

A STUDY ON CHRONIC OTITIS MEDIA ACTIVE MUCOSAL TYPE WITH SINUSITIS AS FOCAL SEPSIS

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CERTIFICATE

This is to certify that the dissertation on **“A STUDY ON CHRONIC OTITIS MEDIA ACTIVE MUCOSAL TYPE WITH SINUSITIS AS FOCAL SEPSIS”** presented herein by Dr.A.SATHEESH KUMAR, is an original work done in the Department of Oto-Rhino-Laryngology, Govt. Royapettah Hospital / Kilpauk Medical College Hospital, Kilpauk Medical College, Chennai and submitted in partial fulfillment of the regulations laid down by The Tamil Nadu Dr.M.G.R.Medical University, Chennai for M.S., Degree Examination Branch IV-Oto-Rhino-Laryngology, under my guidance and supervision during the academic period 2010-2012.

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ABSTRACT

AIM :To establish the role of Sinusitis as Focal sepsis in Chronic Otitis media active mucosal disease, to emphasize the need of proper diagnostic endoscopic evaluation and improvement in middle ear mucosal disease status after functional endoscopic sinus surgery.

METHODS:60 Patients in the age groups of 18-49 year Chronic otitis media active mucosal disease were identified and screened of evidence of Focal Sepsis in Paranasal sinus by Diagnostic Nasal endoscopy and computed tomography of paranasal diseases. Then Functional endoscopic sinus surgery was done to clear sinusitis and middle ear mucosal disease status assessed.

RESULTS :Evaluation revealed that sinusitis in these patients was the causes for persistent discharge. All patients had evidence of sinusitis like pus in middle meatus, deviated nasal septum and turbinoseptal deformity, prominent enlarged bullae, enlarged middle turbinate on DNE and CT. The otoendoscopy showed inflamed and boggy middle ear mucosal status. All patients underwent sptoplasty/FESS depending on findings. Out of 60 patients 52 patient had improved middle ear mucosal status with surgery.

CONCLUSION : In the adult population sinusitis is the most important focal sepsis in case of persistent ear discharge in Chronic Otitis Media active mucosal type of disease. A proper diagnostic nasal evaluation of all Chronic Otitis Media active mucosal type of patients is necessary in comprehensive management of the disease. The clearance of sinusitis has improved the middle ear mucosal status. Unilateral ear discharge is associated with sinusitis only on the corresponding side, which is in concurrence with our study. Functional

endoscopic sinus surgery has emerged as the best procedure for clearance of sinusitis.

KEY WORDS : Chronic otitis media active mucosal disease, sinusitis, functional endoscopic sinus surgery.

INTRODUCTION

In our study we study and analyse the chronic otitis media of active mucosal disease (CSOM-safe type-tubo tympanic) only. The other types of chronic otitis media (COM) namely chronic otitis media active squamous, COM-inactive mucosal, inactive squamous and healed otitis media (the unsafe-attico antral, posterosuperior retraction pocket and marginal perforation) are not analysed. Chronic otitis media active mucosal type is a longstanding infection of a part or whole of mucoperiosteal lining of middle ear cleft characterised by ear discharge and a permanent perforation. A perforation becomes permanent when its margins are covered by squamous epithelium and does not heal spontaneously.

Of various etiology for chronic otitis media active mucosal disease like chronic sinusitis, adenoiditis, tonsillitis, allergic rhinitis, sinusitis act as a focal sepsis in development of chronic otitis media mucosal active type and such an interrelationship is supported by clinical experience and various literature.

Chronic otitis media active mucosal disease patients with coexisting active sinusitis have a chronically persistent ear discharge. Without correcting the sinusitis the management of ear including surgery has frequently led to failures and poor prognosis.

This study correlates that sinusitis is the main and most significant etiological factor for middle ear disease of COM – active mucosal type and that treating sinusitis by FESS in these patients results in the good outcome of disease clearance.

AIMS OF THE STUDY

- To establish the role of sinusitis as focal sepsis in chronic otitis media active mucosal disease
- To analyse the improvement in middle ear mucosal disease status following the treatment of sinusitis by doing functional endoscopic sinus surgery.
- To ascertain that there is overall improvement in the management of chronic otitis media active mucosal disease after clearance/cure of chronic sinusitis by doing endoscopic sinus surgery.
- To emphasize the importance of a proper diagnostic nasal endoscopic evaluation of all chronic otitis media active mucosal disease patients in comprehensive management of chronic otitis media active mucosal type disease.

METHODOLOGY

- Design of The Study : Prospective Study
- Period of Study : June 2010 To November 2011
- Ethical Clearance : Obtained (Ref : Lr.No.3944/Audit/
E1/09 Dt. 30.11.2010
- Financial Support : Nil
- Patients coming under the criteria will be selected
- Written informed consent will be obtained from all participating patients in the regional language.
- An interview is conducted using a questionnaire
- A thorough examination of the patient is done
- The whole information is compiled, statistical analysis is done.

MATERIAL AND TECHNIQUES

The study population consists of chronic otitis media active mucosal disease (tubotympanic type of C.S.O.M) patients who attended the E.N.T. OPD at KMCH and GRH, Chennai during the 2 year period.

Patients with chronic otitis media active mucosal disease (tubotympanic type of CSOM) were randomly selected from our outpatients attending E.N.T OPD. Ear discharge of the patients was sent for culture and sensitivity. The patients were treated with culture directed antibiotics oral as well as topical and followed up for a period of one month. X-ray of the both mastoids were taken.

