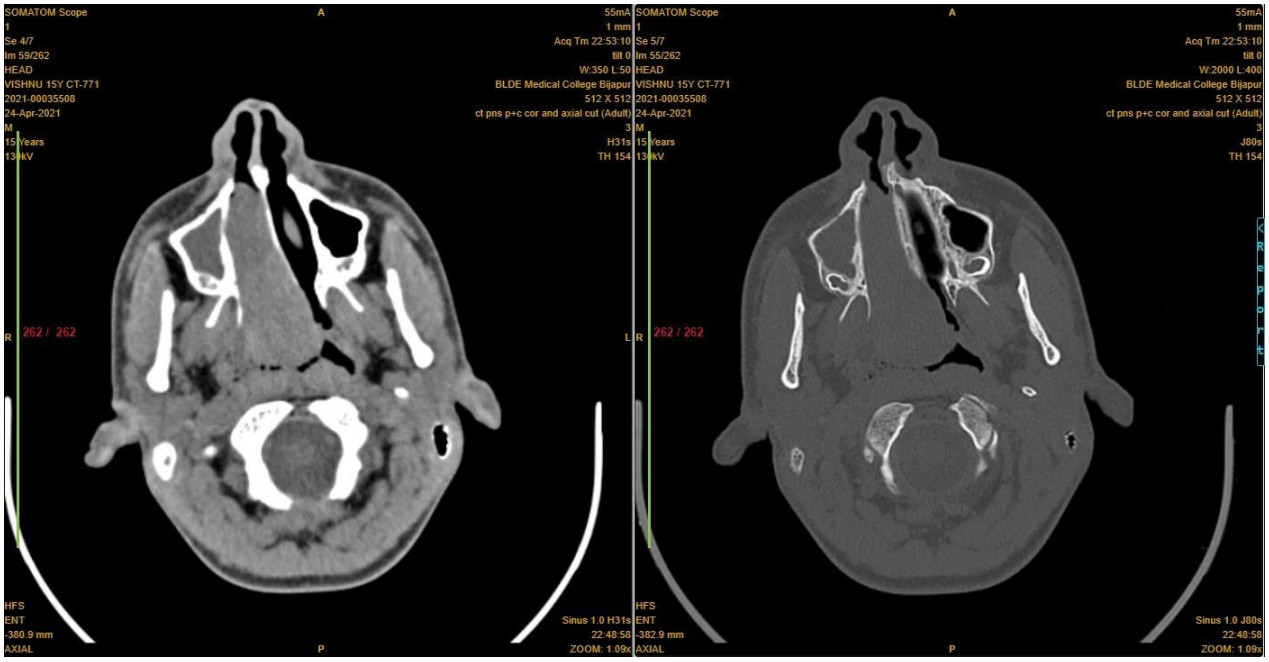


Above is a case of a 50 year old male with nasal obstruction and epistaxis

On CT, soft tissue density content involving the bilateral maxillary, frontal, ethmoidal and sphenoid sinuses entering to bilateral nasal cavities causing widening and obliteration of bilateral ostiomeatal complexes with few hyperdensities and benign bony remodelling was noted.

