ENDOSCOPIC FINDINGS AND RADIOLOGICAL APPEARANCE IN CHRONIC RHINOSINUSITIS- A COMPARATIVE STUDY

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CHENNAI

TAMIL NADU

CERTIFICATE

This is to certify that this dissertation titled **"**ENDOSCOPIC FINDINGS AND RADIOLOGICAL APPEARANCE IN CHRONIC RHINOSINUSITIS- A COMPARATIVE STUDY **"** submitted by **DR.ANOOP.P.S** to the faculty of ENT, The TamilNadu Dr. M.G.R. Medical University, Chennai in partial fulfillment of the requirement for the award of MS degree Branch IV ENT, is a bonafide research work carried out by him under our direct supervision and guidance from August 2009 to October 2011.

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DECLARATION

I hereby solemnly declare that the dissertation titled **"ENDOSCOPIC FINDINGS AND RADIOLOGICAL APPEARANCE IN CHRONIC RHINOSINUSITIS "** has been prepared by me under the guidance & supervision of **Dr.K.R.KANNAPPAN MS, DLO, M.Ch,** Professor & Head of Department of OTORHINOLARYNGOLOGY**, ,** Govt Rajaji Hospital, Madurai. This is submitted to **The TamilNadu Dr. M.G.R. Medical University, Chennai,** in partial fulfillment of the regulations for the award of MS degree (Branch IV) in OTOLRHINOLARYNGOLOGY.

Place: Madurai

Date: **SIGNATURE**

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CONTENTS

ABSTRACT

Background: Paranasal sinus diseases are one of the commonest causes of patients visit to an Otorhinolaryngologist. The symptoms are multilple and vague, while examination is often limited as sinuses can not be examined directly. Anterior rhinoscopy gives little information about middle meatus and osteomeatal unit.

Objective: The study is carried out with an objective to compare the Diagnostic nasal endoscopic findings and radiological appearance in patients with paranasal sinus disease.

Methods: 50 cases of chronic sinusitis not responding to routine medical line of treatment were selected and operated after being thoroughly investigated by means of nasal endoscopy and CT scan.

Results: Out of 50 cases, 35 underwent bilateral surgery and 15 underwent unilateral surgery, so a total of 85 procedures were carried out. Findings of both the CT scan as well as diagnostic nasal endoscopy were compared to each other and ultimately correlated with operative findings.

Interpretation and conclusion: In our study, a high association is found between both the modalities of investigation i.e CT scan and Diagnostic nasal endoscopy with one scoring over the other in different parameter. Diagnostic nasal endoscopy is found to be highly sensitive investigatory modality for parameters like frontal recess, spheno-ethmoid recess and hiatus semilunaris, where as CT scan is found to

be highly sensitive for parameters like maxillary sinus, uncinate process and posterior ethmoids. So, a case of sinus disease should be diagnosed as early as possible using both these modalities as together they complement each other. Early diagnosis and effective management cures the pathology and prevents disastrous complications.

Keywords: Paranasal sinus disease, CT scan, Diagnostic nasal endoscopy, Middle meatus, Osteomeatal unit.

INTRODUCTION

The paranasal sinuses originate as invagination of nasal mucosa into the lateral nasal wall,frontal,ethmoid,maxilla and sphenoid bones during fetal development. Drainage and ventilation are the two most important factors in the maintainance of normal physiology of the paranasal sinuses and their mucous membranes. Infection of these sinuses is one of the commonest causes of patients visit to the otorhinoolaryngologist .

Chronis rhinosinusitis is a heterogenous group of disorders characterized by chronic inflammation of nose and paranasal sinuses.

It occurs when the duration of symptoms is greater than 12 weeks in duration. It is a frequently encountered disease affecting nearly 50 million individuals every year, yet its diagnosis and treatment still poses a challenge.

The understanding of mucociliary drainage pattern and pathophysiology of paranasal sinus disease are the keys to functional endoscopic sinus surgery [FESS]. FESS has popularized the use of telescopes in surgery and has emphasized the importance of nasal endoscopy and computed tomography. Currently patients who have failed medical therapy are suitable for FESS. Diagnostic nasal endoscopy and CT are performed to determine the extend of the disease prior to planning the surgery.

The indications of surgery have changed with a host of effective

medical therapies now available, but despite these a cohort of patients remain in whom surgery will be required.

While a careful clinical history remains the cornerstone of diagnosis and all patients will undergo a general otorhinolaryngological examination, the emphasis has moved towards endoscopy supported by appropriate imaging to confirm the diagnosis, define the extend of pathology and demonstrate relevant anatomy.

Computer assisted tomography [CT] provides an essential pre-operative assessment of patients undergoing FESS. The aim of CT of the sinuses is to delineate the extend of the disease , define any anatomical variants and relationship of the sinuses with the surrounding important structures.

High resolution CT (HRCT) of the paranasal sinuses (PNS) has a significant and necessary place in the pre-operative assessment of patients prior to endoscopic sinus surgery. It helps in establishing the anatomy of the sinuses and its common variants as well as sinus and drainage passage pathology .

Advantages of 64-slice CT over Conventional CT:

- Faster
- Multiplanar reconstruction capability
- Sharper images

- Lesser artifacts from dental amalgam
- 3D endoscopic sinus images maybe obtained

Nasal endoscopy and the intra-operative findings provide crucial information about the state of sinonasal mucosa and cavities. Nasal endoscopy is inexpensive, easily incorporated into the routine examination and easily repeated for special examinations and monitoring the progress of sinus disease.

Anterior rhinoscopy reveals little information with regard to middle meatal cleft and no information regarding the infundibular opening and maxillary sinus orifice.Nasal endoscopy provides the ability to accurately assess these areas for evidence of localized disease , or for anatomical defects that compromise ventilation and mucociliary clearance . Hence endoscopy and computed tomography have revolutionized the understanding and management of chronic rhinosinusitis in recent times.

In this study , we have compared the nasal endoscopic findings and CT abnormalities in patients with chronic rhinosinusitis.

AIM OF THE STUDY

- To compare the endoscopic findings and radiological appearance in patients with chronic rhinosinusitis.

HISTORICAL REVIEW

In 1901 Hirschmann first used the cystoscope to examine the middle meatus.

In 1960 Houndsfield and Ambrose devised the **computerized tomography.**Since then the coronal CT scanning has dramatically improved the imaging of paranasal sinuses anatomy as compared to sinus radiograph.

In 1967 Messerklinger studied mucociliary clearance of the sinuses utilizing endoscopy in patients and time lapsed photography in fresh autopsy specimens.

In 1978 Messerklinger presented systematic and detailed work documenting his endoscopic findings. Wigand and Messerklinger highlighted the importance establishing drainage and preserving of mucosa, as well as development of special instruments, compact, multiangled endoscopes, which allow the precise, safe accomplishment of these goals.

In 1983 Stammberger recognised that the endoscope enables the examiner to recognize the changes that may remain from the naked eye and even from inspection with the microscope thereby allowing diagnosis to be made, confirmed, expanded or even revised and the effects of the topical and systemic therapy can be seen and evaluated.

In 1985 Kennedy et al stated that functional endoscopic sinus surgery is a term collectively used for surgeries devised by Messerklinger to correct the underlying sinus infections.

In 1987 Zinreich et al stated that CT and endoscopy are complementary in the diagnosis and treatment of nasal and paranasal sinus diseases.

In 1987 W.E.Bolger et al. in their study of coronal plane CT Scans of 202patients, directed special attention towards bony anatomic variations and mucosal abnormalities. Paradoxical curvature of the middle turbinate was found in 26.1% of patients, Haller's cells in 45.1%, pneumatization of uncinate process in 2.5% and lamellar cell of the middle turbinate was seen in 46.2% of the cases. In 31.2% pneumatization was noted in the bulbous part of the turbinate and 'true' concha bullosa in 15.7% of the patients. The agger nasi cell was present in 98.5% of patients, crista galli pnuematization in 83.7%, bulla galli in 5.4% and deviated nasal septum in 18.8%.

In 1988 Stammberger and Wolf believed that most sinus infections are rhinogenic in origin. The infection usually starts in middle meatus with mucosal contact, cessation of cilliary action, stasis and infection.

In 1992 Kaluskar et al correlated the CT and operative findings, the maxillary sinuses correlated well, and for the ethmoids the mucosal disease was found to be far more spread than detected on CT scan.

In 1993 John Earwarker examined the prevalence of anatomic variations of the nose and sinuses as determined with coronal CT in 800 cases. There were 354 cases of septal deviation (44%) with a male to female ratio of 1:1 Of the 354 cases of septal deviation 34% had significant septal spur.135 cases showed large paradoxical middle turbinates Abnormalities of OMU were present in 51% patients. Anterior ethmoid air cells related to the frontal recess were present in 90% cases, agger nasi cells were present in 96% cases. Extra-mural supra orbital cells were present in 8% of the cases. Pneumatisation of middle turbinate was noted in 55% of cases while that of the uncinate process was seen in 6% of cases. Ethmoidal bulla was found in 89% of cases, 34 of which were bilateral. Haller's cells were seen in 20% whereas Onodi cells were present in 24% cases.

In 2001 Homing Tan and FH Vincent Chong observed that the unique development of paranasal siuses explains for their enormous amount of anatomical variations. They further stated that CT is an excellent means of providing anatomical information of this region and also assist in endoscopic

evaluation. The role of MRI is limited and provides no extra information except for differentiating between thickened mucosa from fluid retention.

In 2004 M. Kantarci et al. suggested that remarkable anatomic variations of paranasal region and their possible pathologic consequences should be well defined in order to improve success of management strategies, and to avoid potential complications of endoscopic sinonasal surgery.

REVIEW OF LITERATURE

After the advent of sinus surgery,considerable attention has been directedtowards analysis of paranasal sinus anatomy through coronal plane CT imaging and nasal endoscopy. These investigations were done to determine the mucosal abnormalities and bony anatomic variations of paranasal sinuses and assess the possible pathogenecity of these findings in patients undergoing evaluation for sinusitis or sinus surgery.

Since the beginning of the century, plain films have provided a fast and easy method to evaluate the maxillofacial structures.The modality was and continues to be widely available, providing a satisfactory demonstration of the lower one-third of the nasal cavity and maxillary sinuses. The outline of the frontal sinuses as well as the mid-sagittal plane through the sphenoid sinus is also relatively well displayed. The inferior third of the frontal sinus and anterior and posterior ethmoid sinus architecture is poorly depicted on this modality. CT techniques, however, clearly image such abnormalities in these regions.

one of the key problems in testing the validity of the surgical techniques which are based on Messerklinger's philosophy is that rhinosinusitis is not one condition, nor even a spectrum of manifestations of the same condition, but an

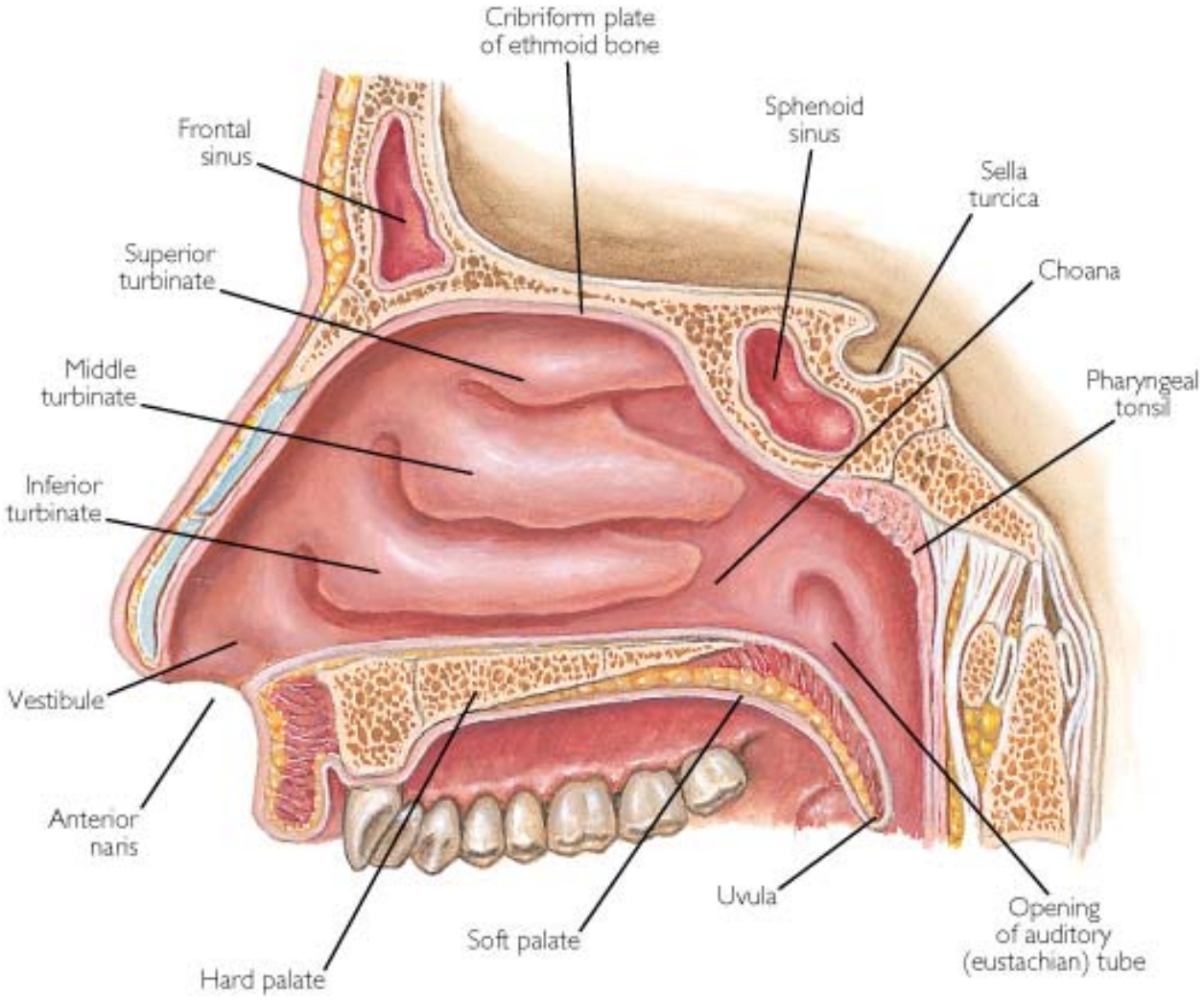
array of various pathological processes.

In 1992 Kennedy prefaced his classification saying that there is only a limited understanding of the etiology, pathology and prognostic factors involved in inflammatory disease. In patients with chronic and recurring sinus infections,

Messerklinger identified ventilatory defects in the middle meatus, anterior and posterior ethmoids. These areas of persistent mucosal contact occurred either as a result of mucosal inflammation and hyperplasia following an infection, or as a result of an anatomic malformation. Such interruption of normal mucociliary clearance caused both persistence of local inflammation and affected the drainage of the frontal and maxillary sinuses, leading to the potential for recurrent infection therein. In the frontal sinus Messerklinger identified retrograde mucociliary flow from the frontal recess of the ethmoid, up the medial wall and into the internal os of the frontal sinus providing a further potential route for the infection. As the result of these observations on mucociliary clearance and endoscopic examinations, he concluded that in the majority of cases, infection spreads from the ethmoids to secondarily affect the maxillary and frontal sinuses.

The endoscopic examination also assists the physician in reaching the decision whether local or systemic medical therapy may be of value or whether surgical intervention is needed. Hence diagnostic Nasal endoscopy has become a routine component of the clinical evaluation of every patient with evident or suspected disease of the nose and paranasal sinuses.

Coronal plane computerized tomographic (CT) scanning has dramatically improved the imaging of paranasal sinus (PNS) anatomy as compared to sinus radiographs. Increasingly, subtle bony anatomical variations and mucosal abnormalities of this region are being detected.