Then the patients selected for the study were subjected to DIAGNOSTIC NASAL ENDOSCOPY and COMPUTED TOMOGRAPHY OF PARANASAL SINUSES. Patients with evidence of sinusitis were treated with antibiotics, antihistamines, mucolytics and decongestants and other supportive medicines for a period of six weeks. Though they had a symptomatic improvement they had a frequent relapse of symptoms. So they underwent functional endoscopic sinus surgery and were followed up post operatively every 2 weeks for a period of 3 months. The patients were assessed every 2 weeks by otoendoscopy for cessation of discharge and improvement in middle ear mucosal status

INCLUSION CRITERIA

1. AGE : 18-49 years
2. SEX : Both sex selected
3. Chronic otitis media active mucosal disease (Tubotympanic type of C.S.O.M.) patients with persistent ear discharge even following culture directed topical and systemic antibiotics
4. Duration of ear discharge : 3 months and more
5. Hearing loss : 25-40 db hearing loss

EXCLUSION CRITERIA

1. Chronic otitis media active squamous, inactive mucosal, inactive squamous, adhesive otitis media patients
2. Recurrent chronic otitis media patients after ear surgery
3. Fungal infection of external ear
4. Hearing loss more than 40 db
5. Patients with adenoid hypertrophy, mass in nose and paranasal sinuses and polyposis of sinuses

About 60 patients who met the above criteria were selected for the study. All these patients underwent diagnostic nasal endoscopy. Otoendoscopy and CT paranasal sinuses.

DIAGNOSTIC NASAL ENDOSCOPY

Diagnostic nasal endoscopy is usually performed using 0° Hopkins 4mm rigid endoscope after packing the nose with 4% xylocaine with nasal decongestants for a minimum period of 20 minutes.

First pass involves examining the floor of nasal cavity, inferior meatus and examining the nasopharynx to look into the medial end of Eustachian tube opening for mucoid or mucopurulent discharge around the torus tubaris. Inflammation of the pharyngeal end of Eustachian tube is looked for and its obstruction by adenoid is visualized.

Turbinoseptal deformity: this grading is regarding the visibility of the middle turbinate with respect to septal deviation.

TS I : Both medial and lateral aspect of middle turbinate visible

TS 2 : Part of medial aspect of middle turbinate obscured by septal deviation.

TS 3 : Septal deflection completely blocks the view of middle turbinate

Then during the second pass the septal deviation, middle turbinate and its abnormalities like concha bullosa, paradoxical shape, middle meatus, hiatus semilunaris and bulla are seen.

Any accessory ostium in anterior or posterior fontanel, pus from middle meatus, enlarged agar nasi cell is looked for. Sphenoidal recess is examined for discharge.

Then during third pass the roof of nasal cavity is examined.

Examination on table

Here the ear is examined with operating microscope or 0° endoscope. After cleaning the discharge, the site and nature of the perforation is visualized. The nature of middle ear mucosa and ossicles are examined. Swab for culture and sensitivity is taken.

Computed tomography of paranasal sinuses

Computed tomogram of paranasal sinuses in both coronal and axial plane at 3000 Hu bone window.

The following abnormalities/ normal variants were looked for

- Deviation of the septum both bony as well as cartilage part
- Concha bullosa
- Medialised uncinate
- Narrowing of osteomeatal complex
- Enlarged agar nasi

- Type of frontal cell
- Haller cells
- Onodi cells
- Type of skull base based on Keros classification
- Pneumatisation of septum
- Mucosal thickening and Opacification of one or more sinuses.

CLASSIFICATION OF CHRONIC OTITIS MEDIA

1. Chronic otitis media

Active mucosal - csom tubotympanic type – perforation with inflamed middle ear mucosa with active discharge.

Active squamousal -csom attico antral type - retraction pocket with cholesteotoma

2. Chronic otitis media

Inactive mucosal - csom tubotympanic type- perforation with normal dry middle ear mucosa

Inactive squamousal -csom attico antral type - only retraction pocket

3. Healed chronic otitis media-tympanosclerosis,healed perforation without retraction or discharge

ETIOLOGY AND PATHOPHYSIOLOGY OF CHRONIC OTITIS MEDIA ACTIVE MUCOSAL TYPE WITH SINUSITIS AS FOCAL SEPSIS

The upper respiratory tract including nose, Eustachian tube, paranasal sinuses are lined by pseudostratified ciliated columnar epithelium. They also contain non ciliated columnar epithelium, basal cells and goblet cells.

In cases of chronic inflammation, there is an increase in size and number of goblet cells. The mucus secreted by the paranasal sinuses are cleared by motility of the cilia, which are 50 to 200 per cell and they beat at the rate of 700 to 800 beats per minute moving at the rate of 1cm per minute.

In patients with sinusitis, the etiology being the anatomical variants leading to stasis of secretions, allergy, viral, bacterial, fungal infections there is alterations in the quality and quantity of the secretions. In some patients, the cause for sinusitis being genetic and congenital defect in mucociliary clearance like Kartageners syndrome, cystic fibrosis, primary ciliary dyskinesia, and also acquired mucociliary dysfunction due to smoking, pollution, medication and surgery.

The normal mucociliary clearance in which the anterior group of sinuses like frontal, maxillary and anterior ethmoidal sinuses drain along the anterior and inferior part of pharyngeal end of Eustachian tube. The posterior group of sinuses including the posterior ethmoid and sphenoid sinuses drain posterior and superior to Eustachian tube.

In sinusitis, the quality and quantity of mucous is altered to either purulent or mucopurulent. This leads to alteration in the mucosa lining the pharyngeal end of Eustachian tube with edema, inflammation of subepithelial lymphoreticular network leading to block and obstruction of Eustachian tube and this leads to reduced ventilation and changes in mucosal lining of middle ear cleft. This leads to hypertrophy and increase in number of goblet cells in middle ear cleft. Hence, sinusitis causes inflammation of the middle ear mucosa with increased and persistent mucoid / mucopurulent discharge and remains as a active mucosal disease

ANATOMY AND PHYSIOLOGY OF MIDDLE EAR

The middle ear together with the Eustachian tube, aditus antrum and mastoid air cells is called middle ear cleft. It is lined by mucous membrane and filled with air.