The diagnosis of Sino-Nasal Polyposis was made on CT which was proven on HPR

Case 3: Juvenile Nasal Angiofibroma

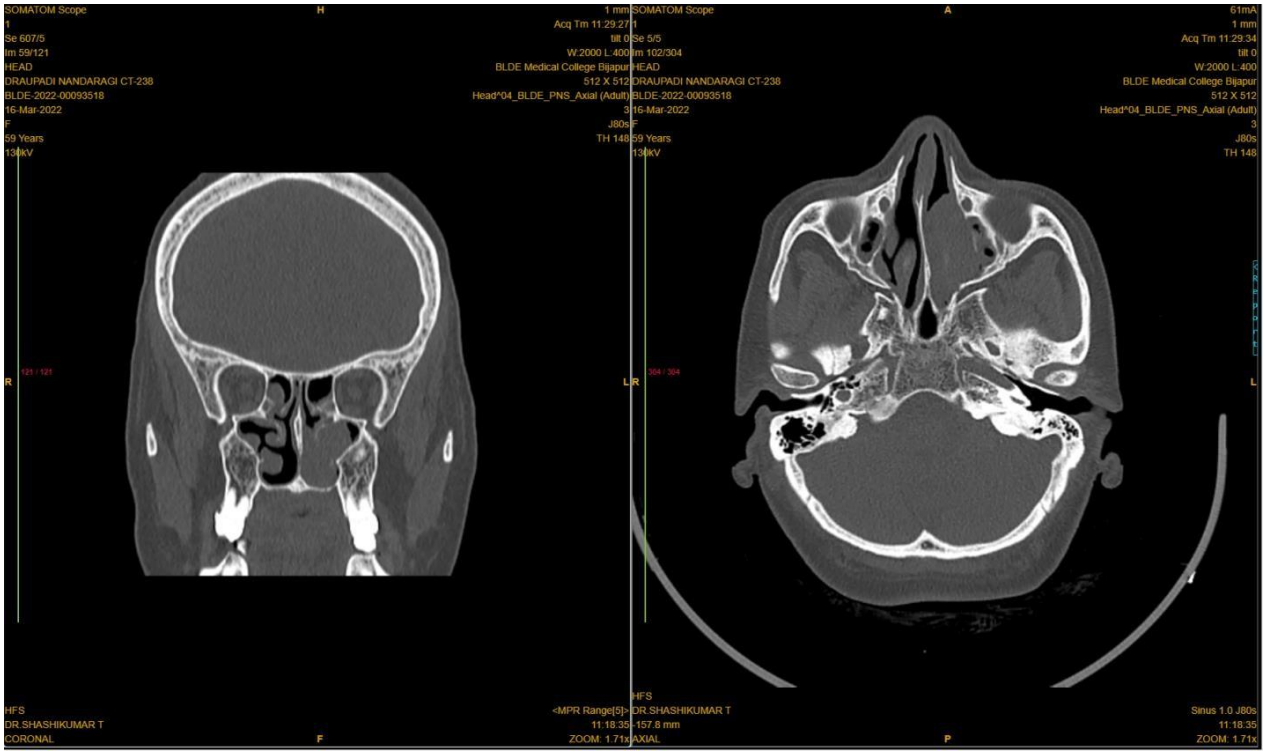


A 15 year old male boy presented with complains of epistaxis and facial swelling.

On CT , right nasopharyngeal mass is seen. It is completely obliterating the right nasopharyngeal airway. Medially it is abutting nasal septum, laterally extending to maxillary sinus, cranially to sphenoid and ethmoid sinuses and anteriorly in right nasal cavity. It is causing widening or right pterygopalatine fossa and pterygomaxillary fissure. The involved sinuses are distended and thinned. No destruction noted.

A diagnosis of Juvenile Nasal Angiofibroma was made on CT which was proven on HPR.

Case 4: Left Maxillary Antro-Choanal Polyp

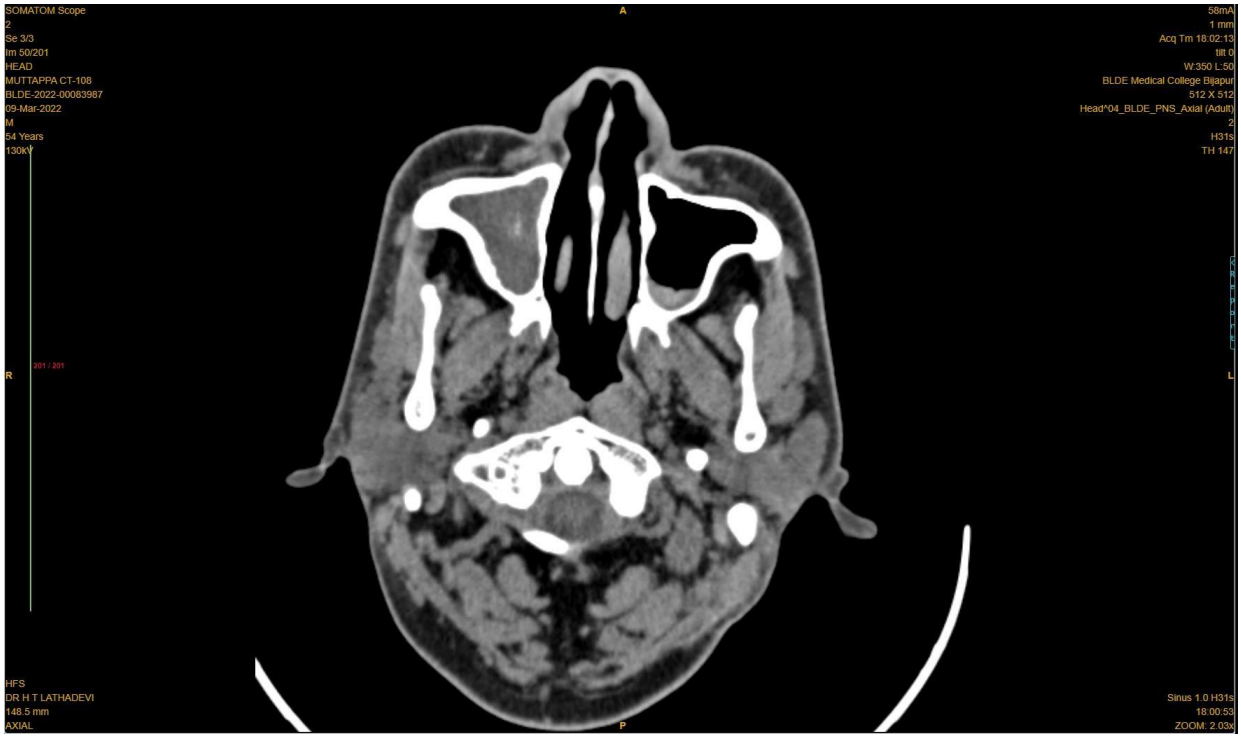


A 59 year old female presented with complains of nasal obstruction.