Lateral nasal wall

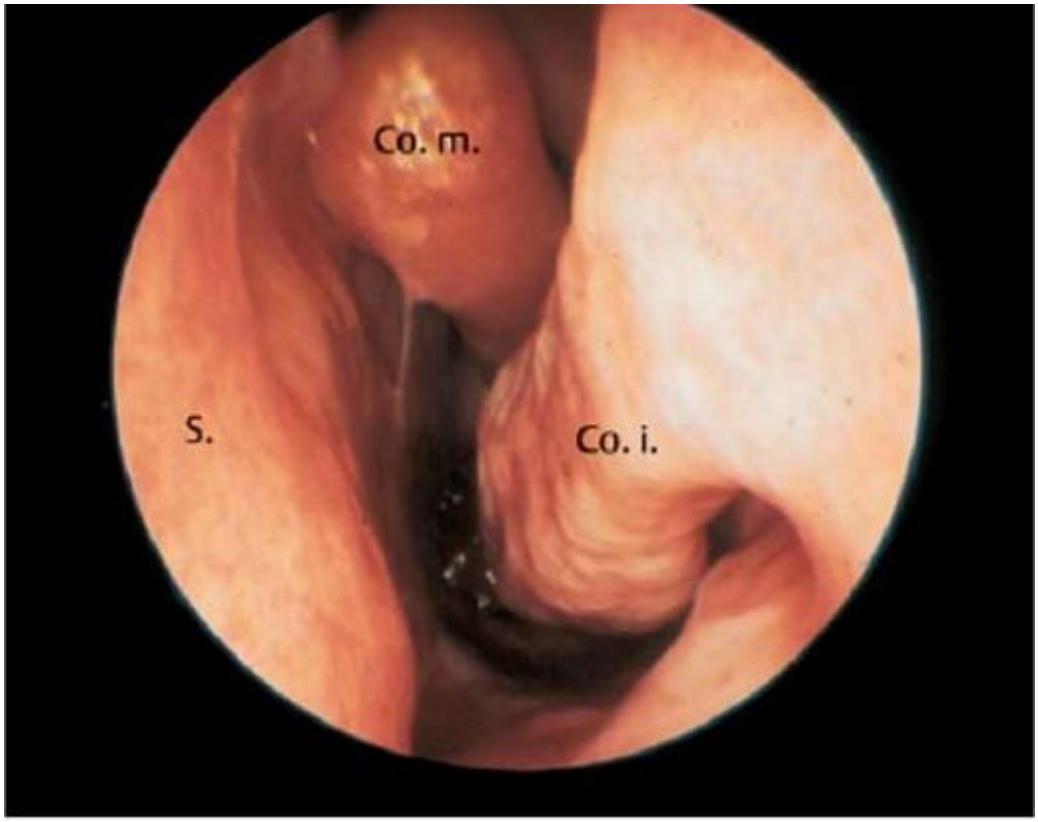
ANATOMICAL CONSIDERATIONS:

Sinus endoscopy and CT sections have helped us to precisely know and understand better, the microarchitectural anatomy of nose and PNS. Understanding the anatomy of lateral nasal wall is the key for endoscopic sinus surgery.

The lateral nasal wall is divided into skin lined vestibule and lateral wall proper which is lined by mucosa, by a ridge “limen nasi or limen vestibuli”. Limen nasi is formed by the lower end of the lateral nasal cartilage.

The lateral nasal wall proper bears three or four nasal conchae or turbinates, named from below upwards -inferior, middle and superior. The air spaces beneath and lateral to each is the corresponding meatus. The part of the nasal cavity above the uppermost concha and below the body of the sphenoid bone is the “spheno-ethmoid” recess.The middle meatus is the key area as the frontal, anterior ethmoid cells and maxillary sinuses all drain into this area. The

posterior ethmoid drain into the superior or supreme meatus, the sphenoid into the spheno-ethmoid recess. Both inferior and middle conchae begin anteriorly at the level of the vertical plane of the forehead and extended one below the other almost to the choana.



Endoscopic picture of inferior cocha (Co.i),middle concha (Co.m) and septum (s)

Superior concha, about half the length of the other two, begins at about the middle of these. The three conchae converge somewhat towards each other posteriorly. The remaining part of the nasal cavity behind their posterior ends is the nasopharyngeal isthmus, which opens into the nasopharynx through the choana.

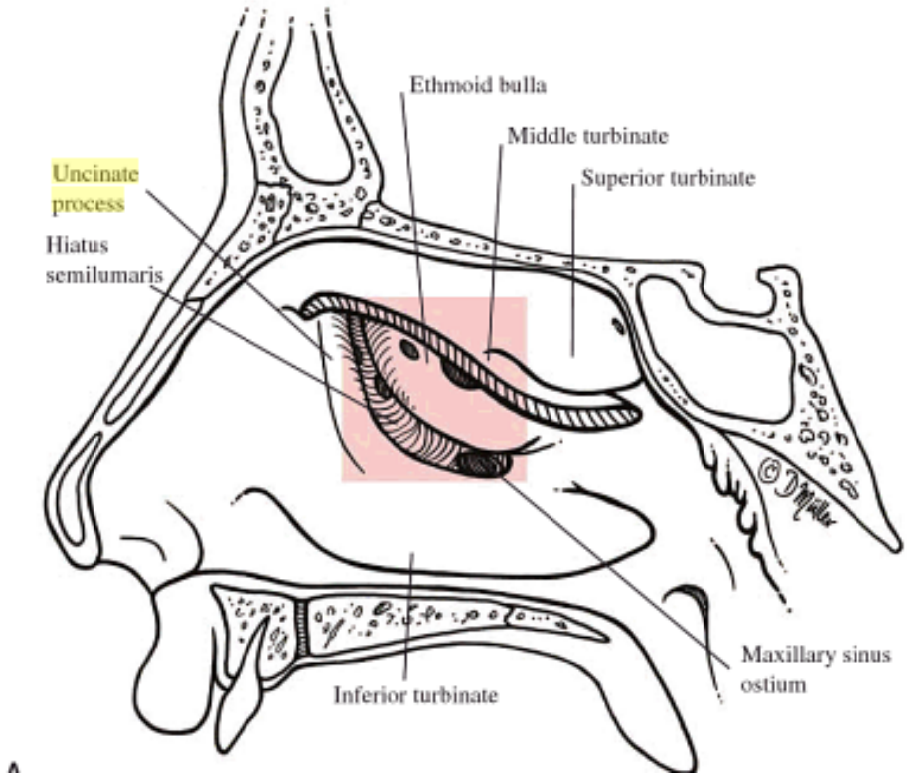
INFERIOR NASAL CONCHA and INFERIOR MEATUS:

Inferior nasal concha is an independent bone covered by thick mucous membrane containing a vascular "plexus cavernosus". Inferior meatus is narrow anteriorly and posteriorly, but is wider and higher at the junction of middle and anterior thirds of inferior turbinate. Here the sharp, curved attachment of inferior to the lateral wall results in "genu" of inferior turbinate.

Nasolacrimal duct opens under the genu, is about 15 - 20mm from the limennasi,30 - 40mm from the anterior nares. Its orifice is slit-like, as the duct runs obliquely through the mucous membrane, protected by a fold "plica lacrimalis or valve of Hasner".

MIDDLE NASAL CONCHA and MIDDLE MEATUS:

Middle concha is a part of the ethmoid labryinth, which basically froms the lateral nasal wall above the inferior turbinate.

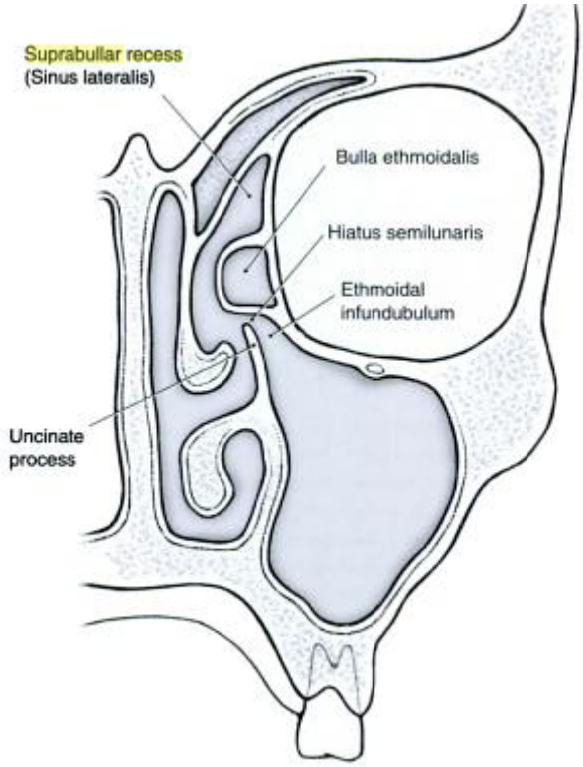

Ethmoid bulla
Middle turbinate
Superior turbinate
Uncinate process
Hiatus semilumaris
Maxillary sinus ostium
Inferior turbinate

The prominent structures in the middle meatus from anterior to posterior are:

1. The uncinate process: a crescent shaped ledge of bone, part of ethmoid.
2. Bulla ethmoidalis: a rounded projection in the middle meatus, it is the most constant and usually the largest air cell in the anterior ethmoid.
3. Hiatus semilunaris: Half moon shaped gap between the posterior free and sharp margin of uncinate process and bulla ethmoidalis.The semilunar hiatus is a curvilinear opening of the lateral nasal wall that lies above the ethmoid uncinate process and below the ethmodical bulla. The semilunar hiatus is infact, a curved furrow that continues from the infundibulum superiorly in the posterior inferior direction, and past the natural ostium of the maxillary sinus, to gradually fade away superior to posterior end of inferior turbinate.

Thus purulent secrections from the frontal and anterior ethmoidal air cells drain across the maxillary ostium. The key locations of anterior ethmoidal air cells drain across the maxillary ostium.

The recess above the bulla is called **suprabullar recess.** Part of the middle meatus posterosuperior to bulla and anterior to the posterior part of the middle turbinate is called sinus lateralis.



Coronal illustration of ethmoid sinus anatomy at the level of maxillary sinus ostia

Ethmoid infundibulum: is a groove between the uncinate process and the bulla. From haitus semilunaris it extends downwards and forwards to a varying Depth of 0.5-10 mm (average 5mm). This depends upon the height of the uncinate process.

Boundaries of infundibulum:

Medially –uncinate process

Laterally: – lamina papyracea (separating the orbit)

Anteriorly and superiorly-frontal process of maxilla

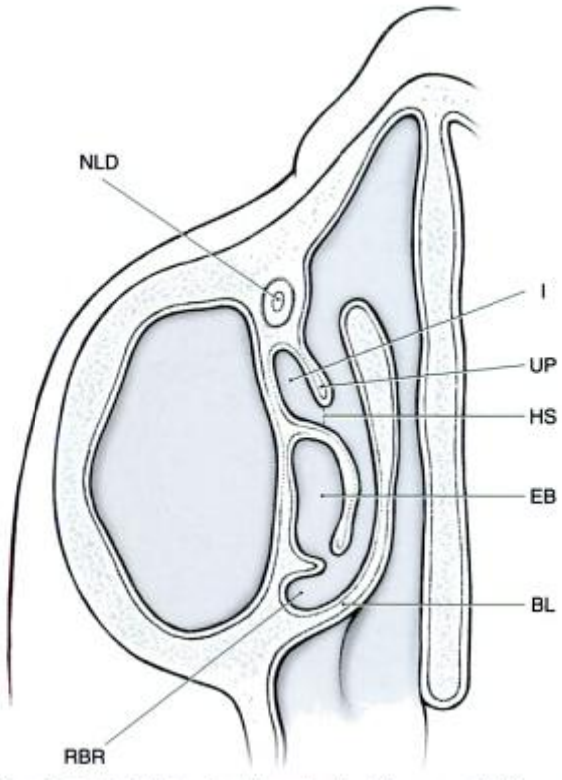
Superolaterally- lacrimal bone

Anteriorly and superiorly- the ethmoid infundibulum may form a blind recess(80%) – the fronto ethmoid recess of the infundibulum. In 20% of cases, it communicates freely with the nasofrontal duct.

Thus, the frontal sinus drains either directly into the infundibulum through the nasofrontal duct or indirectly into the infundibulum through the anterior ethmoid cells. The anterior ethmoids open either into infundibulum (at the frontoethmoidal recess) or anterior to it through the uncinate process (frontal recess of the uncinate process).

The ethmoid sinus:

This is situated within the ethmoid labyrinth and separates the nasal cavity from the orbit and anterior cranial cavity. The ethmoid labyrinth is roughly



Axial illustration of anterior ethmoid anatomy.NLD-Nasolachrimal duct,UP-Uncinate process,EB-ethmoidal bulla,HS-Hiatus semilunaris,BL-basal lamella,RBR-Retrobullar recess.

pyramid shaped with its base posteriorly in relation to sphenoid and apex anteriorly limited by the frontal process of the maxilla and nasal process of the frontal bone.

It is about 4-5 cms long (anteroposteriorly) - 2.5-3 cms high and about 0.5 cms wide anteriorly and 1.5 cms posteriorly. Thus as a whole, the ethmoid labyrinth forms a thin plate broader posteriorly and thinner anteriorly. Superiorly, the labyrinthine roof is thicker and is called “fovea ethmoidalis”. This is limited anteriorly by the inferior wall of the frontal sinus and posteriorly by the

sphenoidal bone.

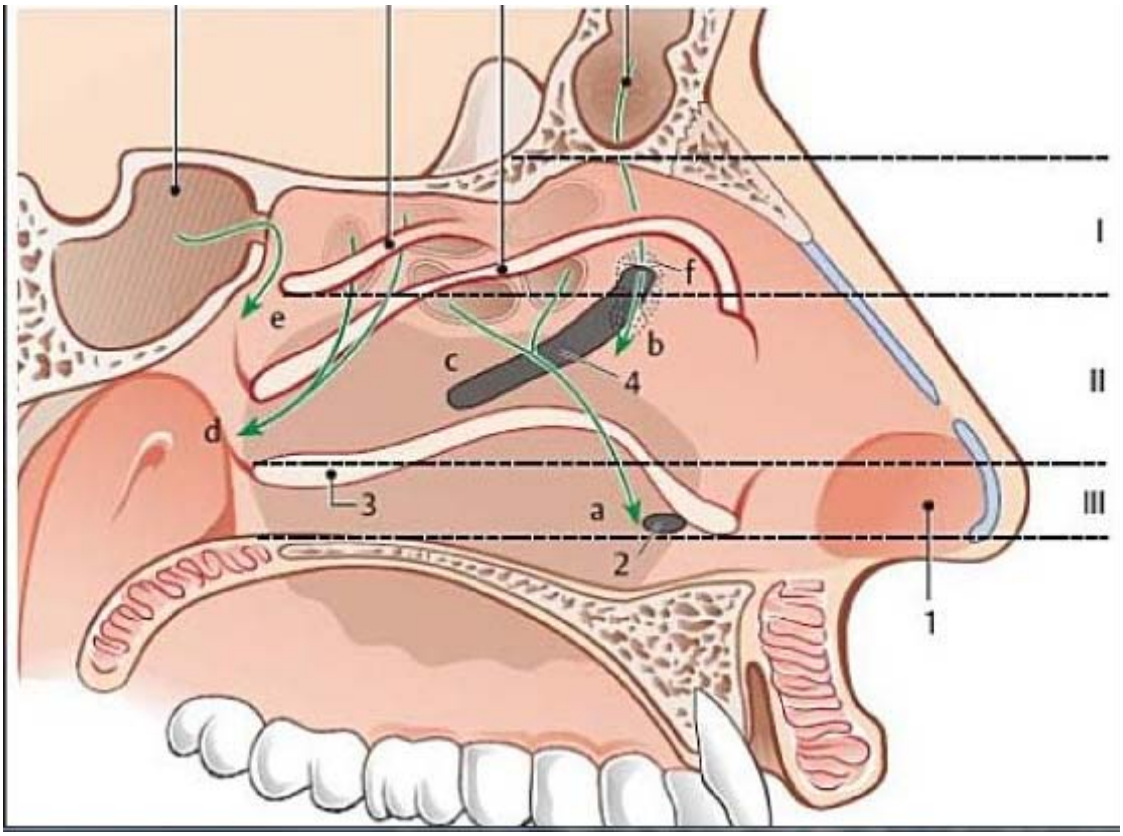
Lateral wall is formed by several bones:

Anteriorly and above – frontal bone

Anteriorly and below – lacrimal bone (os unguis)

Posterior to these it is formed by the papyraceous lamina (os planum) of ethmoid above and uppersection of maxillary bone (medial wall) and vertical lamina of palatine bone below. Inferiorly ethmoid has no wall. Its lower limits are marked by the opening of middle meatus and can thus therefore be considered as the horizontal plane passing alone the lower margin or middle turbinate.