The middle ear extends much beyond the limits of tympanic membrane which forms its lateral boundary and is sometimes divided into i) mesotympanum (lying opposite the pars tensa), ii) epitympanum or the attic (lying above the pars tensa but medial to Shrapnell's membrane and the bony lateral attic wall), iii) hypotympanum (lying below the level of pars tensa). The portion of middle ear around the tympanic orifice of the Eustachian tube is sometimes called the protympanum.

Middle ear can be likened to a six-sided box with a roof, a floor, medial, lateral, anterior and posterior walls.

The roof is formed by a thin plate of bone called tegmen tympani. It also extends posteriorly to form the roof of the aditus and antrum. It separates tympanic cavity from the middle cranial fossa.¹³

The floor is also a thin plate of bone which separates tympanic cavity from the jugular bulb. Sometimes, it is congenitally deficient and

the jugular bulb may project into the middle ear; separated from the cavity only by the mucosa.

The anterior wall has a thin plate of bone which separates the cavity from internal carotid artery. It also has two openings; the lower one for the Eustachian tube and the upper one for the canal of tensor tympani muscle.

The posterior wall lies close to the mastoid air cells. It presents a bony projection called the pyramid through the summit of which appears the tendon of the stapedius muscle to get attachment to the neck of stapes. Aditus, an opening through which attic communicates with the antrum, lies above the pyramid. Facial nerve runs in the posterior wall just behind the pyramid. Facial recess or the posterior sinus is a depression in the posterior wall lateral to the pyramid. It is bounded medially by the vertical part of VIIth nerve, laterally by the chorda tympani and above, by the fossa incudis. Surgically, facial recess is important, as direct access can be made through this into the middle ear.¹²

The medial wall is formed by the labyrinth. It presents a bulge called promontory which is due to basal coil of cochlea, oval window into which is fixed the footplate of stapes; round window or the fenestra cochleae which is covered by the secondary tympanic membrane. Above

the oval window is the canal for facial nerve. Its bony covering may sometimes be congenitally dehiscent and the nerve may lie exposed making it very vulnerable to injuries or infection. Above the canal for facial nerve is the prominence of lateral semicircular canal. Just anterior to the oval window, the medial wall presents a hook-like projection called the processus cochleariformis. The tendon of tensor tympani takes a turn here to get attachment to the neck of malleus. The cochleariform process also marks the level of the genu of the facial nerve which is an important landmark for surgery of the facial nerve. Medial to the pyramid is a deep recess called sinus tympani which is bounded by the subiculum below and the ponticulus above.

The lateral wall is formed largely by the tympanic membrane and to a lesser extent by the outer attic wall called the scutum. The tympanic membrane is semitransparent and forms a 'window' into the middle ear. It is possible to see some structures of the middle ear through the normal tympanic membrane, e.g. the long process of incus, incudostapedial joint and the round window.

Mastoid Antrum

It is a large, air-containing space in the upper part of mastoid and communicates with the attic through the aditus. Its roof is formed by the

tegmen antri, which is a continuation of the tegmen tympani and separates it from the middle cranial fossa. The lateral wall of antrum is formed by a plate of bone which is on an average 1.5cm thick in the adult. It is marked externally on the surface of mastoid by suprameatal (MacEwen's) triangle.

Aditus ad Antrum

Aditus is an opening through which the attic communicates with the antrum. The bony prominence of the horizontal canal lies on its medial side while the fossa incudis, to which is attached the short process of incus, lies laterally. Facial nerve courses just below the aditus.

Intratympanic Muscles

There are two muscles, tensor tympani and the stapedius; the former attaches to the neck of malleus and tenses the tympanic membrane while the latter attaches to the neck of stapes and helps to dampen very loud sounds thus preventing noise trauma to the inner ear. Stapedius is a second arch muscle and is supplied by a branch of VII Cranial nerve while tensor tympani develops from the first arch and is supplied by branch of mandibular nerve (V₃).¹²

Tympanic Plexus

It lies on the promontory and is formed by i) tympanic branch of glossopharyngeal and ii) sympathetic fibers from the plexus round the internal carotid artery. Tympanic plexus supplies innervations to the medial surface of the tympanic membrane, tympanic cavity, mastoid air cells and the bony Eustachian tube. It also carries secretomotor fibres to the parotoid gland. Section of tympanic branch of glosspharyngeal nerve can be carried out in the middle ear in cases of Frey's syndrome.

Lining of the Middle Ear Cleft

Mucous membrane of the nasopharynx is continuous with that of the middle ear, aditus, antrum and the mastoid air cells. It wraps the middle ear structures, the Ossicles, muscles, ligaments, and nerves like peritoneum wraps various viscera in the abdomen raising several folds and dividing the middle ear into various compartments. Middle ear contains nothing but the air; all the structures lie outside the mucous membrane.

Histologically, the Eustachian tube is lined by ciliated epithelium which is pseudo stratified columnar in the cartilaginous part, columnar in

the bony part with several mucous glands in the submucosa. Tympanic cavity is lined by ciliated columnar epithelium in its anterior and inferior part which changes to cuboidal type in the posterior part. Epitympanum and mastoid air cells are lined by flat, non ciliated epithelium.

Blood Supply of Middle Ear

Middle ear is supplied by six arteries, out of which two are the main, i.e.

- Anterior tympanic branch of maxillary artery which supplies tympanic membrane.
- Stylomastoid branch of posterior auricular artery which supplies middle ear and mastoid air cells.

Four minor Vessels are:

- Petrosal branch of middle meningeal artery (runs along greater petrosal nerve).
- Superior tympanic branch of middle meningeal artery traversing along the canal for tensor tympani muscle.
- Branch of artery of pterygoid canal (runs along Eustachian tube)
- Tympanic branch of internal carotid artery.