On CT, polypoidal mucosal thickening invovling the left maxillary sinus, left nasal cavity, middle turbinate and extending to posterior nasopharynx.

A diagnosis of polyp was made on CT which was proven on HPR.

Case 5: Fungal Sinusitis

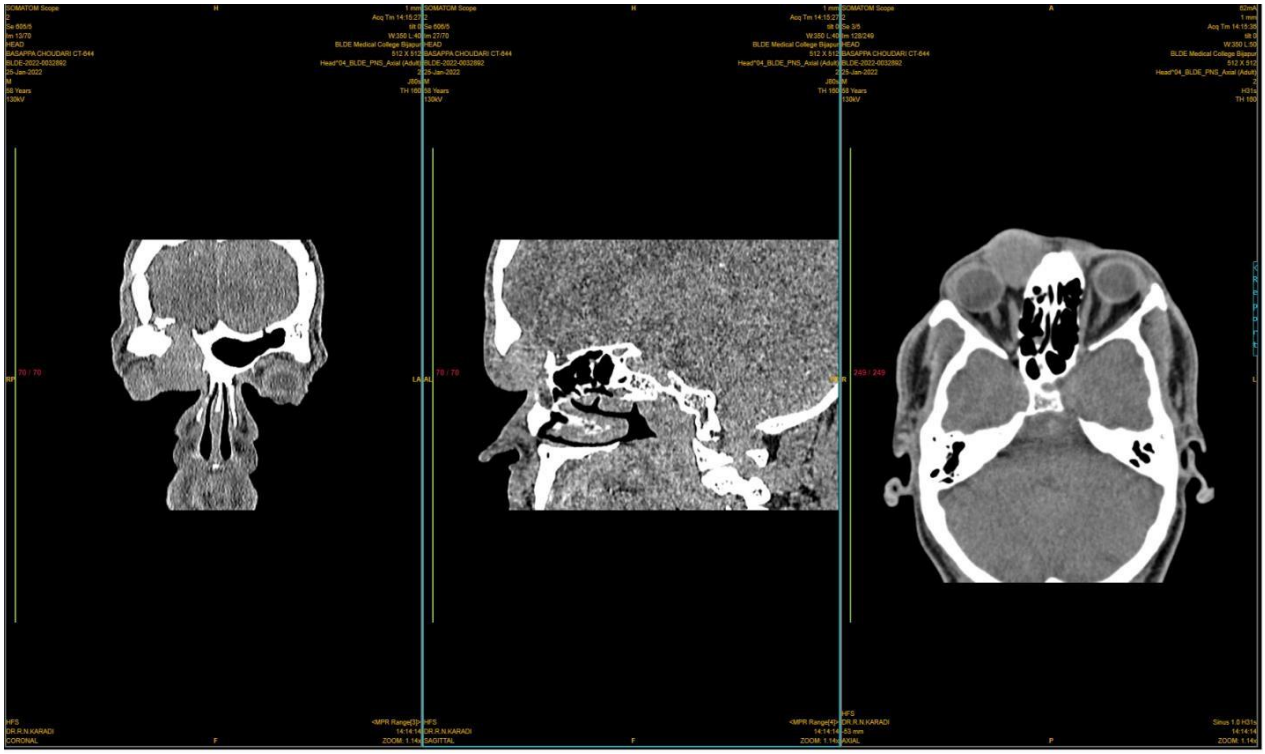


A 54 year old male presented with complains of headache and nasal obstruction.

On CT, heterogenous mucosal hypertrophy with few hyperdensities are seen in both maxillary, left anterior ethmoid, frontal sinus midline. Minimal rarefractions/erosions noted in maxilla in midline & alveolar margins on right side.

A diagnosis of fungal sinusitis was made on CT which was proven on HPR.