The medial wall of ethmoid labyrinth consists above of a continuous lamina



Lateral nasal wall. I. Superior meatus II. Middle meatus III.Inferior meatus 1.Nasal vestibule 2.opening of nasolachrimal duct 3.Origin of inferior turbinate 4. Semilunar hiatus 5.Insertion of middle turbinate 6.Sphenoid sinus 7. Insertion of superior turbinate 8.Frontal sinus a.Drainage of antral cavity b.Drainage of Frontal sinus c.Drainage of anerior ethmoidal cells d.Drainage of posterior etmoidal cells e.Drainage of sphenoid sinus f.area of infundibulum (dotted area)

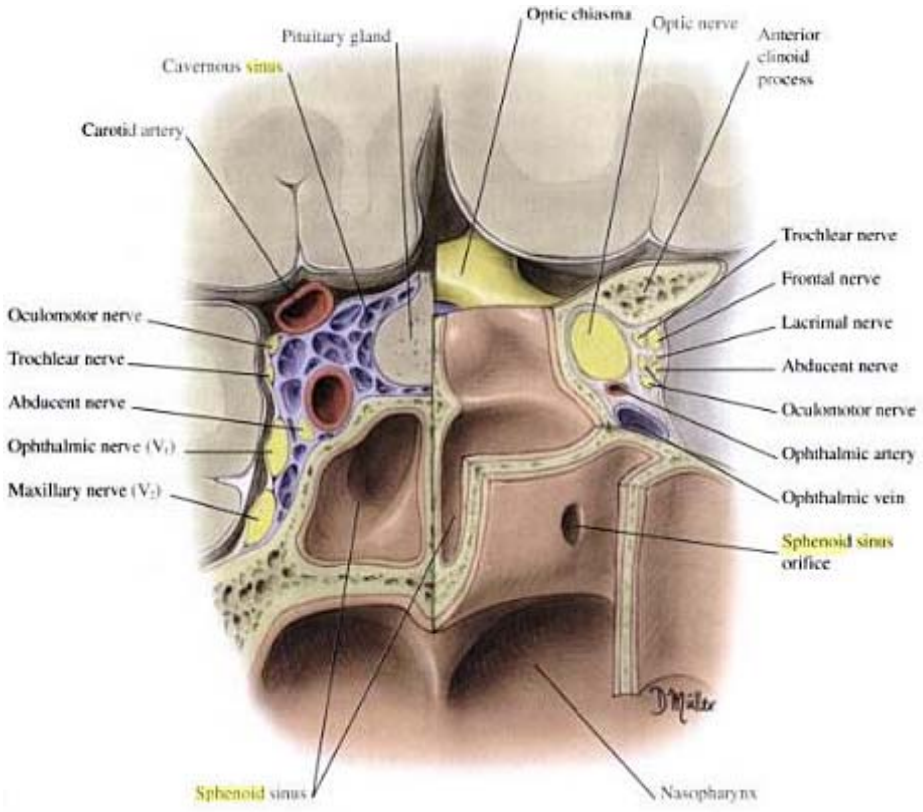
called turbinate (middle, superior and supreme) and corresponding meati. The medial wall has five principal lamellae, which penetrate the labyrinth towards the lateral wall.they are:

1. Uncinate process
2. Bulla
3. Middle turbinate
4. Superior turbinate
5. Supreme turbinate

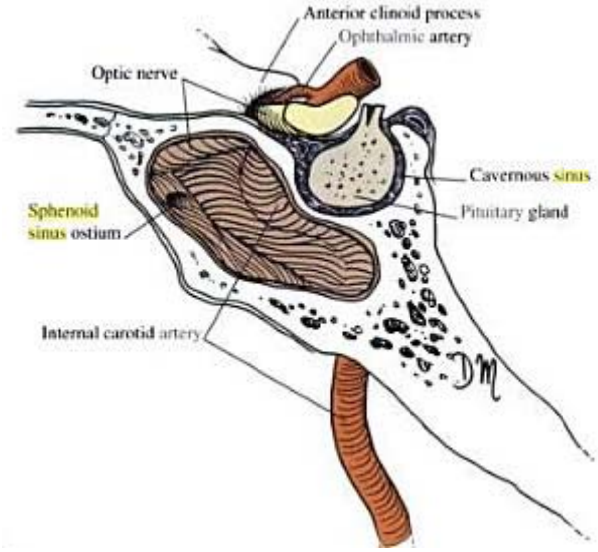
The more delicate secondary lamellae are placed irregularly between the primary ones, giving rise to multiple ethmoid cells. The ethmoids, during development have tendency to grow steadily in all directions beyond the confines of ethmoid until deterred by hard compact bone. The cells, which reside within the ethmoid bone are termed “intramural cells” and those outside are called “extramural cells”. Thus the ethmoid cells may invade the supraorbital plate of frontal bone, infraorbital plate of maxilla, the middle turbinate (concha bullosa), the sphenoid and the lacrimal bone. The extent of pneumatization has definite implication in an endoscopic sinus surgery.

Sphenoid sinus:

The degree of pneumatisation of this sinus is highly variable. Its capacity is said to very from 0.5-30 ml (avg 7.5 ml). The anterior wall of the sphenoid



Coronal section of the sphenoid sinus at various levels illustrating the relationship with surrounding vascular and neural structures.



Sagittal section of the sphenoid sinus showing the adjacent cources of the internal carotid artery and optic nerve.

sinus is about 7cm from the anterior nares. The sinus may either be limited to body of sphenoid, or it may extend to the other parts of sphenoid namely the greater and lesser wings, anterior clinoid process, pterygoid process etc, and also to the basilar portion of the occipital bone. As the degree of pneumatisation increase, the surrounding vital relations like optic nerve, ICA, maxillary nerve etc. are brought more into the sinus cavity producing corresponding bulges into the cavities. FESS in such state is more dangerous. The sphenoid sinus opens into the sphenoethmoidal recess usually through the posterior wall of the recess. Occasionally it may open through the lateral wall of the recess.

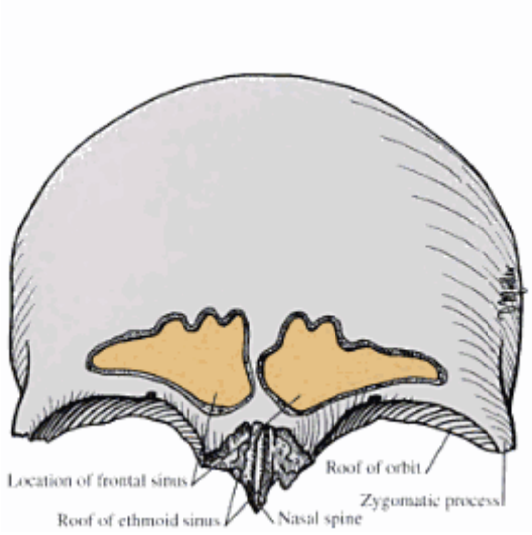
Frontal sinus:

Development of this sinus varies markedly. It develops as one of the several outgrowths from the region of the frontal recess similar to the anterior ethmoidal cells.In fact some regard it as an anterior ethmoid cell that has invaded the frontal bone. Several sinuses may occur on one or both sides, lying one lateral to the other or one behind the other. These sinuses may either drain one into the other or separately.

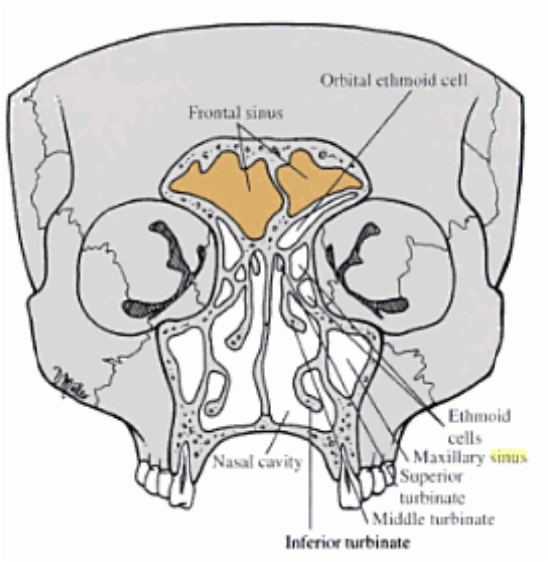
Two parts:

I. Vertical (in squama of frontal bone)

II. Horizontal (in the orbital roof of the frontal bone).

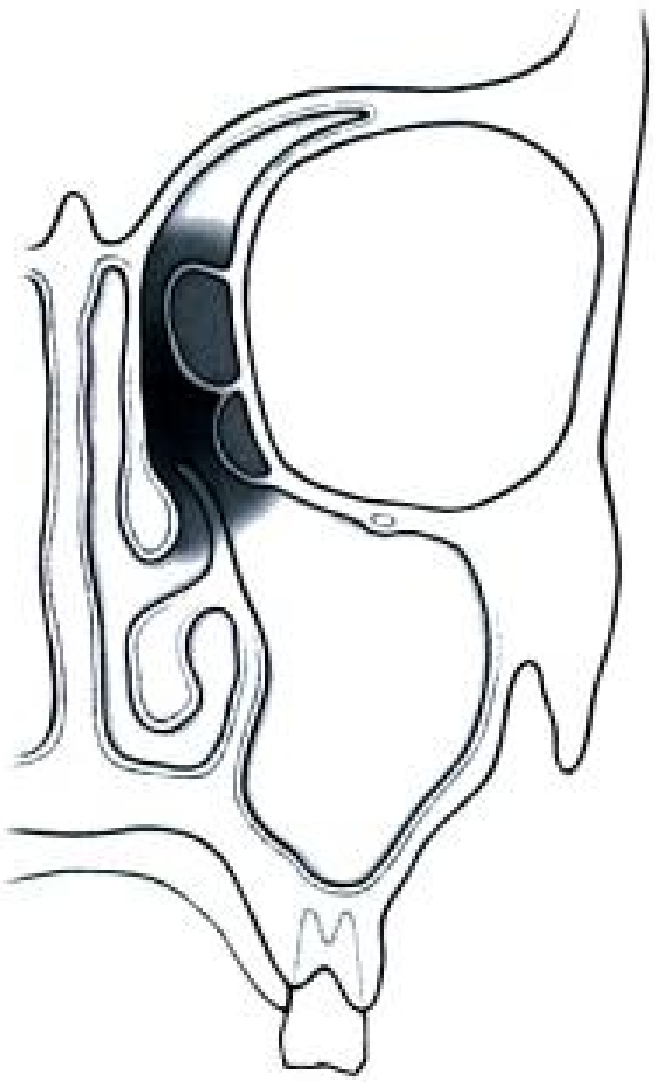


Bony anatomy of frontal sinus: frontal view-anterior wall has been partially removed to expose the sinus.



Bony anatomy of the frontal sinus:coronal section.orbital ethmoidal cells often intrude between the orbit and frontal sinus floor.

Important relations of frontal sinus are the anterior cranial fossa and the orbit. The bone separating the sinus from above is usually thin and an operative perforation can easily occur.



The osteomeatal comlex is illustrated by shading . it includes the maxillary sinus ostia, the anterior ethmoidal cells and their ostia, the ethmoidal infundibulum,the hiatus semilunaris and the middle meatus.

CAUSES OF OSTEOMEATAL OBSTRUCTION:

I) Pathological variations:

1. Mucosal thickening due to oedema or hyperplasia of mucosa secondary to infection or allergy.
2. Polyposis.
3. Synechiae in middle meatus.
4. Pathologic mucous which is thick viscid blocking the OMC.
5. Immotile cilia syndrome.

II)Anatomical variations:It is very important to understand the various anatomic variants, as most of these are useful in warning the surgeon of the impending risk of the procedure. The importance of anatomic variations as a predisposing cause of sinus disease.

The various anatomic variations are classified as:

A. Primary bony abnormalities

1. Septal abnormalities a. Septal deviation
   b. Septal spur
2. Middle turbinate a.paradoxical curve
   b. Hypoplaisa

3. Uncinate process, ethmoid bulla and osteomeatal complex

a. Uncinate process - Vertical or horizontal

b. Ethmoid bulla – Enlarged or normal

- Absent/hypoplastic

4.unilateral choanal atresia.

B. Extension of sinus air cells.

1) Ethmoid complex: Intra mural cells

Extra mural cells

a. Extra mural Agger nasi cells

b. Extra mural supra orbital cells

c. Extramural Middle turbinate cells (Concha bullosa).

d. Extramural uncinate process cells

e. Extra mural superior turbinal cells

f. Cells of orbital plate of the maxilla (Haller cells)

g. Extramural sphenoidal cells – posterior ethmoidal cells migrating into anterior sphenoid bone surrounding the optic nerve (Onodi cell) or reach anterior wall of sella turcica.

2) Sphenoid sinus extensions

a. Absence of Sphenoid sinus

b. Lateral recess

i. Lesser wing

ii. Greater wing

iii. Pterygoid.

c. Midline recess

i. Rostral

ii. Septal vomeral

iii. Inferior clival

iv. Superior clival

d. Dehiscences of optic nerve and internal carotid artery

3) Frontal sinus extensions

a. Aplastic

b. Hypoplastic

c. Extensions into orbital plate

d. Extensions into crista galli

e. Extensions into anterior ethomids

4) Maxillary sinus extensions

a. Infraorbital recesses

b. Alveolar recesses

c. Zygomatic recesses

Other anatomic variations include:

a) Maxillary sinus septa

b) Accessory ostia

c) Septations of sphenoid sinus

CHRONIC RHINOSINUSITIS

Rhinosinusitis is widely believed to comprise of a spectrum of inflammatory and infectious diseases concurrently affecting the mucous membrane of nose and paranasal sinuses. Because of the complexity of the factors that are associated with rhinosinusitis,there has been significant debate and confusion related to the development of definitions. A widely accepted set of classifications or definitions was developed by the Rhinosinusitis Task Force of the American Academy of Otorhinolaryngology-Head and Neck Surgery and reported by Lanza and Kennedy. These criteria are based in large part on temporal time frames.The distinctions between Acute rhinosinusitis[ARS], Recurrent acute rhinosinusitis [RARS],Subacute rhinosinusitis [SRS], Chronis rhinosinusitis [CRS] and acute exacerbation of chronic rhinosinusitis [AECRS] are based on temporal differences in the presentation and in some cases,on the clinical presentation.

CLASSIFICATION OF RHINOSINUSITIS

CLASSIFICATION	DURATION
Acute [ARS]	7 days to ≤ 4 weeks
Subacute	4-12 weeks
Recurrent acute	≥4 episodes of ARS per year
Chronic	≥12 weeks
Acute exacerbation of chronic	Sudden worsening of CRS with return to baseline after.

Chronic rhinosinusitis is defined as the group of disorders characterized by inflammation of the mucosa of the nose and paranasal sinuses of atleast 12 consecutive weeks duration.

The ultimate end stage of chronic rhinosinusitis is inflammatory mucosal thickening and in a subset of patients ,polypoid changes.Although its histologic hallmark is persistent underlying eosinophilic inflammation,the exact cause and pathophysiology have been a source of extensive controversy.