Veins drain into pterygoid venous plexus and superior petrosal sinus.

ANATOMY AND PHYSIOLOGY OF EUSTACHIAN TUBE

Anatomy

Eustachian tube, also called the auditory or the pharyngotympanic tube, connects nasopharynx with the tympanic cavity. In an adult, it is about 36mm long and runs downwards, forwards and medially from its tympanic end, forming an angle of 45° with the horizontal. It is divided into two parts: The bony, which is posterolateral, forms one third (12mm) of the total length and fibro cartilaginous, which is anteromedial, forms two-thirds (24mm). The two parts meet at isthmus which is the narrowest part of the tube. The fibro cartilaginous part of the tube is made of single piece of cartilage folded upon itself in such a way that it forms the whole of medial lamina, roof and a part of the lateral lamina; the rest of its lateral lamina is made of fibrous membrane.

The tympanic end of the tube is bony, measures 5x2mm and is situated in the anterior wall of middle ear, a little horizontal section through the Eustachian tube showing bony and cartilaginous parts, isthmus, tympanic and pharyngeal ends above the level of floor. The pharyngeal end of the tube is slit-like vertically. The cartilage at this end

raises an elevation called torus tubarius which is situated in the lateral wall of the nasopharynx, 1-1.25 cm behind the posterior end of inferior turbinate.¹³

STRUCTURE

Muscles Related to Eustachian tube

Three muscles are related to the tube: Tensor veli palatini, Levator veli palatini and the Salpingopharyngeus. The medial fibers of the tensor veli palatini are attached to the lateral lamina of the tube, and when they contract help to open the tubal lumen. These fibres have also been called the dilator tubae muscle. The exact role of the levator veli palatini and the Salpingopharyngeus muscles to open the tube is uncertain. It is believed that levator veli palatini muscle of the tube forms a bulk under the medial lamina, and during contraction pushes it upward and medially thus assisting in opening the tube.

The elastin hinge, the cartilage at the junction of medial, and lateral lamina at the roof, is rich in elastin fibres which form a hinge. By its recoil, it helps to keep the tube closed when no longer acted upon by dilator tubae muscle.

Ostmann's pad of fat, it is a mass of fatty tissues related laterally to the membranous part of the cartilaginous tube. It also helps to keep the tube closed and thus protect it from the reflux of nasopharyngeal secretions.

Lining of the Eustachian Tube

Histologically, the mucosa shows pseudo stratified ciliated columnar epithelium interspersed with mucous secreting goblet cells. Sub mucosa, particularly in the cartilaginous part of the tube, is rich in seromucinous glands. The cilia beat in the direction of nasopharynx and thus help to drain secretions and fluid from the middle ear into the nasopharynx.

Nerve Supply

Tympanic branch of CN IX supplies sensory as well as parasympathetic secretomotor fibers to the tubal mucosa. Tensor veli palatine is supplied by mandibular branch of trigeminal (V3) nerve. Levator veli palatine and salpingopharyngeus receive motor nerve supply through pharyngeal plexus (Cranial part of CN XI through vagus.)

Functions

Physiologically, Eustachian tube performs three main functions:¹³

1. Ventilation and thus regulation of middle ear pressure.
2. Protection against (a) Nasopharyngeal sound pressure and (b) Reflux of nasopharyngeal secretions.
3. Middle ear clearance of secretions.

1. Ventilation and regulation of middle ear pressure

For normal hearing, it is essential that pressure on two sides of the tympanic membrane should be equal. Negative or positive pressure in the middle ear affects hearing. Thus, Eustachian tube should open periodically to equilibrate the air pressure in the middle ear with the ambient pressure.

Normally, the Eustachian tube remains closed and opens intermittently during swallowing, yawning and sneezing. Posture also affects the function; tubal opening is less efficient in recumbent position and during sleep due to venous engorgement. Tubal function is also poor in infants and young children and thus responsible for more ear problems in that age group. It usually normalizes by the age of 7-10 years.

2. Protective functions

Abnormally, high sound pressures from the nasopharynx can be transmitted to the middle ear if the tube is open thus interfering with normal hearing. Normally, the Eustachian tube remains closed and protects the middle ear against these sounds.

A normal Eustachian tube also protects the middle ear from reflux of nasopharyngeal secretions into the middle ear. This reflux occurs more readily if the tube is wide in diameter (patulous tube), short in length, (as in babies), or the tympanic membrane is perforated (cause for persistence of middle ear infections in cases of tympanic membrane perforations).

High pressures in the nasopharynx can also force nasopharyngeal secretions into the middle ear, e.g. forceful nose blowing, closed-nose swallowing as in the presence of adenoids or bilateral nasal obstruction.

3. Clearance of middle ear secretions

Mucous membrane of the Eustachian tube and anterior part of the middle ear is lined by ciliated columnar cells. The cilia beat in the direction of nasopharynx. This helps to clear the secretions and debris in the middle ear towards the nasopharynx. The clearance function is further augmented by active opening and closing of the tube.

ANATOMY AND PHYSIOLOGY OF NOSE AND PARANASAL SINUSES

Nasal Cavity Proper

Each nasal cavity has a lateral wall, a medial wall, a roof and a floor.

Lateral nasal wall Three and occasionally four turbinates or conchae mark the lateral wall of nose. Conchae or turbinates are scroll-like bony projections covered by mucous membrane. The spaces below the turbinates are called meatus.

Inferior turbinate is a separate bone and below it, into the inferior meatus, opens the nasolacrimal duct guarded at its terminal end by a mucosal valve called Hasner's valve.