Case 6: Frontal Sinus Mucocele

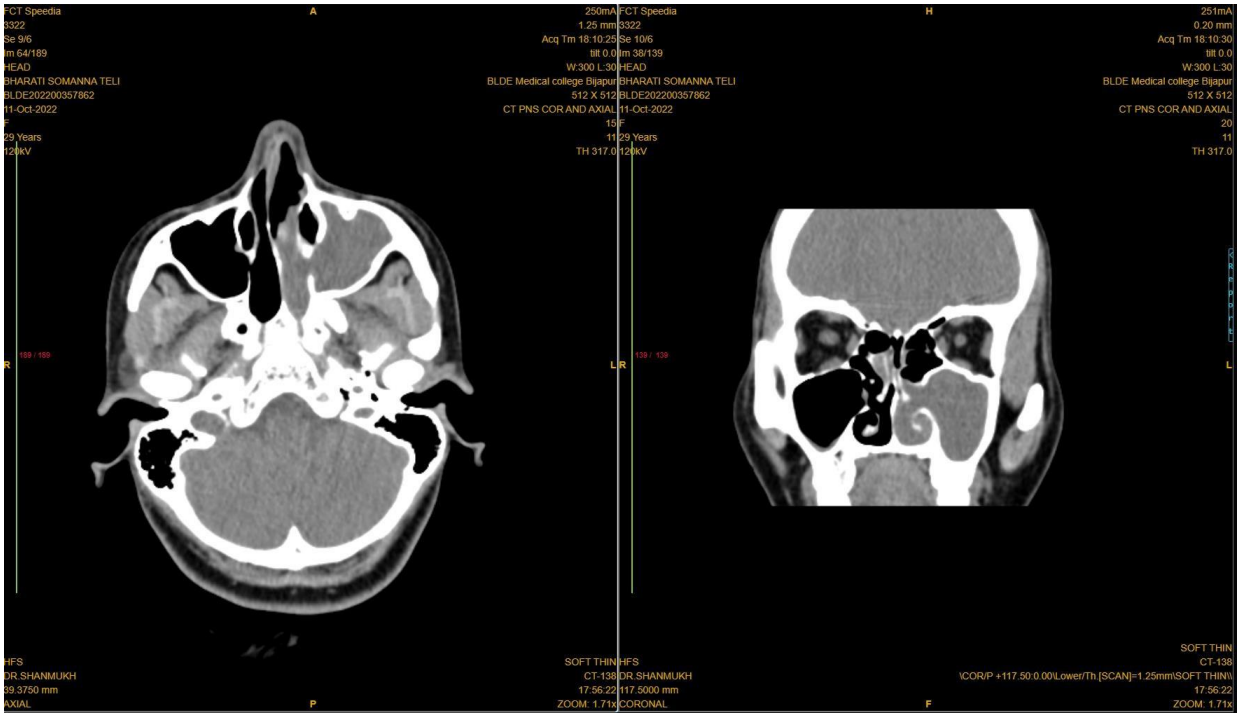


A 58 year old male presented with headache and swelling over frontal region.

On CT, a relatively well defined soft tissue density lesion in the right frontal sinus, inferiorly extending into the medial extra conal compartment of the right eye causing mass effect on the right eye ball and displacing it inferiorly.

A diagnosis of Frontal Sinus Mucocele was made on CT which was proven on HPR.

Case 7: Left Maxillary Sinus Antrochoanal Polyp

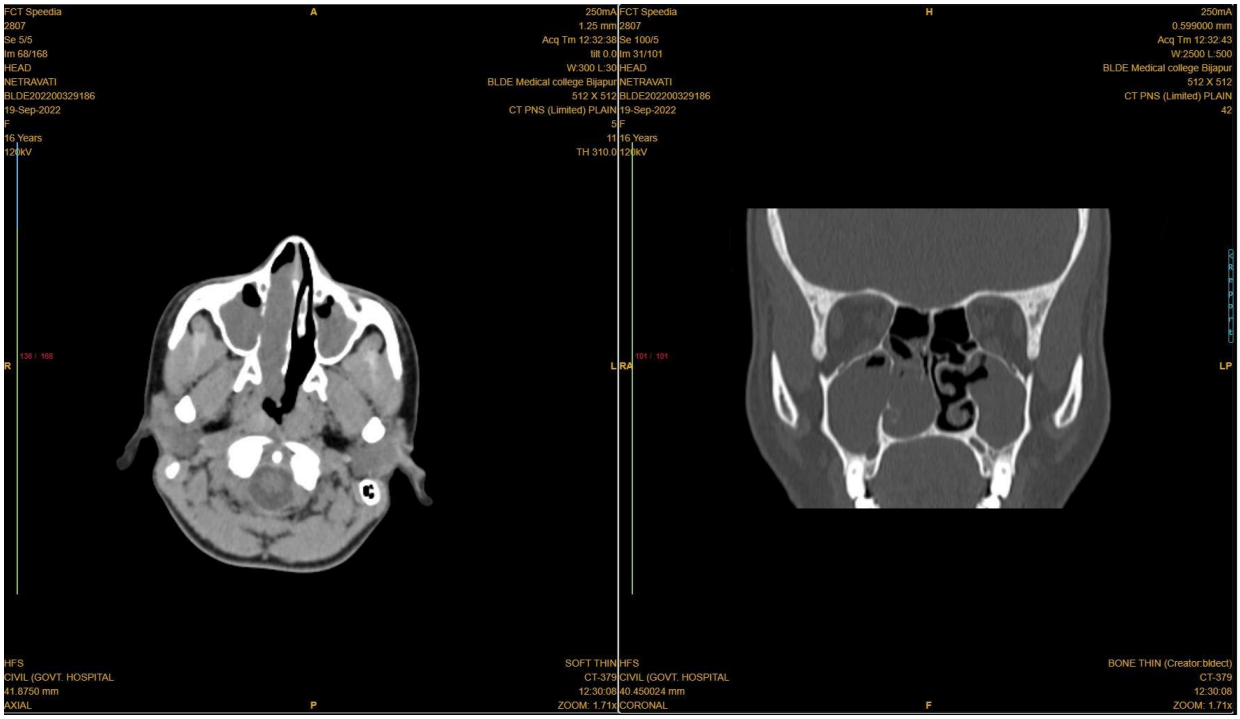


A 29 year old female presented with nasal obstruction and discharge.