ETIOLOGICAL FACTORS IN CHRONIC RHINOSINUSITIS

Infectious- Viral

Bacterial

Fungal

Local factors

Craniofacial anomalies

Choanal atresia

Cleft palate

Velopharyngeal insufficiency

Nasal obstruction

Allergic and nonallergic rhinitis

Polyps

Foreign bodies, nasogastric tubes

Adenoid infection

Tumors

Rhinitis medicamentosa

Trauma

Barotrauma

Local infections

Dental infection

- Prior surgery
- Anatomic variations/aberrations
  - Septal deviation
  - Concha bullosa
  - Haller's cells
  - Paradoxic middle turbinate
  - Atelectatic maxillary sinus
  - Prominent ethmoid bulla
- Ciliary dyskinesias
  - Kartagener's syndrome

Systemic factors

- Asthma
- Cystic fibrosis

Immune deficiencies

- Congenital
  - Selective antibody deficiency
    - IgA deficiency
    - IgG subclass deficiencies
  - Common variable immune deficiency
  - Vaccine hyporesponsiveness

C4 deficiency

X-linked agammaglobulinemia

Ataxia-telangiectasia

Hyper-IgM syndrome

Hyper-IgE

Acquired

HIV/AIDS

Organ transplant/cancer chemotherapy

Environmental factors- Air pollution

Cigarette smoke

Exhaust fumes

Swimming

DIAGNOSIS OF CHRONIC RHINOSINUSITIS

HISTORY AND CLINICAL PRESENTATION

A meticulously elicited history and assessment of clinical features can help in narrowing down the differential diagnosis,which can help the clinician decide the diagnostic modalities to opt for.

The salient features of CRS include pressure headaches, post nasal discharge,facial pressure and nasal congestion. other features that may be commonly associated with this condition include nasal obstruction, hyposmia or anosmia,cough,Eustachian tube dysfunction etc.

To resolve the ambiguity of presenting symptoms,the rhinosinusitis task force of American Academy of Otorhinolaryngology and Head and Neck Surgery [AAO-HNS] attempted to create a uniform diagnostic paradigm for sinusitis by organizing common sinonasal symptoms into major and minor factors. The presence of two or more major factors ,or one major and two minor factors is considered suggestive of sinusitis.

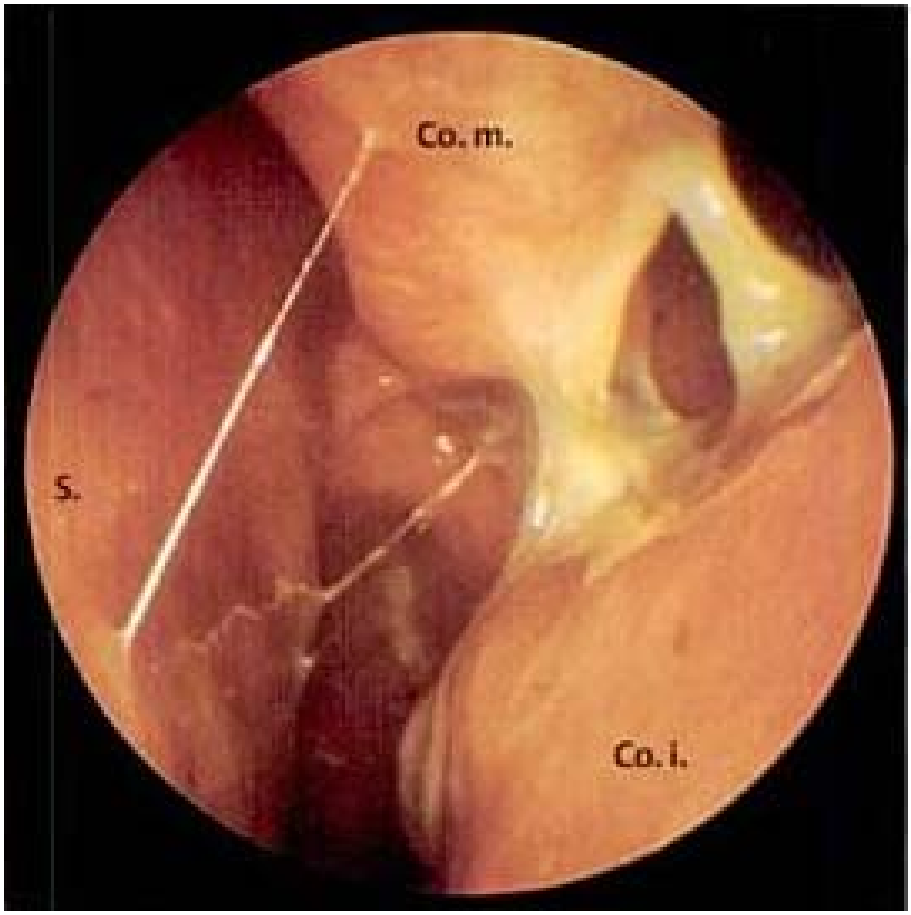
Major and minor factor associated with the diagnosis of chronic rhinosinusitis

Major factors	Minor factors
Facial pain/pressure	Head ache
Facial congestion/fullness	Fever [non-acute cases]
Nasal obstruction/blockage	Halitosis
Nasal discharge /purulence /discoloured post nasal discharge	Fatigue
Hyposmia/anosmia	Dental pain
Purulence in nasal cavity on examination	Cough
Fever [in acute rhinosinusitis only]	Ear pain/pressure/fullness

Otorhinolaryngologic examination

Anterior rhinoscopy

Anterior rhinoscopy is usually done using nasal speculum and head light.in all patients with nasal complaints ,it is mandatory to conduct a rhinoscopic examination. Features to be looked for during this examination include the size of the turbinate, condition of the nasal mucosa, and any mechanical obstruction as well as quantity ,quality color and viscosity of the secretion .



Pus in the left middle meatus between inferior and middle turbinate.

Endoscopic examination

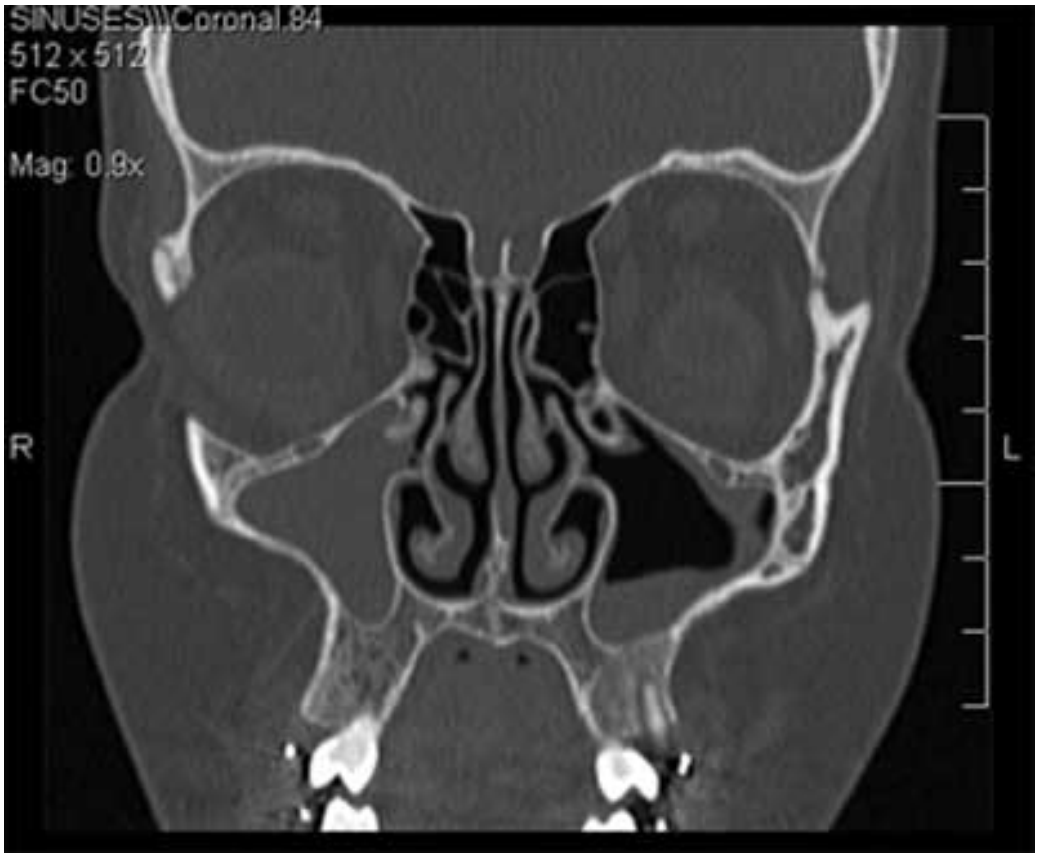
Diagnostic nasal endoscopy is a routine component of the clinical evaluation of every patient with evident or suspected disease of the nose and paranasal sinuses. The endoscope helps the examiner to recognize changes that may remain hidden from the naked eye or even inspection with microscope.As a result of endoscopic examination, provisional diagnosis can be made ,confirmed,expanded or revised.The endoscopic examination also assists the otorhinolaryngologist in deciding whether local and/or systemic drug therapy may be promising or whether surgical intervention is indicated.It also detects and evaluates anatomical abnormalities like septal deviation and other inflammatory changes.This is particularly relevant as the presence of these conditions is likely to alter the treatment protocol. The decision to investigate the patient further with tomography or CT scan is usually based on a combination of the historyand the endoscopic findings.

Nasal valve examination

Nasal swabs and antral lavage for bacteriology

Radiological examination

Plain radiography



Complete opacification of maxillary sinus in a coronal CT scan.

Occipitomental [Waters view]

Occipitofrontal [caldwells view]

Lateral view

Computed tomography

Computed tomography [CT] is by far the most preferred radiological modality to assess the status of the sinuses. The CT scan is now the gold standard and has replaced plain X-rays as the imaging study of choice in chronic sinusitis. CT scans, especially the coronal images, are useful in imaging the underlying sinus anatomy in detail. The combination of nasal endoscopy and CT scans in the evaluation of chronic sinus disease allows for precise diagnosis and treatment. One of the primary strengths of sinus CT imaging is improved contrast resolution: that is to say, the ability to depict bone/air and bone/ soft tissue interfaces. Another primary strength of CT scans is improved spatial resolution: that is, the ability to depict very small structures. With coronal, axial, and sagittal views, a single point in space can now be visualized and depicted in 3 dimensions on CT. This allows for increased understanding by the surgeon and radiologist of the anatomical structures causing blockage of the normal sinus flow. CT scans in these 3 planes provide the endoscopic sinus surgeon a road map for performing sinus surgery to improve

efficacy and safety . CT scan has also been used for staging of the disease by the Lund- Mackay system proposed by the task force on rhinosinusitis of the AAO-HNS.

Lund-Mackay computed tomography staging system

Sinus	Right	Left
Frontal	/2	/2
Maxillary	/2	/2
Anterior ethmoid	**/2**	/2
Posterior ethmoid	/2	/2
Sphenoid	/2	/2
Osteomeatal complex	/2	/2
Total	/24	/24

Each individual sinus is scored:0=clear,1=partial opacification,2=total opacification Scoring of OMC:0=clear,2=occluded.

PROTOCOL FOR DIAGNOSIS OF CHRONIS RHINOSINUSITIS

MANDATORY EXAMINATIONS/ INVESTIGATIONS	OTHER INVESTIGATIONS/OPTIONAL
OTORHINOLARYNGOLOGIC EXAMINATION • Anterior rhinoscopy • Nasal endoscopy • Nasal valve examination BACTERIOLOGY • Nasal swabs • Antral lavage RADIOLOGY • Plain x-ray paranasal sinus • computed tomography • magnetic resonance imaging BLOOD INVESTIGATIONS • Complete blood count • absolute eosinophil count • ESR • Immunoglobulins • Thyroid function test	MUCOCILIARY FUNCTION • Nasomucociliary clearance • Ciliary beat frequency • Nitric oxide measurement RHINOMANOMETRY • Acoustic rhinomanometry • Anterior and posterior Rhinometry OLFACTORY TESTS • Threshold tests • Scratch and sniff test- UPSIT ALLERGY TESTING • Skin tests • IgE levels NASAL BIOPSY

MANAGEMENT

Medical management of CRS without nasal polyp General measures Avoidance of pollution/dust/smoke/pollen/occupational fumes Moisturization: saline nasal spray Humidification:either warm or cool mist

ANTIMICROBIAL THERAPY

Antimicrobial treatment is important in the preoperative period to reduce the bacterial load in the involved sinuses and postoperatively to prevent infection of static secretions. When mucociliary transport is restored, antibiotics can be discontinued. With rare exceptions, antibiotic therapy should precede both imaging studies and surgical intervention.

Criteria for Selecting an Antibiotic for Empiric Therapy of Ear, Nose, and Throat/Sinus Infections

1. Excellent pneumococcal activity

2. Good gram-negative activity (*Haemophilus influenzae*, *Moraxella catarrhalis*)

3. Adequate staphylococcal coverage

4. Adequate anaerobic coverage

5. Acceptable formulation and dosage regimen

Specific pharmacotherapy

Topical corticosteroids

Mucolytics-like guaifenesin

Decongestants-short course topical decongestants

Systemic decongestants

pratropium bromide nasal spray

Topical cromolyn sodium

Antihistaminics

Anti-leukotrienes

Immunoglobulins

Functional Endoscopic Sinus Surgery

SURGICAL MANAGEMENT

INDICATION AND GOALS

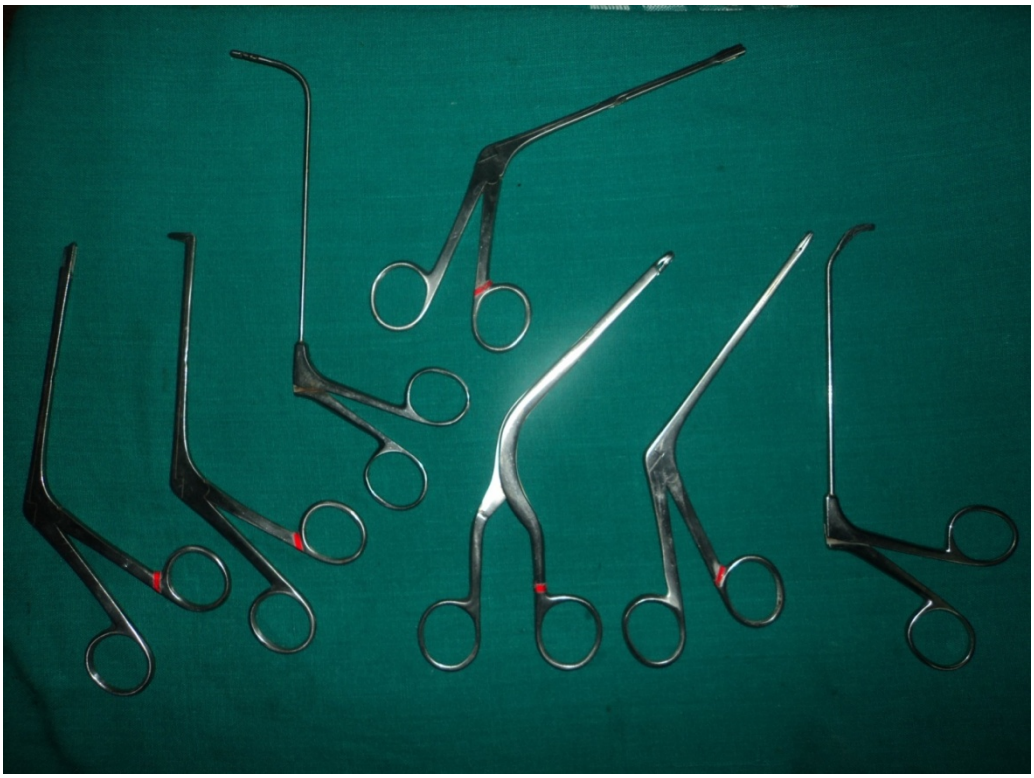
Other than CRS not responding to optimum medical management ,the other cases of rhinosinusitis for which sinus surgery is indicated include recurrent acute rhinosinusitis,allergic fungal sinusitis. Sinonasal polyposis,

Acute rhinosinusitis with complications,sinus mucoceles and antrochoanal polyps.

Endoscopic sinus surgery aims to reduce the disease in patients with rhinosinusitis by:

- Removal of pathological tissue from osteomeatal complex area,which helps in restoration of mucociliary function of sinus mucosa.
- Ventilation of sinuses that helps in reduction of number of mucosal glands and goblet cells population leading to decreased nasal secretions.
- Clearing the pathway for better delivery and distribution of topical nasal medication in the nose and sinus mucosa.
- Reduction of diseased sinus mucosa surface area by removal of polypoid disease.
- Improvement of olfaction by opening superior meatus and sphenoethmoid recess.