Middle turbinate is an ethmoturbinal- a part of ethmoid bone. It is attached to the lateral wall by a bony lamella called ground or basal lamella. Its attachment is not straight but in an S-shaped manner. In the anterior third, it lies in sagittal plan and is attached to lateral edge of cribriform plate. In the middle third, it lies in frontal plane and is attached to lamina papyracea while in its posterior third, it runs horizontally and forms roof of the middle meatus and is attached to lamina papyracea and medial wall of maxillary sinus.

The ostia of various sinuses draining anterior to basal lamella form anterior group of paranasal sinuses while those which open posterior and superior to it form the posterior group.⁸

Middle meatus shows several important structures which are important in endoscopic surgery of the sinuses.

Uncinate process is a hook-like structure running in from anterosuperior to posteroinferior direction. Its posterosuperior border is sharp and runs parallel to anterior border of bulla ethmoidalis, the gap between the two is called hiatus semilunaris (inferior). It is a two-dimensional space of 1-2 mm.

The anteroinferior border of uncinat process is attached to the lateral wall. Posteroinferior end of uncinat process is attached to inferior turbinate dividing the membranous part of lower middle meatus into anterior and posterior fontanel. The fontanel area is devoid of bone and consists of membrane only and leads into maxillary sinus when perforated. Upper attachment of uncinat process shows great variation and may be inserted into the lateral nasal wall, upwards into the base of skull or medially into the middle turbinate. This also accounts for variations in drainage of frontal sinus.¹⁰

The space limited medially by the uncinate process and frontal process of maxilla and sometimes lacrimal bone, and laterally by the lamina papyracea is called infundibulum.

Natural ostium of the maxillary sinus is situated in the lower part of infundibulum. Accessory ostium or ostia of maxillary sinus are sometimes seen in the anterior or posterior fontanel.

Bulla ethmoidalis: It is an ethmoidal cell situated behind the uncinate process. Anterior surface of the bulla forms the posterior boundary of hiatus semilunaris. Depending on Pneumatisation, bulla may be a pneumatized cell or a solid bony prominence. It may extend superiorly to the skull base and posteriorly to fuse with ground lamella.

When there is space above or behind the bulla, it is called suprabullar or retrobullar recesses, respectively. The suprabullar and retrobullar recesses together form the lateral sinus (sinus lateralis of Grunwald). The lateral sinus is thus bounded superiorly by the skull base, laterally by lamina papyracea, medially by middle turbinate and inferiorly by the bulla ethmoidalis. Posteriorly the sinus lateralis may extend up to basal lamella of middle turbinate. The cleft-like communication between the bulla and skull base and opening into middle meatus is also called

hiatus semilunaris superior in contrast to hiatus semilunaris inferior referred to before.

Atrium of the middle meatus is a shallow depression lying in front of middle turbinate and above the nasal vestibule.

Agger nasi is an elevation just anterior to the attachment of middle turbinate. When pneumatized, it contains air cells, the agger nasi cells, which communicate with the frontal recess. An enlarged agger nasi cell may encroach on frontal recess area, constricting it and causing mechanical obstruction to frontal sinus drainage.

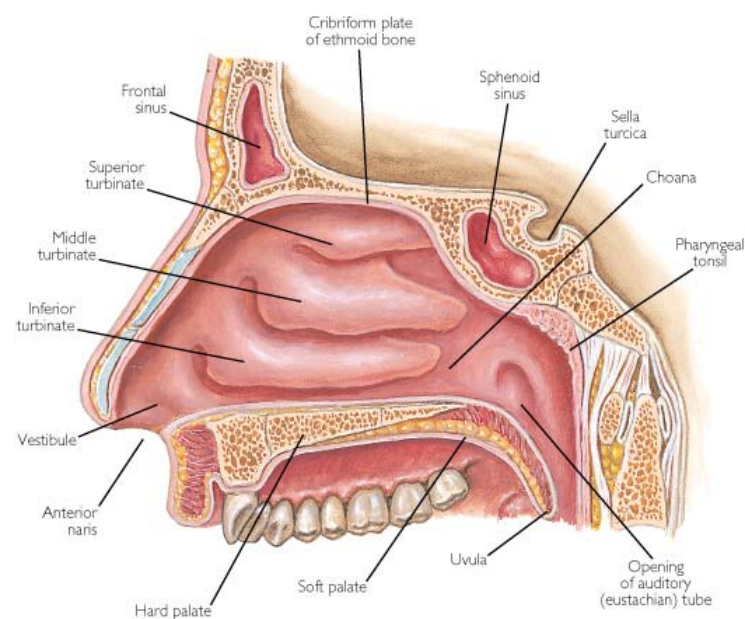
Pneumatization of middle turbinate leads to an enlarged ballooned out middle turbinate called concha bullosa. It drains into frontal recess directly or through agger nasi cells. Haller cells are air cells situated in the roof of maxillary sinus. They are pneumatized from anterior or posterior ethmoid cells. Enlargement of Haller cells encroaches on ethmoid infundibulum, impeding draining of maxillary sinus.

Superior turbinate is also an ethmoturbinal and is situated posterior and superior to middle turbinate. It may also get pneumatized by one or more cells.

Superior meatus is a space below the superior turbinate. Posterior ethmoid cells open into it. Number of posterior ethmoid cells varies from 1 to 5. Onodi cell is a posterior ethmoidal cell which may grow posteriorly by the side of sphenoid sinus or superior to it for as much a distance as 1.5 cm from the anterior surface of sphenoid. Onodi cell is surgically important as the optic nerve may be related to its lateral wall.

Sphenoethmoidal recess is situated above the superior turbinate. Sphenoid sinus opens into it.

Supreme turbinate is sometimes present above the superior turbinate and has a narrow meatus beneath it.



Medial wall Nasal septum forms the medial wall.