On CT, diffuse soft tissue opacification of left maxillary sinus causing obliteration of left osteomeatal complex and widening of maxillary ostium, seen extending in the left nasal cavity and into nasopharynx on the left side.

A diagnosis of polyp was made on CT which was proven on HPR.

Case 8: Right Maxillary Sinus Antrochoanal Polyp

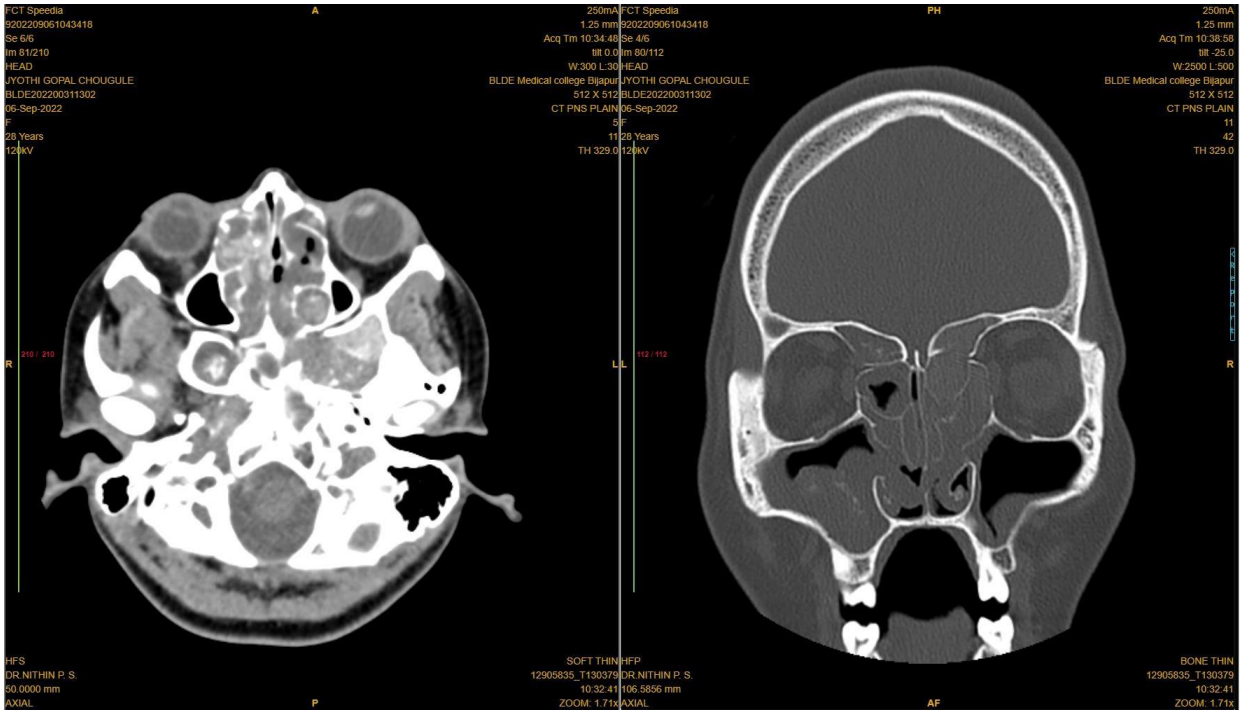


A 16 year old female presented with nasal obstruction and discharge.

On CT, homogenously opacified right maxillary sinus with widening of right maxillary ostium extending through the ostium into the nasal cavity causing obstruction of the middle meatus.

A diagnosis of polyp was made on CT which was proven on HPR.