INSTRUMENTS USED IN FESS



- Relief from nasal obstruction in cases with gross surgical anatomic variations such as concha bullosa or big spur.

MATERIALS AND METHODS

The materials for the present study included all patients attending the E.N.T outpatient department who had chronic rhinosinusitis not responding to medical line of management at Government Rajaji hospital ,Madurai between August 2009 and October 2011.

A total of 50 patients who had clinical features suggestive of chronic rhinosinusitis were evaluated using a standard proforma and underwent the following investigative procedures systematically as and when needed.They were willing to undergo functional endoscopic surgery.

Sample Size: 50

Sampling: Prospective Study.

Inclusion Creteria:

All the patients with clinically proven chronic sinusitis not responding to routine medical line of treatment.

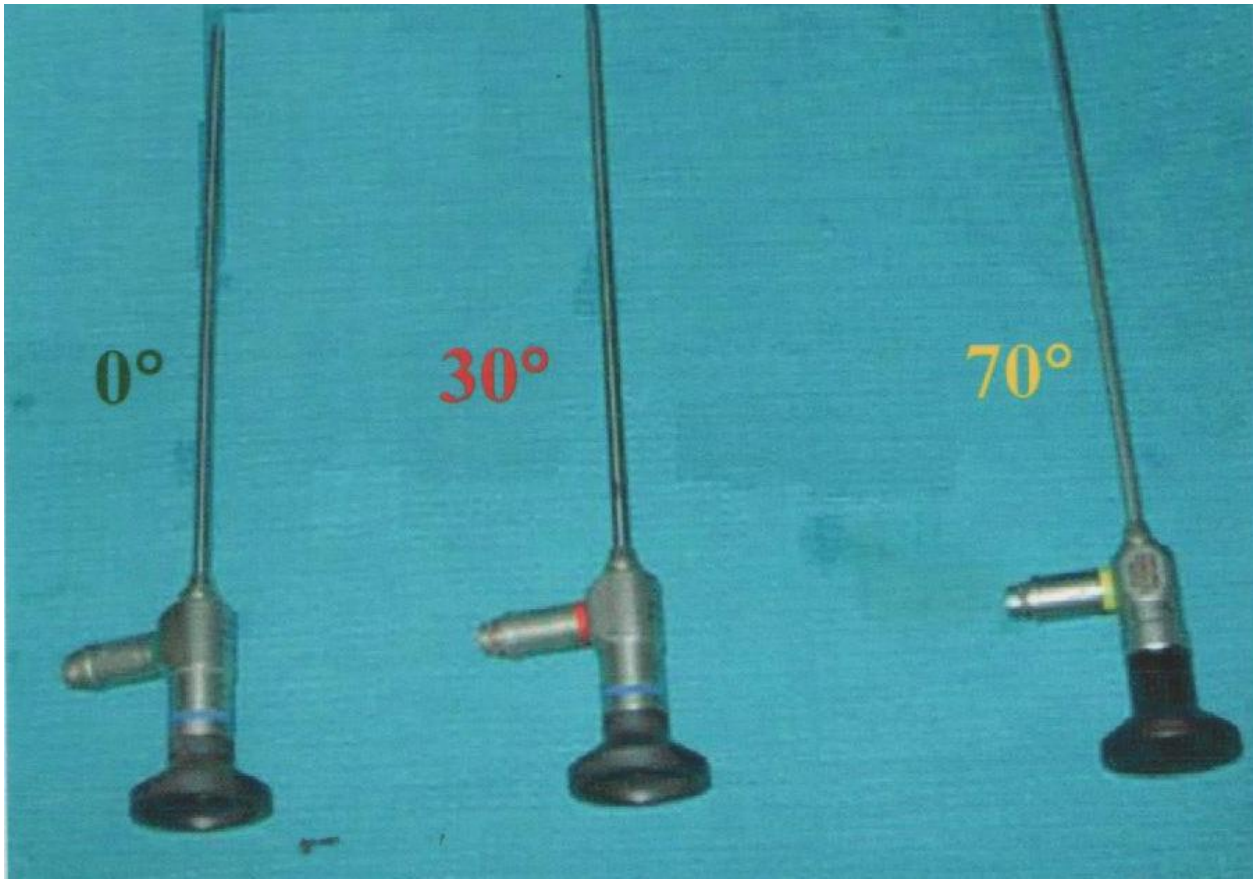
Exclusion Criteria:

Patients with acute attack of sinusitis.

Patient with sinus malignancies.

Patient who were not willing to undergo FESS.

HOPKINS ROD



Methods of Collection of Data:

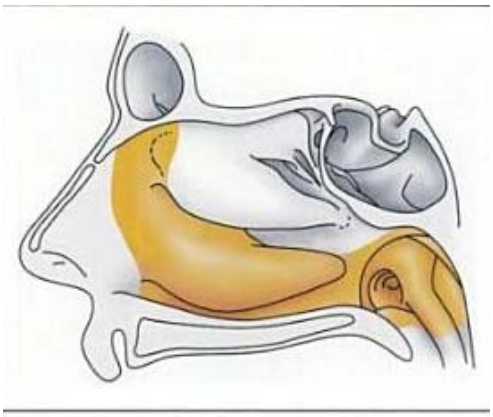
1. The cases selected for the study were subjected to detailed history taking and examination.
2. A routine haemogram (HB, BT, CT, TC, DC) and urine examination (albumin,sugar, microscopy), swab from middle meatus for culture sensitivity along with X-ray para nasal sinuses were done for the patients.
3. All the patients in active stage of the disease were treated with course of suitable antibiotic, systemic antihistamines and local decongestants.
4. Each patient underwent a systematic diagnostic nasal endoscopy and computed tomography of nose and para nasal sinuses.CT scan was taken within two days of performing diagnostic nasal endoscopy.

Equipments Used:

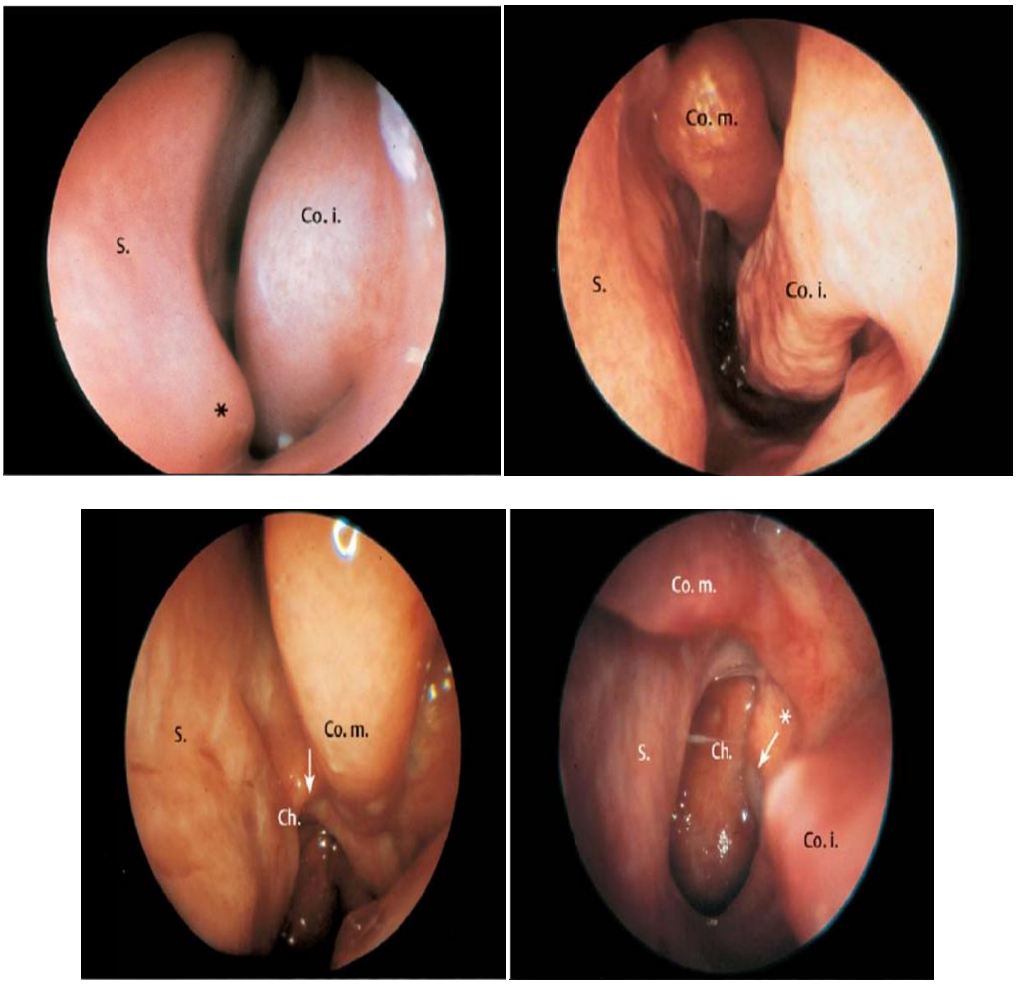
Nasal endoscope: Karl Storz Hopkins rod optical with cold light source and fibre optic light delivery system. Endoscopes used were with 0 degree,30 degree and 70 degree angles of view of 4mm diameters.

Karl Storz Endovision Telecam deluxe camera sytem with monitor. Topical decongestant and anesthetic agent (4% Xylocaine with 1:100.000 adrenaline).

DIAGNOSTIC NASAL ENDOSCOPY-FIRST PASS

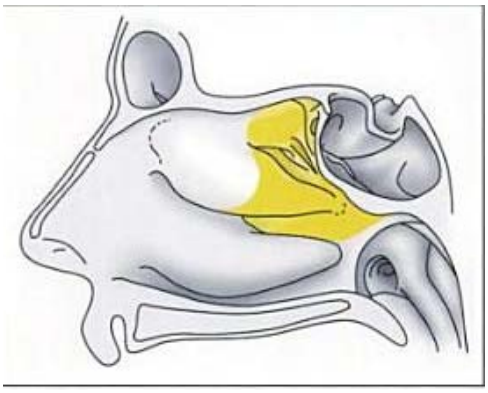


FIRST PASS EXAMINES THESE AREAS.

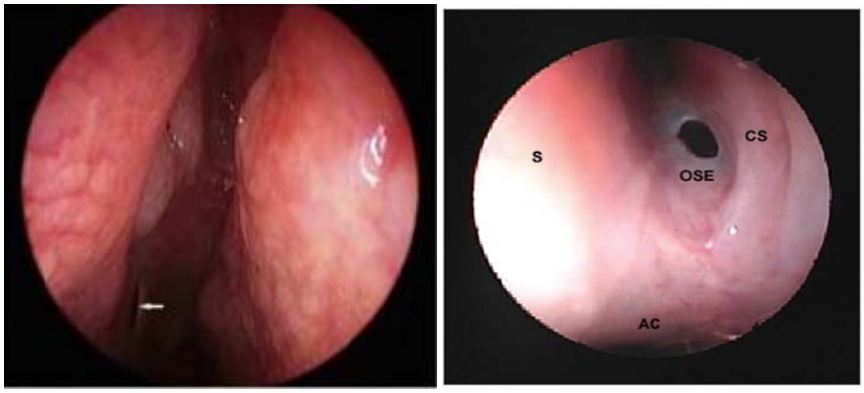


Diagnostic nasal endoscopy-first pass.Co.m-middle concha, Co.i-inferior concha, s-septum, Ch-choana.

SECOND PASS



SECOND PASS EXAMINES THESE AREAS



Sec ond pass showing posterior accessory ostium and sphenoid ostium.S-septum,CS-superior turbinate,AC-choanal arch.

Sphenoethmoidal recess and sphenoid ostium

Antifog solutions (Savlon).

Suction apparatus, Cannula, Ball probe and Freer's elevator

Position: Supine with head slightly elevated and turned towards the examiner, who is standing at the right side of the patient.

Anaesthesia:

Topical decongestant 4% Xylocaine with 1: 100.000 adrenaline solution using applicators like cottonoid strips.

Procedures: Endoscopy was performed by three passes.

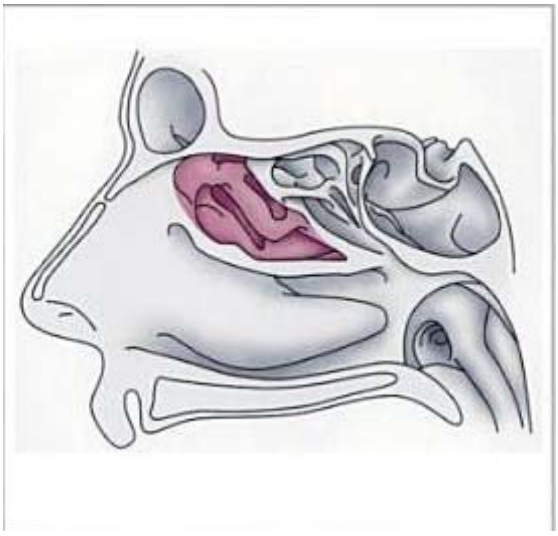
I. Pass:

Along the floor of nasal cavity towards nasopharynx to visualize the status of inferior turbinate and meatus, Eustachian tube orifice, nasopharyngeal mucosa, nasolacrimal duct orifice and any pathological variations.

II. Pass:

Scope was reinserted between inferior turbinate and middle turbinates. The inferior portion of middle turbinate and middle meatus,the fontanelles and any accessory ostium are examined. The sphenoethmoidal recess is visualized by passing the scope medial to the posterior aspect of middle turbinate and rotating it superiorly. The superior turbinate and the natural sphenoid ostium may be often visualized.

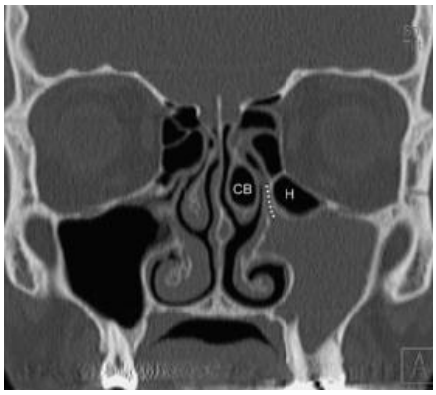
THIRD PASS



AREAS EXAMINED IN THIRD PASS

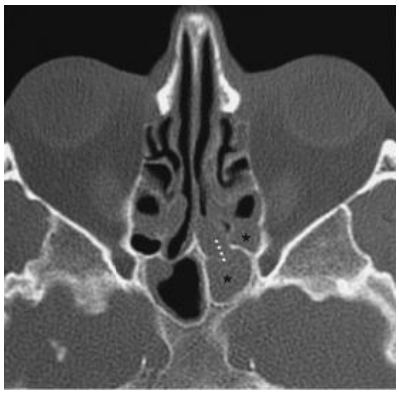
Third pass showing uncinate process,bulla ethmoidalis and anterior part of middle meatus

CT SCAN OF THE PARANASAL SINUSES



Infundibular pattern-ethmoidal infundibulum is obstructed by thickened mucosa and markedly narrowed by a haller cell (H) and a concha bullosa (CB)

Osteomeatal unit pattern



Sphenoethmoidal recess pattern

III. Pass:

The scope is rotated laterally beneath the posterior aspect of middle turbinate to gain access to the deeper areas of middle meatus.visualization of bulla ethmoidalis,hiatus semilunaris and infundibular entrance is obtained.uncinate process and its overlying mucosa is visualized.

CT scan of the paranasal sinuses

A CT scan is performed after an acute infection has been treated and acute changes have been resolved. CT is used to identify areas of persistent chronic inflammation that persists between episodes and may be a cause for recurrent acute infections. It was performed within two days of performing a diagnostic nasal endoscopy in the patient.