Roof : Anterior sloping part of the roof is formed by nasal bones; posterior sloping part is formed by the body of sphenoid bone; and the middle horizontal part is formed by the cribriform plate of ethmoid through which the olfactory nerves enter the nasal cavity.

Floor : It is formed by palatine process of the maxilla in its anterior three-fourths and horizontal part of the palatine bone in its posterior one-fourth.

Lining Membrane of Internal Nose

Vestibule : It is lined by skin containing hair, hair follicles and sebaceous glands.

Olfactory region : Upper one-thirds of lateral wall (up to superior concha), corresponding part of the nasal septum and the roof of nasal cavity form the olfactory region. Here, mucous membrane is pale in colour.

Respiratory region : Lower two-thirds of the nasal cavity form the respiratory region. Here mucous membrane shows variable thickness being thickest over nasal conchae especially at their ends, quite thick over the nasal septum but very thin in the meatuses and floor of the nose. It is

highly vascular and also contains erectile tissue. Its surface is lined by pseudo stratified ciliated columnar epithelium which contains plenty of goblet cells. In the submucous layer of mucous membrane, are situated serous, mucous, both serous and mucous secreting glands, the ducts of which open on the surface of mucosa.

ANATOMY OF PARANASAL SINUSES

Paranasal sinuses are air-containing cavities in certain bones of skull. They are four on each side.

Clinically, paranasal sinuses have been divided into two groups:

Anterior group : This includes maxillary, frontal and anterior ethmoidal. They all open in the middle meatus and their ostia lie anterior to basal lamella of middle turbinate.

Posterior groups : This includes posterior ethmoidal sinuses which open in the superior meatus, and the sphenoid sinus which open in sphenoethmoidal recess.¹²

Maxillary Sinus (Antrum of Highmore)

It is the largest of paranasal sinuses and occupies the body of maxilla. It is pyramidal in shape with base towards lateral wall of nose and apex directed laterally into zygomatic process of maxilla and some times in the zygomatic bone itself. On average, maxillary sinus has a capacity of 15ml in an adult.

Relations

Anterior wall is formed by facial surface of maxilla and is related to the soft tissues of cheek.

Posterior wall is related to infratemporal and pterygopalatine fossae.

Medial wall is related to the middle and palatine process of the maxilla and is situated about 1cm below the level of the floor of nose. Depending on the age and pneumatization of the sinus, the roots of the all molars, sometimes the premolar and canine, are in close relation to the floor of maxillary sinus separated from it by a thin lamina of bone or even no bone at all. Oroantral fistulae can result from extraction of any of these teeth. Dental infection is also an important cause of maxillary sinusitis.¹¹

Ostium of the maxillary sinus is situated high up in medial wall and opens in the posterior part of ethmoidal infundibulum into the middle

meatus it is unfavorably situated for natural drainage. An accessory ostium is also present behind the main ostium in 30% of cases.

Roof of the maxillary sinus is formed by the floor of the orbit. It is traversed by infraorbital nerve and vessels.

Frontal sinus

Each frontal sinus is situated between the inner and outer tables of frontal bone, above and deep to the supraorbital margin. It varies in shape and size and is often loculated. The two frontal sinuses are often asymmetric and the intervening bony septum is thin and often obliquely placed or may even be deficient. Frontal sinus may be absent on one or both sides or it may be very extending into orbital plate in the roof of orbit.

Anterior wall of the sinus is related to the skin over the forehead; inferior wall, to the orbit and its contents; and posterior wall to the meninges and frontal lobe of the brain. Opening of frontal sinus is situated in its floor and leads into the middle meatus directly or through a canal called frontonasal duct. In the middle meatus, frontal sinus drains into frontal recess (55%), above but not into the infundibulum (30%), into the infundibulum (15%) and above the bulla ethmoidalis (1%).

Ethmoidal Sinuses

Ethmoidal sinuses are thin walled air cavities in the lateral masses of ethmoid bone. Their number varies from 3 to 18. They occupy the space between upper third of lateral nasal wall and the medial wall of orbit. Clinically, ethmoidal cells are divided into anterior ethmoid group which opens into the superior meatus and sphenoethmoidal recess.

Each ethmoid labyrinth has important relations. Roof is formed by anterior cranial fossa, lateral to the cribriform plate. Meninges of brain form important relations here. Lateral wall is related to the orbit. The thin paper-like lamina of bone (lamina papyracea) separating air cells from the orbit can be easily destroyed leading to spread of ethmoidal infections into the orbit. Optic nerve forms close relationship with the posterior ethmoidal cells and is at risk during ethmoid surgery.

Sphenoid Sinus

It occupies the body of sphenoid. The two, right and left sinuses, are rarely symmetrical and are separated by a thin bony septum which is often obliquely placed and may even be deficient. Ostium of the sphenoid sinus is situated in the upper part of its anterior wall and drains into sphenoethmoidal recess.

Relations of the sphenoid sinus are important to the surgeon while doing trans-sphenoidal hypophysectomy. The relations of the sinus differ in the anterior and posterior parts.

In the anterior part, roof is related to the olfactory tract, optic chiasma and frontal lobe while the lateral wall is related to the optic nerve, internal carotid artery and maxillary nerve and these structures may stand in relief in the sinus cavity.

In the posterior part roof is related to pituitary gland, sella turica while each lateral wall is related to Cavernous sinus, internal carotid artery and CNIII, IV, VI and all the divisions of V.

Degree of pneumatization of sphenoid sinus varies and so do the extent of sinus and the structures related to it. Sinus cavity may be large and extend into the wings of sphenoid and even pterygoid plates.