Case 9:Fungal Sinusitis

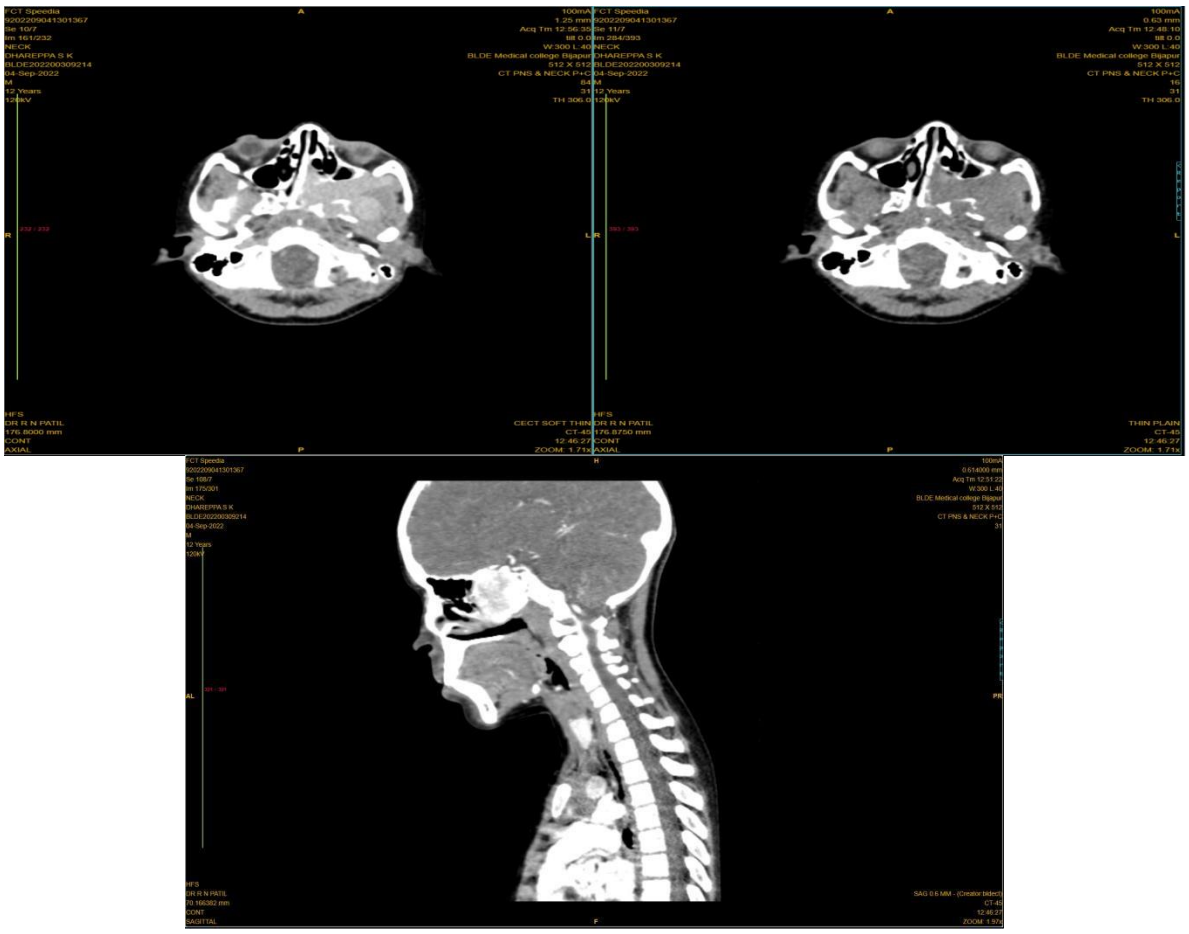


A 28 year old female presented with complains of headache and nasal obstruction.

On CT, diffuse extensive marked mucosal thickening and total soft tissue opacification of the sphenoid and frontal sinuses, left maxillary antrum as well as the ethmoidal complexes on both sides, that appears merging with the nasal turbinates and almost totally obliterating the nasal cavities. Soft tissue window images show hyperdense material within the nasal cavity.

A diagnosis of Fungal Sinusitis was made on CT which was proven on HPR.

Case 10: Nasopharyngeal Angiofibroma

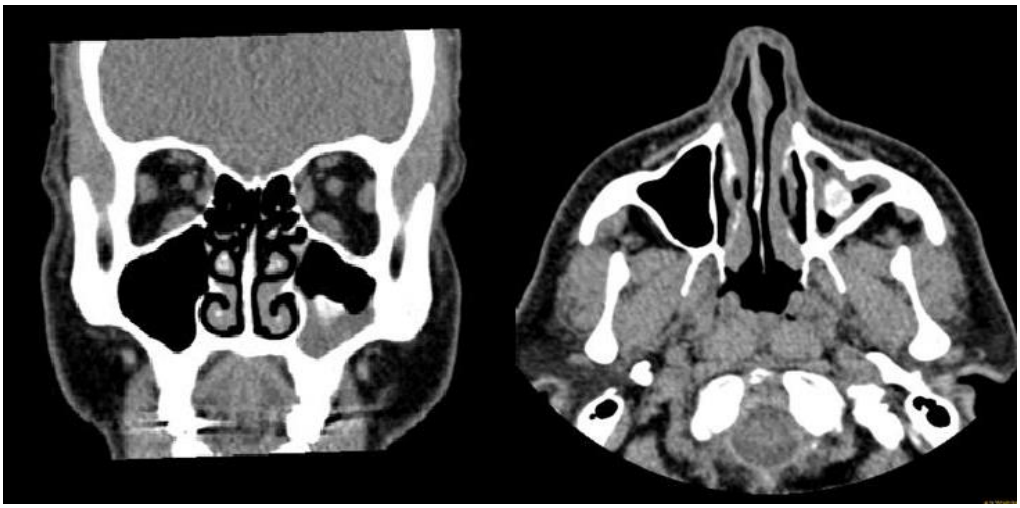


A 17 year old boy presented with complains of epistaxis, facial swelling and headache.