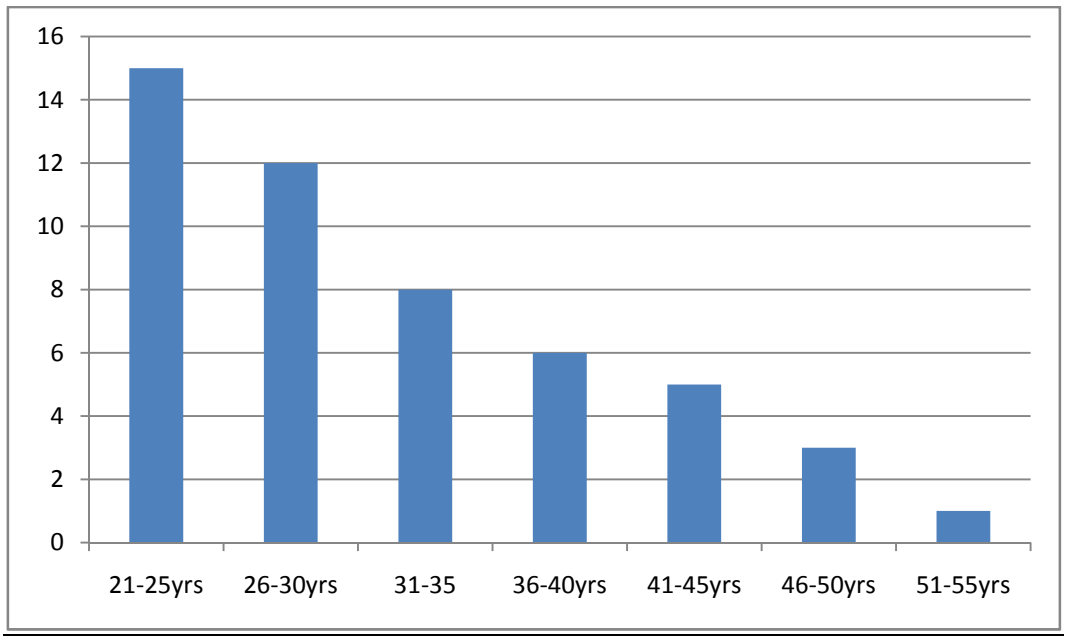
RESULTS AND OBSERVATIONS

The present study was conducted on 50 patients in the Department of ENT, Madurai medical college and Government Rajaji hospital,madurai.Our study Included fifty patients; out of which bilateral surgery was done of 35 patients and unilateral was done on 15 patients. Thus a total of 85 procedures were carried out. Middle meatal antrostomy, infundibulotomy along with anterior ethmoidectomy and frontal recess clearance was done in all the cases. While posterior ethmoid clearance and sphenoidotomy was done in some cases.

AGE DISTRIBUTION:

The age of the patient in our study Varied from 21yrs to 55yrs. Maximum number of patients were in 21 to 25 years of age group, therefore 54% of patients were in 2nd decade of age.

Age [years]	No: of patients	Percentage
21-25	15	30
26-30	12	24
31-35	8	16
36-40	6	12
41-45	5	10
46-50	3	6
51-55	1	2
Total	50	100%



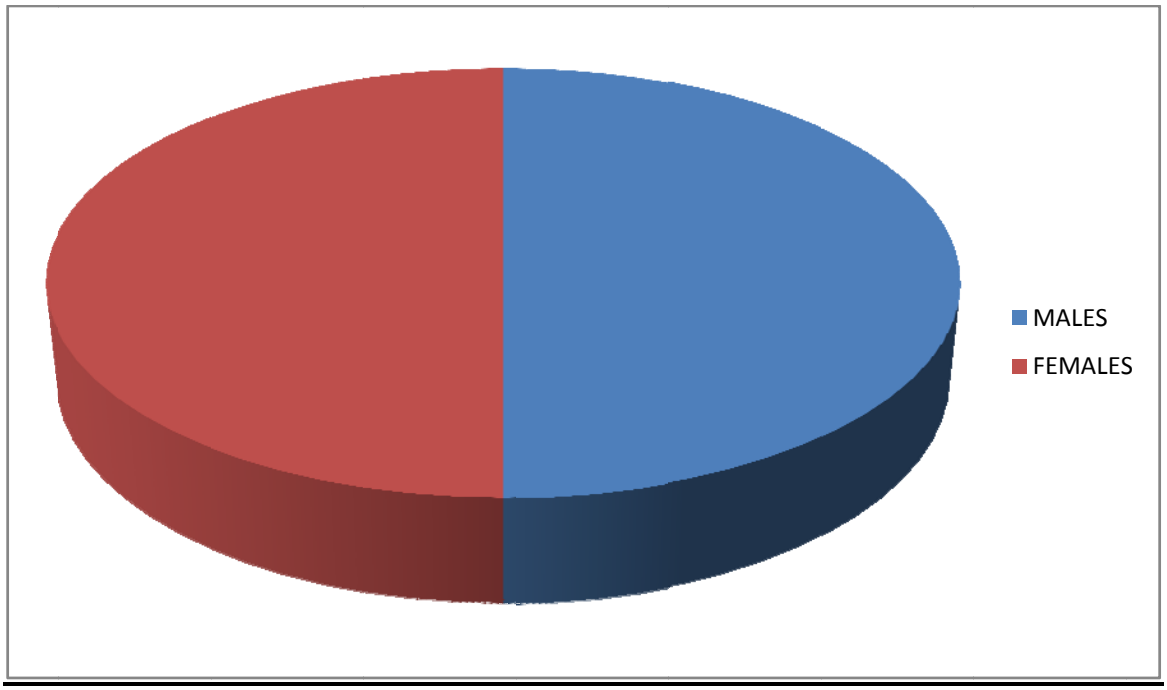
X-axis-age in years,Y-axis-number of patients

SEX DISTRIBUTION

NO: of cases in the study=50

Total number of cases	Males	Females
50	25	25

Out of the 50 patients of study 25 were males and 25 females. All were racially Indian.



SYMPTOMS:

Common symptoms of the patients in our study were headache, nasal discharge and nasal obstruction. With sneezing and hawking less commonly. 84% of patients had headache, 84% had nasal obstruction, 70% had nasal discharge, postnasal discharge was seen in 44% of patients and sneezing in 30%

Symptoms	No of patients	Percentage
Nasal obstruction	42	84
Nasal discharge	35	70
Head ache/facial pain	42	84
Post nasal discharge	22	44
Sneezing	15	30
Others	3	6

SIGNS:

In our study commonest sign was oedmatous nasal mucosa in 34% patients,sinus tenderness was seen in 36% of patients followed by purulent middle meatal discharge in 24% of patients. Hypertrophied middle turbinate was found in 20% where as non purulent middle meatal discharge was seen in 30% of the patients.

Signs	No of Patients	Percentage
Nasal mucosa: Congested	8	16
Nasal mucosa: Pale	13	26
Nasal mucosa: Edematous	17	34
Inferior turbinate hypertrophy	8	16
Middle turbinate hypertrophy	10	20
Middle Meatus: Non purulent	15	30
Purulent	12	24
Sinus Tenderness	18	36
Others	10	20

DIAGNOSIS

All of our patients suffered from chronic rhinosinusitis

ENDOSCOPIC OPERATIVE PROCEDURES PERFORMED:

Before undergoing functional endoscopic sinus surgery every patient underwent through evaluation of nose and paranasal sinus through diagnostic nasal endoscopy and computerized tomography (Coronal cuts) and the results were confirmed during the operative procedure.

The various operative procedures performed in our study are as follows. Out of fifty cases, thirty five underwent bilateral procedures whereas fifteen underwent unilateral procedure. So a total of eighty five procedures were carried out.

Septal correction [SMR/septoplasty] was done in 8 procedures. Anterior ethmoidectomy and middle meatal antrostomy was done in 54 procedures. In 23 procedures total ethmoidectomy with middle meatal antrostomy along with frontal recess clearance was done.

OPERATIVE PROCEDURE	
Septal correction	8
AE+MMA	54
TE+MMA+FRC	23
Total	85

CORRELATION OF DIAGNOSTIC ENDOSCOPY FINDINGS WITH COMPUTED TOMOGRAPHY FINDINGS:

The parameters correlated in our study include middle turbinate, middle meatus, bulla ethmoidalis, hiatus semilunaris, frontal recess and sphenoethmoid recess.

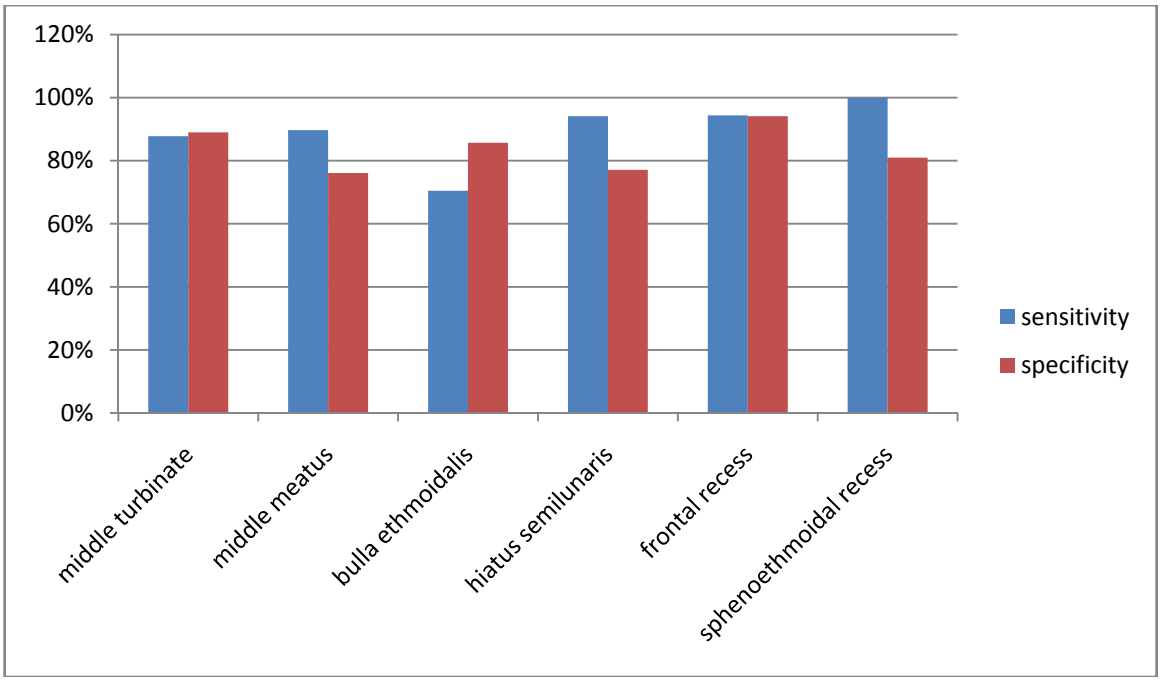
The false positive, false negative, sensitivity and specificity were calculated forn diagnostic endoscopy as compared to CT findings. Diagnostic endoscopy was found to have sensitivities for frontal recess, hiatus semilunaris and sphenoethmoidal recess as 94%, 94% and 100% respectively. While sensitivity for middle turbinate, bulla ethmoidalis and middle meatus was 87%, 70% and 89% respectively.

The specificity of diagnostic endoscopy for frontal recess, middle turbinate and bulla ethmoidalis was found as 94%, 88% and 85% respectively and for sphenoethmoidal recess, hiatus semilunaris and middle meatus as 81%, 77% and 76% respectively. So diagnostic endoscopy was found to be more sensitive for frontal recess,sphenoethmoidal recess and hiatus semilunaris and more specific for middle turbinate, bulla ethmoidalis.

CORRELATION OF DIAGNOSTIC ENDOSCOPY FINDING

WITH COMPUTED TOMOGRAPHY FINDINGS

Sl.no	1	2	3	4	5	6
Parameter	Middle turbinate	Middle meatus	Bulla Ethmoid Alis	Hiatus Semilunaris	Frontal recess	Spheno ethmoidal Recess
DNE[N]+ CT [N]	32	16	18	27	32	30
DNE[A]+CT[A]	36	61	12	32	17	3
DNE[A]+CT[N]	4	5	3	8	2	7
DNE[N]+CT[A]	5	7	5	2	1	0
SENSITIVITY	87.8	89.7	70.5	94.1	94.4	100
SPECIFICITY	88.8	76.1	85.7	77.1	94.1	81
PREDICTIVE +VE	90	92.4	80	80	89.4	30
PREDICTIVE-VE	86.4	69.5	78.2	93.1	96.9	100



CORRELATION OF CT FINDINGS WITH OPERATIVE FINDINGS:

The various parameters were correlated in our study were inferior meatus,inferior turbinate, middle meatus, middle turbinate, infundibulum, uncinate process,maxillary sinus, hiatus semilunaris, bulla ethmoidalis, anterior ethmoids, posterior ethmoid, sphenoethmoid recess, haller cells and frontal recess.

The false positive, false negative, sensitivity and specificity of CT compared to OT were calculated for each parameter.

CT showed highest sensitivity for maxillary sinus, posterior ethmoids ,haller cells and uncinate process which were 93%, 96%, 100% and 89% respectively.

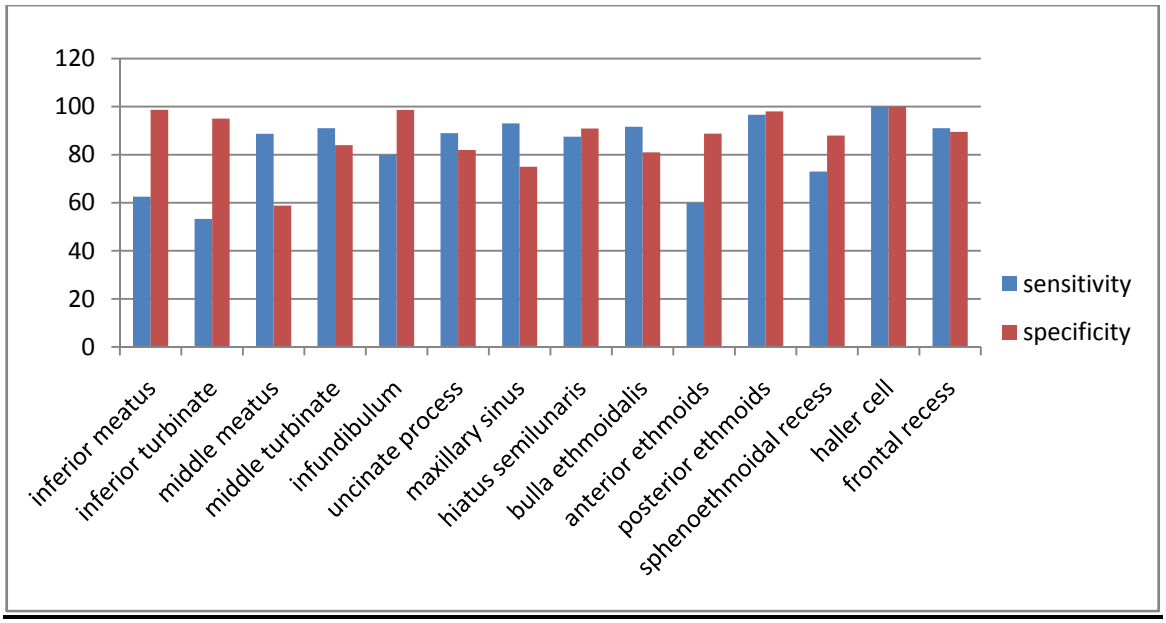
CT was found to be relatively less sensitive for parameters like infundibulum,hiatus semilunaris, frontal recess and middle meatus. The values were 80%, 87%,90% and 88% respectively.

The specificity of CT was found to be best for hiatus semilunaris, haller cells, frontal recess, inferior meatus, anterior ethmoids, posterior ethmoids and inferior turbinate. The values were 90%, 100%, 89% 98%, 88%, 98% and 95% respectively.CT was relatively less specific for bulla ethmoidalis, maxillary sinus, middle meatus and sphenoethmoid recess. The values were 81%, 75%, 58% and 88% respectively.

CORRELATION OF CT SCAN FINDINGS WITH OPERATIVE FINDINGS.