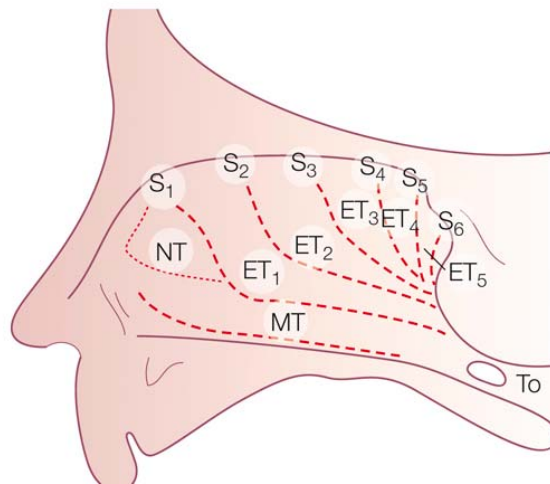
Mucous Membrane of Paranasal Sinuses

Paranasal sinuses are lined by mucous membrane which is a continuous with that of the nasal cavity through the ostia of sinuses. It is thinner and less vascular as compared to that of the nasal cavity. Histologically, it is ciliated columnar epithelium with goblet cells which secrete mucus. Cilia are more marked near the ostia of sinuses and help in drainage of mucus into the nasal cavity.¹²



Development of Paranasal Sinuses

Paranasal sinuses develop as outpouchings from the mucous membrane of lateral wall of nose. At birth, only the maxillary and ethmoidal sinuses are present and are large enough to be clinically significant.



Growth of sinuses continues during childhood and early adult life. Radiologically, maxillary sinuses can be identified at 4-5 months, ethmoids at 1 year, frontal at 6 years and sphenoids at 4 years.⁸

Lymphatic Drainage

The lymphatics of maxillary, ethmoid, frontal and sphenoid sinuses form a capillary network in their lining mucosa and collect with lymphatics of nasal cavity. Then, they drain into lateral retropharyngeal and or juglodigastric nodes.

PHYSIOLOGY OF PARANASAL SINUSES

Ventilation of Sinuses

Ventilation of paranasal sinuses takes place through their ostia, during inspiration, air current causes negative pressure in the nose. This varies from -6mm to -200mm of H_2O , depending on the force of inspiration. During expiration, positive pressure is created in the nose and this sets up eddies which ventilate the sinuses. Thus, ventilation of sinuses is paradoxical; they are emptied of air during inspiration and filled with air during expiration. This is just the reverse of what takes place in lungs which is filled during inspiration and empty during expiration.⁸

Mucus Drainage of Sinuses

Mucus secreted in the paranasal sinuses travels to the ostium in a spiral manner. Here, the cilia are very active and propel mucus into the meatuses from where it is carried to the pharynx. The mucus from anterior groups of sinuses travels along the respective lateral pharyngeal gutter situated behind the posterior pillar, and from there it is spread over the posterior pharyngeal wall to be finally swallowed. In infections of the

anterior group of sinuses, lateral lymphoid bands, situated behind the posterior pillars, get hypertrophied.¹⁰

Functions of Paranasal Sinuses

1. Air-conditioning of the inspired air by providing large surface area over which the air is humidified and warmed.
2. To provide resonance to voice.
3. To act as thermal insulators to protect the delicate structures in the orbit and the cranium from variations of intranasal temperature.
4. To lighten the skull bones.

Drainage and ventilation are the two most important factors in the maintenance of normal physiology of the paranasal sinuses and their mucous membranes. The sinuses are lined with ciliated stratified or pseudostratified columnar epithelium under which is the tunica propria, which contains mucous and serosanguinous glands. Covering the epithelium is a biphasic mucous blanket forming the mucociliary system.

The mucous blanket normally contains mast cells, polymorphonuclear leucocytes, eosinophils, lysozyme and immunoglobulin A. The upper layer (gel layer) is highly viscous, which enables the cilia to move the blanket forwards. The system captures 80%

of inspired particles larger than 3-5 microns and 60% of those larger than 2 microns and exposes them to mast cells, polymorphonuclear leucocytes etc. while sweeping them into the pharynx to be swallowed.¹¹

Hilding (1944) in experiments on dogs showed that ciliary streaming in the sinus always leads to the ostium. India ink was placed on the floor of the maxillary sinus spirals somewhat laterally and upward to the anterior lateral wall, then anteromedially and upwards to the ostium. In none was the ink seen to pass through the artificial window in the inferior meatus. In frontal sinus also the flow of mucus occurs a circular fashion centering at the natural ostium. In sphenoid and ethmoid sinuses the flow is directly towards the natural ostium. The thicker and more tenacious the mucus the more rapidly can the cilia evacuate it (Hilding, 1932).

The cilia beat in a synchronized (transverse) and metachronized (longitudinal) manner. The cilia move almost exclusively in the sol phase of the secretion. The gel phase is actively transported over the sol phase like a “carpet” by the cilia when their tips touch this overlying “carpet” during their short active beat. There is no contact between the cilia and the gel phase during their slower recovery stroke.

Altered mucociliary drainage and disease processes

Chronic sinusitis implies a breakdown in the mucociliary system. In obstructed sinus, there is accumulation of inflammatory cells, mucous and bacteria. The partial pressure of oxygen (pO_2) of the sinus falls with obstruction. Growth of anaerobic and facultative organisms is favoured by limited air access. Granulocyte function is also impaired due to reduced oxygen tension. These changes usually involve the anterior ethmoid first which are ideally located and anatomically constructed to suffer chronic obstruction. These delicate 'prechambers' to the frontal and maxillary sinuses contain numerous small air cells and their narrow ostia are obstructed easily. Whenever there is mucosal swelling and obstruction to drainage in the ethmoid, the drainage and ventilation of the larger dependent sinuses can be seriously interfered with. Superimposed infection causes further mucosal swelling and obstruction thus creating a vicious cycle.

Thus integrity of the mucociliary system is essential to the prevention of chronic sinusitis.