On CT, an ill defined soft tissue density lesion involiving nasopharynx and left nasalcavity extending to involve left pterygomaxillary fissure and sphenopalatine foramen with large superomedial extension into bilateral sphenoid sinus, left maxillary sinus and inferolateral extension into the left infratemporal fossa through pterygomaxillary fissure.Superiorly the lesion is extending to involve the pituitary fossa, left cavernous sinus and left optic canal causing its widening. It is causing significant erosion of Planum sphenoidale, superior ,left lateral wall of sphenoid sinus.Destruction of inferior wall of left sphenoid sinus, posterior wall of left maxillary sinus.The lesion is causing significant widening of left pterygomaxillary fissure with destruction of adjacent bones.Small suspicious extension to left vidian canal.

A diagnosis of Nasopharyngeal Angiofibroma as made which was proven on HPR.

Case 11: Chronic Sinusitis misdiagnosed as Fungal Sinusitis

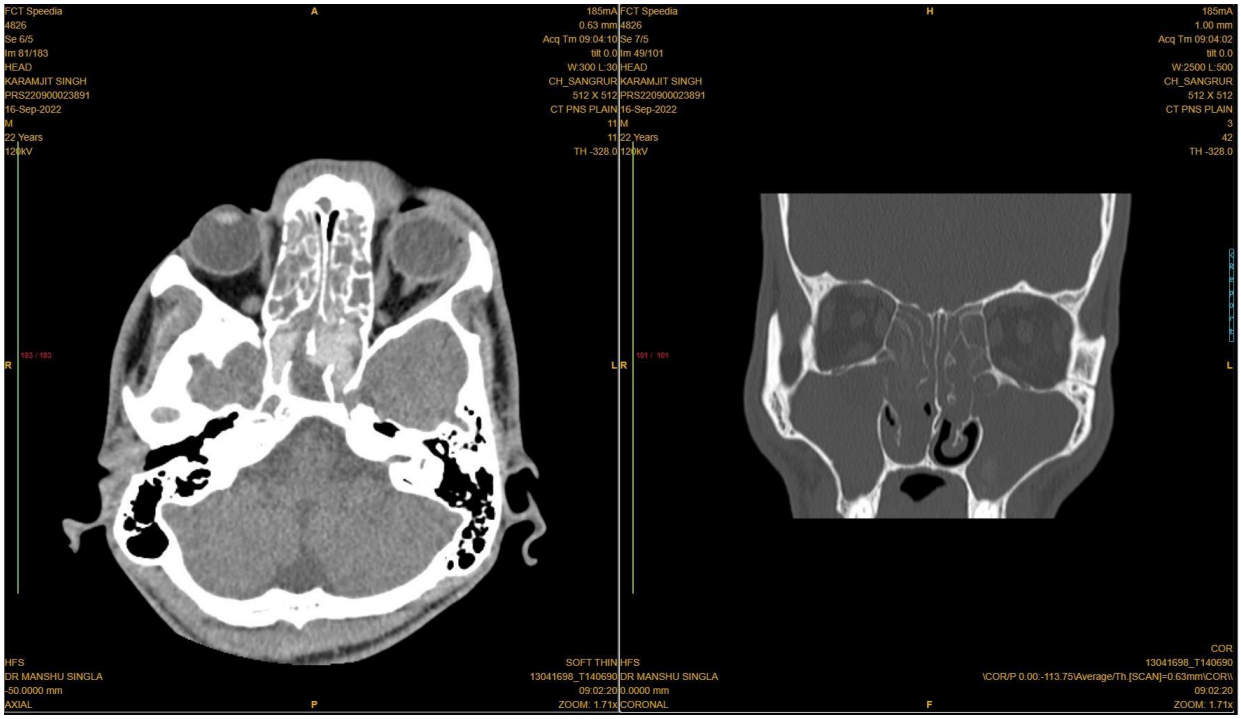


A 45 year old male presenetd with complains of headache.

On CT, mucosal thickening in the left maxillary sinuss with hyperdense content

A diagnosis of Fungal Sinusitis was made on CT, however it came out to be Chronic Sinusitis with Inspissated Secretion on HPR.