SL .NO	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Parameter	IM	IT	MM	MT	IN	UP	MS	HS	BE	AE	PE	SER	HC	FR
CT[N]+ OT[N]	79	77	20	32	73	23	18	20	30	16	49	49	4	43
CT[A]+ OT[A]	5	8	55	53	4	57	67	42	55	6	29	30	1	30
CT[A]+ OT[N]	1	4	14	6	1	5	6	2	7	2	1	6	0	5
CT[N]+ OT[A]	3	7	7	5	1	7	5	6	5	4	1	11	0	3
Sensitivity	62.5	53.3	88.7	91	80	89	93	87.5	91.6	60	96.6	73.1	100	91
Specificity	98.7	95	58.8	84	98.6	82	75	90.9	81	88.8	98	88	100	89.5
Predictive +VE	83.3	66.6	79.7	89.6	80	92	91.7	95.4	88.7	72.7	96.6	83.3	100	85.7
Predictive -VE	96.3	91.6	74	86.4	98.6	76	78	76.9	85.7	77.7	98	80	100	93.4

(CT-CT scan findings,OT-intra-operative findings, IM-inferior meatus,IT-inferior turbinate, MM-middle meatus, MT-middle turbinate, IN-infundibulum, UP-uncinate process, MS-maxillary sinus,HS-hiatus semilunaris, BE-bulla ethmoidalis, AE-anterior ethmoids, PE-posterior ethmoids, SER- sphenoethmoidal recess, HC-haller cells,FR-frontal recess)



CORRELATION OF DIAGNOSTIC ENDOSCOPY FINDINGS WITH OPERATIVE FINDINGS:

The various parameters correlated were inferior meatus, inferior turbinate,middle meatus, middle turbinate, uncinated process, hiatus semilunaris, bulla ethmoidalis, sphenoethmoidal recess, frontal recess and agger nasi cell.The false positive, false negative, sensitivity and specificity were calculated of nasal endoscopy as compared to operative findings for each parameter and tabulated.In our study the sensitivity of diagnostic nasal endoscopy was maximum for middle meatus, uncinate process, hiatus semilunaris, bulla ethmoidalis and agger nasi cell. The values were 93%, 89%, 100%, 87.5% and 95% respectively. The sensitivity was comparatively less for

sphenoethmoid recess, frontal recess, inferior meatus and inferior turbinate. The values were 75%, 82%, 71% and 72% respectively.

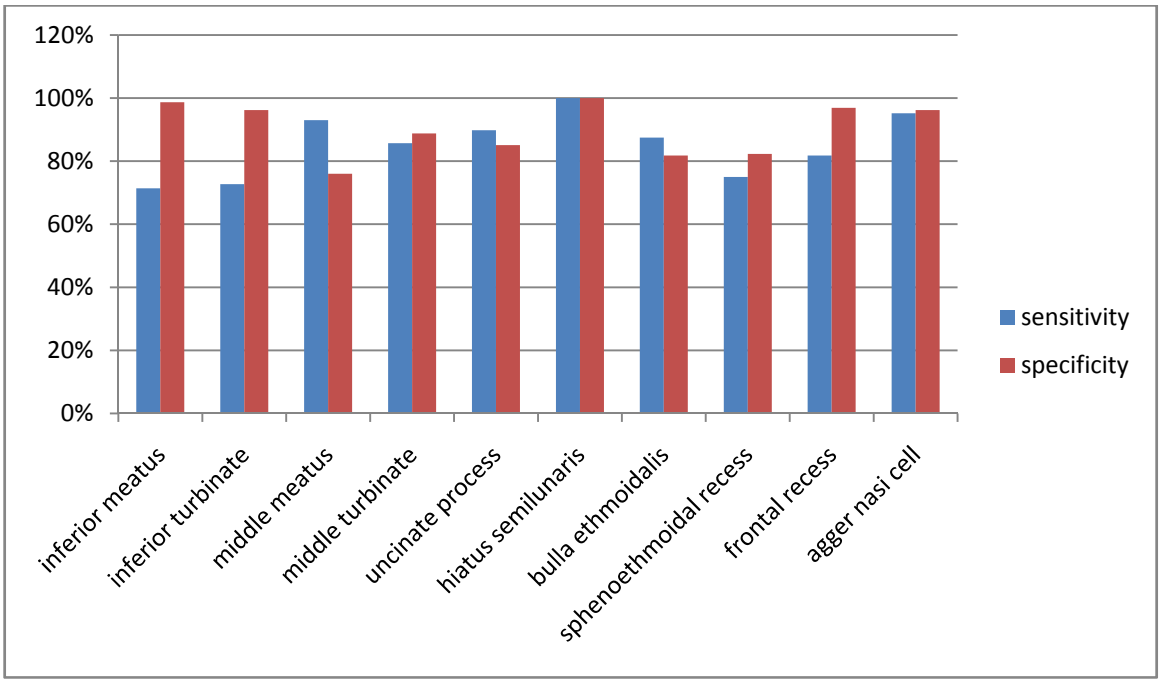
The specificity of diagnostic nasal endoscopy was maximum for hiatus semilunaris, frontal recess, agger nasi cell, inferior meatus and inferior turbinate.

The values were 100%, 97%, 96%, 98% and 96% respectively. The specificity was comparatively less for middle meatus, uncinate process, bulla ethmoidalis, sphenoethmoidal recess and middle turbinate. The values were 76%, 85%, 82%, 82% and 89% respectively.

CORRELATION OF DIAGNOSTIC NASAL ENDOSCOPY FINDINGS WITH OPERATIVE FINDINGS

Sl.no	1	2	3	4	5	6	7	8	9	10
Parameter	IM	IT	MM	MT	UP	HS	BE	SER	FR	ANC
DNE[N]+ OT[N]	79	78	19	32	23	24	18	14	32	26
DNE[A]+ OT[A]	5	8	55	30	53	30	14	3	18	20
DNE[A]+ OT[N]	1	3	6	4	4	0	4	3	1	1
DNE[N]+ OT[N]	2	3	4	5	6	0	2	1	4	1
sensitivity	71.4	72.7	93	85.7	89.8	100	87.5	75	81.8	95.2
specificity	98.7	96.2	76	88.8	85.1	100	81.8	82.3	96.9	96.2
Predictive +ve	83.3	72.7	90	88.2	92.9	100	77.7	50	94.7	95.2
Predictive -ve	97.5	96.2	82.6	86.4	79.3	100	90	93.3	88.8	96.2

(DNE-diagnostic nasal endoscopy,OT-operative findings,ANC-agger nasi cell)


120%
100%
80%
60%
40%
20%
0%
inferior meatus
inferior turbinate
middle meatus
middle turbinate
uncinate process
hiatus semilunaris
bulla ethmoidalis
sphenoethmoidal recess
frontal recess
agger nasi cell
sensitivity
specificity

DISCUSSION

The present study entitled "Endoscopic findings and radiological appearances in chronic rhinosinusitis: A comparative study" was conducted in the Department of ENT, Madurai Medical college and Government Rajaji Hospital , Madurai from October 2010 to October 2011. The study included 50 patients of chronic sinusitis who did not respond to medical line of treatment and are willing to undergo Functional Endoscopic Sinus Surgery.

Of the 50 patients 35 underwent bilateral and 15 unilateral endoscopic surgeries, hence a total of 85 procedures were carried out. All the cases had undergone diagnostic endoscopy and computed tomography before the operation.

Age distribution

In our study age of patients varies between 21 and 55 years with the maximum number of patients in 21 to 25 year category. The study conducted by Kirtane et al (1991) the ages ranged form 16 to 52 years, with majority of patents cases (46.78%) in the third decade. In our study the majority of the patients 17 cases (34%) were in the third decade.

Sex distribution

In the present study 25 patients i.e 50% were males and the other 50 % were females. In the study conducted by Kirtane et al (1991) there were 19 males (59.37%) and 13 females (40.62%).

Clinical features

1)Symptoms:

In our study nasal obstruction and headache were the commonest symptoms both of which are present in 42 patients. The next frequently occurring complaint was nasal discharge present in 35 patients. The other symptoms that were noted postnasal discharge in 22 patients, sneezing 15 patients and other symptoms like fever, epistaxis, anosmia/cacosmia etc in 3 patients.

In the majority of patients the duration of symptoms was present for more than

6 months.

In the study conducted by Kirtane MV et al (1991) the commonest complaints was nasal discharge occurring in 25 patients (78.1%), followed by headache in 22 patients (68.7%) and nasal obstruction in 22 patients (68.7%). The other complaints were sneezing in 6 patients (18.7%), anosmia and cacosmia in 2 patients each (6.25%). The duration of symptoms varied from 3 months to 30 years.

In the study conducted by Gandotra et al (March 2000) the nasal discharge and headaches were the most common symptoms, and the next common symptoms were postnasal drip and nasal obstruction.

The results of the present study are comparable with all of these studies.

2) Signs:

In our study the commonest clinical signs present were nasal mucosal oedema in 17 patients and congested mucosa in 8 patients, while a pale mucosa was present in 13 patients. The other finding was middle meatal discharge-mucopurulent in 15 patients and non-purulent in 15 patients and sinusIn the study conducted by Venkatchalam V.P. et al (March 2000), clinical findings were hypertrophied inferior turbinate (10%), hypertrophied middle turbinate (17.14%), Congested mucous membrane (15.71%), sinus tenderness (7.14%) and Ethmoidal polyps (12.8%).

Diagnosis:

In the present study 46 [98%] patients had chronic rhinosinusitis and four[2%] patients had nasal polyposis.

In the study conducted by Gandotra S.C. et al (March 2000) 60.8% had chronic sinusitis and 21.7% had ethmoidal polyps. While in the study conducted by

Jones N.S. et al (1997), 75% had chronic rhinosinusitis and 25% had nasal polyposis.

Computed Tomographic Patterns:

All the patients in our study were subjected to CT scans and instead of giving a long list of positive findings, a definite pattern, dividing the findings in 5 recognisable patterns of inflammatory sinonasal disease was followed which gives a clear picture of the disease and helps in planning surgery.

Out of the 50 cases, the infundibular pattern, i.e. involvement of maxillary sinus only due to ipsilateral obstruction of inferior aspect of infundibulum was present in 25%. The osteomeatal unit (OMU) pattern, i.e. involvement of frontal, ethmoidal and maxillary sinus or combination of any two with osteomeatal complex involvement was present in 23%. Sinonasal polyposis (SNP) pattern, i.e. when a combination of polypoidal soft tissue densities are present through out the nasal vault and paranasal sinuses in association with variable diffuse sinus opacification was seen in 2 %. Sphenoethmoid recess (SER) pattern. i.e. when obstruction is present in SER region with involvement of posterior ethmoid and sphenoid sinus was present in 10%. And lastly the sporadic or unclassifiable pattern which includes inflammatory sinus

disease which cannot be categorized into the above 4 patterns. This includes finding such as retention cysts, mucoceles and mild mucoperiosteal thickening. This was present in 4% in our study.

Correlation of diagnostic endoscopic findings with computed tomographic findings:

All the patients included in our study underwent diagnostic endoscopy followed by CT scan. On endoscopy, in addition to gross findings such as pathologic discharge, subtle evidence of disease in the osteomeatal area may be identified. Among the parameters that were correlated, the diagnostic endoscopy was found to be most sensitive investigation for the hiatus semilunaris, sphenoethmoid recess and frontal recess with sensitivity of 94.1%, 100% and 94.4% respectively.

While the specificity of these parameters were 77.1%, 81% and 94.1%. As all the three parameters considered are the key areas where all the major sinuses drain, it can be inferred that diagnostic endoscopy can be definitely used as a very sensitive tool towards diagnosing the infection in the adjacent sinuses.

But the sensitivity and specificity for the middle turbinate (87.8 and 88.8%) middle meatus (89.7% and 76.1%) and bulla ethmoidalis (70.5% and 85.7%) were not so good as compared to the above parametes.

There were a significant percentage of various parameters that could not be visualized at diagnostic endoscopy in certain cases: middle turbinate, middle meatus, bulla ethmoidalis, hiatus semilunaris, frontal recess and sphenoethmoid recess. This is because in some of the cases it was impossible to pass the endoscope beyond certain point either due to presence of severe anatomical abnormalities like a gross deviation of the nasal septum, paradoxical middle turbinate, or a concha bullosa. CT scan definitely proved to be very helpful In these cases.

Diagnostic endoscopy is a very sensitive and specific tool to diagnose the disease and to note the pathology in the areas that are inaccessible for visualization by routine anterior rhinoscopy. The diagnostic endoscopic findings correlate well with the computed topographic findings.

Operative procedures performed:

In the present study out of 50 patients, 35 underwent bilateral surgeries, hence a total of 85 procedures were carried out. Apart from that 8 underwent septal correction , Frontal recess clearance with anterior ethmoidectomy and middle meatal antrostomy was done in 30 patients. Frontal recess clearance with total ethmoidectomy with middle meatal antrostomy was done in 23 patients. Sphenoidotomy was done in 2 patients.Thus a total of 85 procedures were

carried out.

Correlation of computed tomography findings with the operative findings:

CT is effective in demonstrating predisposing causes of chronic sinusitis (eg.Anatomical variants) and provides precise guidance for therapeutic endoscopic instrumentation. CT with its excellent capability for displaying bone and soft tissues is the current diagnostic modality of choice for evaluating the osteomeatal complex(Zinreich et al 1987).

Among the various parameters that were correlated, the sensitivity was found to be good for almost all the parameters [maxillary sinus (94.3%) frontal recess (88%), posterior ethmoids (92%) and expect for the anterior ethmoids (88%).Similar observation was done by Kaluskar and Patil (1992) when they

compared the sinus disease radiologically (plain x-ray and coronal CT) and at surgery.

Hence one must be cautious and take note of even seemingly insignificant changes in the infundibular block. The specificity of CT scan was found to be good for the anterior ethmoids(90.38%) and sphenoid sinus (92.3%) than for the maxillary sinus (84.2%).So CT is also a very specific investigation for the disease in all the sinuses except the maxillary sinus and its ostium.The scan serve as a "road map" for the surgeon as he negotiates the potentially hazardous clefts of the paranasal sinus unit.

Correlation of diagnostic endoscopic, computed tomographic and operative findings.

As the total number of procedures that were carried out in our study were 85,all the confirmed operative findings of 85 sides were available. Only the parameters that were confirmed at operation of being normal or abnormal were correlated with the diagnostic endoscopy and computed tomography scan.

The diagnostic endoscopy findings correlated very well with the operative findings. As has been mentioned earlier the only draw back of diagnostic endoscopy was that there were a significant proportion of cases in whom not all the parameters could be visualized due to presence of gross pathology or

severe anatomical abnormality that made in impossible to pass the endoscope beyond certain point. The association between Diagnostic endoscopy and CT was calculated using Chi square test.

Chi square $\chi 2 = 77.3$

Since $P < 0.05$ indicates there is a high association between diagnostic endoscopy and CT.

The advantages and disadvantages of diagnostic endoscopy can be stated as follows:

Advantages of diagnostic endoscopy are:

- Optical brilliance and clear field of vision.
- Easy handing, office procedure, economic.
- Ability to "look around corners" with deflecting angles.
- Ability to Visualize structures deep in the nasal cavity.
-Ability to work with minimum trauma using local anesthesia.
- Ability to detect to detect hidden disease.
- Documentation and education.

Limitations of nasal endoscopy are:-

1. Gross septal deviation can make endoscopy difficult and unrewarding.
2. Localized disease within the infundibulum, frontal recess and maxillary sinus ostium is difficult to diagnose.
3. Optical illusory effect – due to this, a beginner may find difficult to orient the anatomy especially when using different optical views.
4. Depth perception is not there because of absence of binocular vision.
5. Gives no information regarding position and status of vital relations of spheno-ethmoids.
6. Extent of disease within the spheno-ethmoid is difficult to be made out. CT imaging of PNS can overcome these limitations.

The computed tomographic findings correlated well with the confirmed findings at operation, but there were a significant number of false positives and false negatives particulary for the sinuses. The coronal section CT scans provided most of the information required for an endoscopic clearance. Overall, the advantages and disadvantages of CT scans can be stated follows:

Advantages of CT scan are:

1. It shows progressively deeper structures as the surgeon encounters them during operation (eg: uncinate process, bulla ethmoidalis, ground lamella,sphenoid sinus, in an A-P direction).
2. It shows the relationships of the above structures to important areas such as the lamina papyracea and skull bone, reducing the morbidity.
3. Dehiscences of the lamina papyracea are better visualized.
4. Comparative study of two sides of the ethmoids labyrinth is possible.To sum up, the CT scan serves as a "road map" for the surgeon as he negotiates the potentially hazardous clefts of the PNS unit. It is a non-invasive, rapid, convenient investigation, which helps in documentation and education. As already mentioned CT scan delinates the extent of disease, anatomical and pathological variations far better than other methods.

Disadvantages of CT scan: -

1. Radiation dose to the sensitive areas like cornea and lens is particularly high when axial cuts are taken – nearly 185 times more than that recorded for plain X – rays. Careful positioning of the patient in the scanner can reduce this.

2. Inability to differentiate between fibrous tissue (post-op) and inflammatory mucosal disease. Thus CT scan falsely indicates recurrent disease because of the presence of postoperative fibrosis in the PNSs. (i. e, Specificity of CT is lower than the Sensitivity of CT).
3. Relatively expensive investigation. CT scan should be used to provide supplementary clinical data to the history and endoscopic examination, and assist in directing surgical treatment to the affected areas.

SUMMARY AND CONCLUSION

- This study was conducted in the department of ENT, Madurai medical college and Government Rajaji Hospital from August 2009 to October 2011.
- This study was undertaken with the objective of comparing the diagnostic endoscopy and computed tomographic findings in patients with chronic sinusitis.
- Fifty patients suffering from chronic sinusitis underwent Functional Endoscopic Sinus Surgery after being thoroughly evaluated by diagnostic endscopy and CT scan.
- The factors affecting the drainage of various sinuses along with the state of various sinuses were compared as per diagnostic endoscopy, computed tomography and operation.
- Sensitivity and specificity, positive predictive value and negative predictive values were calculated for both diagnostic endoscopy and computed tomography.
- Association was calculated using Chi square test with overall P value less than 0.05 signifying that there is a high association between both CT and endoscopy.

- In the overall assessment, following conclusions can be drawn:

1. Majority of the patients were in the second decade and there were equal number of male and female patients.

2. The commonest symptoms were nasal obstruction and headache along with nasal discharge.

3. The commonest signs were middle meatal discharge, edematous mucosa and sinus tenderness.

4. The commonest CT pattern in our study was of infundibular type, followed by Osteomeatal type.

5. Anterior ethmoidal sinus was most the frequently diseased sinus in our study.

6. The findings of diagnostic endoscopy correlated very well with operative findings except for some of the findings, which could not be visualized at diagnostic endoscopy due to some severe anatomical / pathological changes.

7. Extent of disease in each sinus is very well recognized in CT.

8**. Both diagnostic endoscopy and computed tomography imaging of PNS are important preoperative evaluation tools in detecting pathology and both are complementary to each other.**

Diagnostic endoscopy and CT scan is a must prior to any functional endoscopic sinus surgery. They help in assessing the extent of sinus disease and to know the variations and vital relations of the paranasal sinuses. CT assists the surgeon as a “road-map” during FESS.

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PROFORMA

Name of the Patients:

Age/Sex : Case No:

Religion : Reg. No. IP/OP/No. :

Occupation : Date of Admission :

Income : Date of Discharge :

Address : Diagnosis :

Chief Complaints:

A] Present History

1) Nasal Discharge

Duration :

Onset & Progress :

Unilateral/ Bilateral :

Diurnal Variation :

Seasonal Variation :

Quality :

Watery / Mucoid/

Colour :
Odour :

Any Other :

2) Nasal Obstruction:

Duration :

Onset & Progress :

Unilateral/ Bilateral :

Diurnal Variation :

Seasonal Variation :

3) Headache / Facial Pain ;

Duration :

Onset & Progress :

Site :

Postural Variation :

Seasonal Variation :

Localized Radiating :

Aggravating :

Relieving Factors :

Any Other :

4) Post-Nasal Discharge;

Quality :

Colour :

Odour :

5) History of Epistaxis :

6) History of Sneezing :

Duration :

Onset & Progress :

Seasonal Variation :

Aggravating factors :

Relieving Factors :

7) H/O Allergy :

8) H/O Fever :

9) H/O Cough :

10) Abnormalities of Smell(If any) :

Hyposmia/Parosmia/Anosmia/Cacosmia.

11) Any Other Symptoms:

[B] Past History:

H/O Similar Complaints in past- Any treatment taken :

Medical- Surgical.

H/O TB/HT/DM/ any exposure

[C] Personal History

Diet : Adequate /Inadequate, Veg/Non-Veg

Appetite :

Sleep :

Micturation :

Bowels :

Habits: Smoking, Beedis /Cigarettes since…….. Years/months.

Tabacco Chewing since …… years

[D] Family History :

H/O Similar complaints in family members-

[I] General Physical Examination:

Built an Nourishment : Good / Moderate / Poor.

Pallor / Cyanosis / Clubbing :

Icterus /Lymphadenopathy:

Vital Signs:

Pulse Rate : / mm

Temperature :

Blood Pressure : mm

Respiratory rate : Per min.

Examination of Face :

Quality of Voice :

[II] Systemic Examination

1) Respiratory System:

2) Cardio-Vascular System:

3) Per Abdomen:
4) Centeral Nervous System;

[III] E.N.T. Examination

1. Examination of Nose :

a) External Appearance :

b) Cold Spatula Test :

c) Anterior Rhiniscopy :

i) Vestibule :

ii) Mucosa: Pale /Edematous/ Congested / Crusting

iii) Septum:

Right Left

iv) Cavity:

v) Turbinates

Inferior

Middle

vi) Meati

Inferior

Middle

Olfactory Cleft

vii) Floor :

viii) Roof :

ix) Any Other abnormality :

d) Examination of Paranasal Sinuses:

	Right	Left
(i) Frontal		
(ii) Ethmoidal		
(iii) Maxillary		

e) Posterior Rhinoscopy:

2. EXAMINATION OF ORAL CAVITY AND OROPHARYNX

a) Oral cavity :

b) Oropharynx :

Pillars :

Tonsils :

Palate :

Uvula :

Posterior Pharyngeal Wall :

c) Indirect Laryngoscopy :

3. EXAMINATION OF EARS ;

	Right	Left

(i) External Appearance

(ii) External Auditory Canal

(iii) Tympanic Membrane

(iv) Siegelisation Test :

(v) Tunning Fork Tests:
Rinne's

Weber's

ABC ;

(vi) Mastoid tenderness

(vii) Facial Nerve Examination:

INVESTIGATIONS

1) Blood:

a) Haemoglobin :

b) ESR :

c) Total WBC Count :

d) Different WBC Count :

Neutophils : Eosinophils :

Basophils :

Lymphocytes : Monocutes :

e) Absolute Eosinophils Count :

f) Bleeding Time : g) Clotting Time :

2) Urine : Albumin :

Sugar :

Micro :

3) X-ray PNS :

4) Nasal Swab for Culture and Sensitivity :

5) DIAGNOSTIC ENDOSCOPY:
Nasal endoscopic findings :

1) Floor of the Nose

2) Septum :

3) Inferior meatus:

4) Inferior Turbinate :

5) Middle Turbinate :

6) Nasopharynx :

7) Sphenoid ethmoid recess :

8) Posterior tip of turbinate :

9) Middle Meatus :

10) Hiatus Semilunaris

11) Ethmoidal Bulla

12) Uncinate:

13) Nasal polyps:

14) Frontal Recess:

15) Anatomical Variations:

i. Agger Nasi Cells :

ii. Accessory Maxillary ostium:

iii. Bulla ethmoidalis:

iv. Uncinate Process

v. Middle Turbinate:

vi. Onodi Cells:
vii. Septal Deviation:

6) COMPUTED TOMOGRAPHIC FINDINGS:

Plain / Contrast

Axial / Coronal

i) Frontal Sinus

ii) Nasolacrimal Duct

iii) Anterior ethmoids

iv) Infundibulum

v) Maxillary Sinus

vi) Middle meatus

vii) Frontal recess

viii) Polyps

ix) Posteriors ethmoids

x) Sphenoid ethmoid recess

xi) Sphenoid

xii) Agger nasi Cells

xiii) Haller Cells

xiv) Ethmoid Bulla

xv) Uncinate Process

xvi) Middle Turbinate

xvii) Onodi Cells

xviii) Septal Deviation
xix) Accessory Maxillary ostium.

DIAGNOSIS :

TREATMENT :

Procedures Performed:

Correlation of diagnostic endoscopic, computed tomograpic and operative findings

		Diagnostic endoecopy				Computed tomography				Operative Findngs	
Sl. no	Parameter	NL	AB	F+ ve	F- ve	NL	AB	F +ve	F - ve	NL	AB
1.	Inferior meatus	79	5	1	2	79	5	1	3	79	5
2.	Inferior turbinate	77	8	3	3	77	8	4	7	77	8
3.	Middle meatus	19	61	5	4	20	69	14	7	23	55
4.	Middle turbinate	32	36	4	5	32	53	6	5	32	53
5.	Infundibulum	0	0	0	0	73	4	1	3	73	4
6.	Uncinate process	23	53	4	6	23	57	5	7	23	57
7.	Maxillary sinus	0	0	0	0	18	67	6	5	18	67
8.	Hiatus semilunaris	27	32	0	0	20	75	2	6	24	55
9.	Bulla ethmoidalis	18	14	4	2	30	55	7	5	30	55
10.	Anterior	0	0	0	0	20	6	2	4	25	26

	ethmoids										
11.	Posterior ethmoids	0	0	0	0	50	29	1	1	49	30
12.	Spheno-ethmoidal recess	30	3	3	1	55	30	6	11	44	38
13.	Nasopharynx	31	43	3	5	33	45	5	4	0	0
14.	Haller cells	0	0	0	0	5	1	0	0	0	0
15.	Frontal cell	32	20	1	4	48	37	5	1	43	42
16.	Agger nasi cells	26	20	1	1	26	33	0	0	26	33

SL. NO	NAME	AGE	SEX [M/F]	IP. NO	symptoms					Signs									
					NO	ND	H	PND	SNZ	MU	S	IT		MT		IM		MM	
												R	L	R	L	R	L	R	L
1.	Kavitha	30	F	10525	+	-	+	-	-	P	N	N	N	N	N	N	N	MU	PS
2.	Tajnisha	29	F	11622	+	+	+	-	-	N	N	H	P	N	N	N	N	N	NV
3.	Devi	25	F	11640	+	-	+	-	+	N	N	N	N	P	N	N	P	MU	N
4.	Pandi	34	M	18951	-	+	-	-	-	N	N	N	N	P	P	N	P	N	N
5.	Lakshmi	30	F	20054	+	+	+	+	-	P	L	N	P	N	N	N	N	N	P
6.	Senthil kumar	26	M	20504	+	+	+	-	+	N	N	P	N	P	N	P	N	P	N
7.	Suresh	27	M	22078	+	+	+	-	+	N	N	H	H	H	P	N	N	NV	N
8.	Pandeeswari	28	F	23093	+	+	-	+	-	N	L	H	N	N	P	N	N	NV	NV
9.	Easwari	40	F	24058	+	+	-	+	-	N	N	H	N	N	P	N	N	N	NV
10.	Selvaraj	52	M	25058	+	+	+	+	-	P	N	N	P	N	N	N	N	N	N
11.	Paramasivam	26	M	12673	+	+	+	-	+	N	N	N	N	N	H	N	N	NV	N
12.	Raja	33	M	26666	+	-	+	+	-	N	N	N	N	H	N	N	PS	N	NV
13.	Pandi	36	F	28355	-	+	+	-	+	P	N	N	H	N	P	N	N	N	P
14.	Majitha beevi	25	F	29995	-	+	+	-	+	C	R	N	N	N	N	N	N	P	N
15.	Panju	37	F	29056	+	+	+	-	-	N	N	N	N	N	N	N	N	NV	N
16.	Anandaraj	48	M	31654	+	+	+	+	-	P	N	N	N	N	N	N	N	N	NV
17.	Meyammal	48	F	33338	+	+	+	-	-	P	N	N	P	H	P	N	N	N	N
18.	Chitra	26	F	33973	+	+	+	-	+	N	N	N	N	N	N	N	NV	MU	PS
19.	Kalaiselvi	25	F	37284	+	+	+	-	-	N	N	N	H	P	N	N	N	N	NV
20.	Raghu prakash	26	M	38283	+	+	+	+	-	N	N	P	N	P	NV	N	N	NV	MU
21.	Fathima	23	F	41018	+	+	+	+	-	N	N	N	N	P	N	N	N	NV	N
22.	Lakshmi	35	F	43789	+	+	-	-	-	N	N	N	P	H	N	N	N	NV	N
23.	Sathya	22	F	44923	+	-	-	+	-	N	N	N	N	N	P	N	N	P	NV
24.	Ponnusamy	49	M	45562	+	+	+	-	+	C	N	N	N	PX	NV	N	N	N	N
25.	Theertham	44	F	46097	+	+	+	+	-	N	N	N	N	N	N	N	N	NV	PS
26.	Rathan banu	34	M	47177	+	+	+	-	-	P	N	N	N	N	N	N	N	MU	NV
27.	Indrani	21	F	50291	-	+	+	+	-	N	N	N	N	PX	P	N	N	N	NV
28.	Chitra	27	F	57285	+	-	+	+	-	N	N	N	H	NV	N	P	N	NV	N
29.	Balu	22	M	53416	+	+	-	+	+	N	N	H	N	N	N	N	P	NV	NV
30.	Prakash	30	M	57037	+	+	+	-	-	P	N	N	N	H	PX	N	N	P	N

31.	Mookaih	36	M	57535	+	-	+	+	-	P	N	N	N	NV	N	N	N	N	N
32.	Ganesan	37	M	60905	+	-	+	+	-	N	N	N	P	N	P	N	N	N	P
33.	Murugan	33	M	62537	+	-	+	-	-	N	N	N	N	NV	N		N	NV	MU
34.	Sangeetha	21	F	39625	+	+	+	-	+	N	N	N	N	N	N	P	N	N	MUP
35.	Muneeswaran	23	M	41757	-	+	+	-	+	N	R	P	N	H	P		N	N	NV	MU
36.	Prakash	44	M	44045	+	-	+	+	-	N	N	N	H	N	H		N	N	NV	MU
37.	Anandan	24	M	45163	-	+	+	+	-	P	N	N	P	N	N		N	N	N	PS
38.	Nallasivam	23	M	47477	-	+	+	+	-	N	N	N	N	H	N		N	P	NV	MU
39.	Kumar	37	M	47962	+	+	-	-	+	N	N	N	N	N	H		N	N	NV	N
40.	Ganesh	31	M	49948	+	+	+	-	-	P	N	P	N	N	P		N	N	N	PS
41.	Pushpavalli	45	F	52612	+	+	+	+	-	N	N	N	N	H	N		N	N	N	N
42.	Venketaraman	22	M	53074	+	-	+	-	-	N	N	N	P	N	H		N	N	P	N
43.	Sakthivel	21	M	48383	-	+	+	+	+	N	N	N	N	N	N		N	N	NV	MUP
44.	Indrani	45	F	47472	+	-	-	-	-	P	N	N	N	N	N		P	N		NV
45.	Tamirasi	42	F	64053	+	-	+	-	-	N	N	N	N	N	NV		N	N	NV	MU
46.	Mahalakshmi	25	F	64730	+	+	+	-	+	N	N	N	N	N	N		N	N	NV	PS
47.	Kathirvel	31	M	66263	+	+	+	+	-	N	N	N	N	N	N		N	P	NV	NV
48.	Amutha	35	F	67149	+	-	+	-	-	N	N	N	N	N	P		N	N	P	N
49.	Kamatchi raja	24	M	68715	+	+	+	-	+	C	N	N	N	N	H		N	N	N	P
50.	Amutha	30	F	69968	+	-	+	+	-	N	R	N	N	N	N		N	N	N	MUP

KEY TO MASTER CHARTS

+ : PRESENT

- : ABSENT

N : NORMAL

E : EDEMATOUS

P : POLYPOIDAL

H : HYPERTROPHIEDC : CONGESTED

MUP : MUCOPURULENT

MU : MUCOID

NV : NOT VISUALISED

PS : POLYPS

PX : PARADOXICAL

NA : NARROW

BO : BLOCKED
M : MEDIALISED

L : LATERALISED

TM : THICKENED MUCOSA

CB : CONCHA BULLOSA

PM : POLYPOIDAL MUCOSA