Case 12: Allergic Fungal Sinusitis

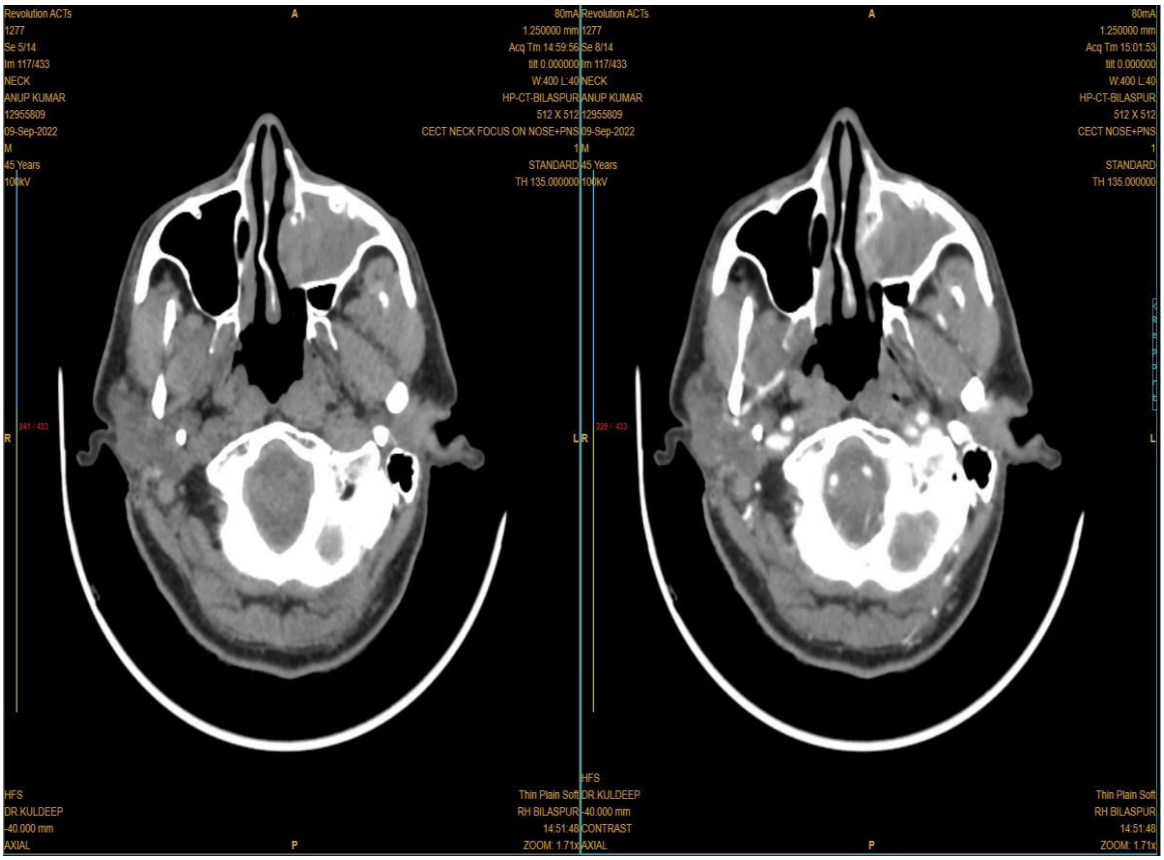


A 22 year old male presented with complains of headache and nasal obstruction.

On CT, expanded bilateral maxillary antrum with obliteration of bilateral OMC's, bilateral ethmoidal complexes and the bilateral frontal sinuses showing complete inhomogeneous opacification with hyperdense material is seen located centrally surrounded by hypodense mucosa.

A diagnosis of Allergic Fungal Sinusitis was made on CT which was proven on HPR.

Case 13: Sino-Nasal Malignancy in Left Maxilla



A 55 year old male presented with complains of facial swelling and epistaxis.

On CT, a relatively well definedheterogenously enhancing sino-nasal mass with few nonenhancing areas within predominantly involving the left maxillary sinus and seen protruding medially into the left nasal cavity through the osteomeatal complex with widening of the left OMC.

A diagnosis of Sino-Nasal Malignancy was made on CT, which came out to be Squamous Cell Carcinoma on HPR.

ETHICAL CLEARANCE CERTIFICATE

IEC/100.09/2021
Date- 22/01/2021

B.L.D.E. (DEEMED TO BE UNIVERSITY)

(Declared vide notification No. F.9-37/2001-U.3 (A) Dated: 29-2-2008 of the MHRD, Government of India under Section 3 of the UGC Act, 1956)

The Constituent College

SHRI. B. M. PATIL MEDICAL COLLEGE, HOSPITAL AND RESEARCH CENTRE

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The Institutional ethical committee of this college met on 11-01-2021 at 11-00 am to scrutinize the synopsis of Postgraduate students of this college from Ethical Clearance point of view. After scrutiny the following original/corrected and revised version synopsis of the Thesis has been accorded Ethical Clearance

Title: Evaluation of Sino-Nasal diseases by MDCT and to correlate histo-pathological findings

Name of PG student: Dr Shaurya Kaushal, Department of Radiology

Name of Guide/Co-investigator: Dr Shivanand V Patil Assoc.Professor of Radiology

DR. S.V.PATIL
CHAIRMAN, IEC

Institutional Ethical Committee
B L D E (Deemed to be University)
Shri B.M. Patil Medical College,
VIJAYAPUR-586103 (Karnataka)

Following documents were placed before Ethical Committee for Scrutinization:

1. Copy of Synopsis / Research project
2. Copy of informed consent form
3. Any other relevant documents.