ANATOMY AND PHYSIOLOGY OF NASOPHARYNX (EPIPHARYNX)

Applied Anatomy:

Nasopharynx is the upper most part of the pharynx and therefore, called the epipharynx. It lies behind the nasal cavities and extends from the base of skull to the soft palate of the level of the horizontal plane passing through the hard palate.

Roof of the nasopharynx is formed by basisphenoid and basiocciput. Posterior wall is formed by arch of the atlas vertebra covered by prevertebral muscles and fascia. Both the roof and the posterior wall imperceptibly merge with each other.

Floor is formed by the soft palate anteriorly but is deficient posteriorly. It is through this space, the nasopharyngeal isthmus, that the nasopharynx communicates with the oropharynx.¹²

Anterior wall is formed by posterior nasal apertures or choanae, separated from each other by the posterior border of the nasal septum. Posterior ends of nasal turbinates and meatuses are seen in this wall.

Lateral wall : Each lateral wall presents the pharyngeal open of Eustachian tube situated 1.25 cm behind the posterior end of inferior turbinate. It is bounded above and behind by an elevation called torus

tubarius raised by the cartilage of the tube. Above and behind the tubal elevation is a recess called fossa of Rosenmuller which is the commonest site for origin of carcinoma. A ridge extends from the lower end of torus tubarius to the lateral pharyngeal wall and is called the salpingopharyngeal fold, it is raised by the corresponding muscle.

Nasopharyngeal Tonsil (Adenoids)

This is subepithelial collection of mass of lymphoid tissue in the midline at the junction of roof and posterior wall of the nasopharynx and causes the overlying mucous membrane to be thrown into radiating folds.. If is hypertrophied, it blocks the eustachian tube causing middle ear pathology.

Tubal Tonsil

It is collection of subepithelial lymphoid tissue situated at the tubal elevation. It is continuous with adenoid tissue and forms a part of the Waldeyer's ring. When enlarge due to infection, it causes Eustachian tube occlusion.

Epithelial lining of Nasopharynx

Functionally, nasopharynx is the posterior extension of nasal cavity. It is lined by pseudostratified ciliated columnar epithelium.

Lymphatic Drainage

Lymphatics of the nasopharynx including those of the adenoids and pharyngeal end of Eustachian tube, drain into upper deep cervical nodes

either directly or indirectly through retropharyngeal and parapharyngeal lymph nodes. They also drain into spinal accessory chain of nodes in the posterior triangle of the neck. Lymphatics of the nasopharynx may also cross midline to drain into contralateral lymph nodes.

Functions of Nasopharynx

1. Acts as a conduit for air, which has been warmed and humidified in the nose, in its passage to the larynx and trachea.
2. Through the Eustachian tube, it ventilates the middle ear and equalizes air pressure on both sides of tympanic membrane. This function is important for hearing.
3. Elevation of the soft palate against posterior to pharyngeal wall and the uvula's ridge helps to cut off nasopharynx from oropharynx. This function is important during swallowing, vomiting, gagging and speech.
4. Acts as a resonating chamber during voice production. Voice disorders are seen in nasopharyngeal obstruction and velopharyngeal incompetence.
5. Acts as a drainage channel for the mucus secreted by nasal and nasopharyngeal glands.

REVIEW OF LITERATURE

In this study, the primary problem is the Eustachian tube dysfunction. Long standing cases of Eustachian tube dysfunction leads to chronic otitis media mucosal, COM Squamousal, healed otitis media. Either active in mucosal with persistent discharge or in squamous type with chlosteotoma. If inactive in mucosal, it presents as dry perforation, in squamousal type as retraction pocket.

In Indian journal of otology study by Aditya M Yeolekar And K S Sengupta at Department of ENT, Indira Gandhi Medical college, Nagpur, India, a prospective study was conducted including 340 ear in 200 patients.⁷

Distribution of sinonasal disease was studied in all 200 patients and concluded that sinonasal disease is the most common cause for the persistence of ear symptoms in chronic otitis media and supported by their improvement after treating the sinonasal pathology. He has emphasized that evaluation and management of sinuses is a must in all cases of chronic otitis media.

A Fujita, I Honjo, K.Kuzata has studied in North America cases of refractory otitis media in 83 adolescents with 103 controls and they had concluded after evaluating the various parameters including the Eustachian tube function and found that 48% of the cases had refractive ear disease due to sinusitis and 78% had abnormal sinuses and concluded that in cases of chronic otitis media with refractory to treatment the main focus of pathology/infection is in sinuses. American journal Otolaryngology , refractory otitis media, sinuses being the focus 1993.¹

In American academy of allergy and immunology has stated that inflammation in the middle ear is an extension of mucosal disease of the nasal and upper airway passages including sinuses. Mucosa of the middle ear is capable of mounting allergic and immunologic challenge similar to rest of mucosa in respiratory tract by an antigenic stimulus.

The lining mucous membrane of the middle ear and Eustachian tube is similar to the membrane of nose, sinuses and larynx. Infection and inflammation will result in Eustachian tube obstruction.

In 1980 J J Grote And W Kuijpers studied extensively on Otitis media retrospectively and confirmed Eustachian tube block leads to middle ear effusion, then chronic otitis media and its significant relation to antral sinusitis a view supported by dawn in 1970 study and mawson in

1967. The Journal of Laryngology and Otology 1980 JJ.GROTE and W.KUIJPER²

In 1989 Bluestone and his colleagues studied about 40 patients of chronic otitis media active mucosal and found Eustachian tube dysfunction to be reason for the persistence of the disease. He concluded that diseases of the sinuses as the main cause rather than adenoid in adolescents and adults for Eustachian tube block. Bluestone 1971 and Hanjo et al 1981⁶

In international journal of pediatric ORL. J D Swarts and colleagues studied in older children and adult the concept of nasopharyngeal inflammation as the reason for persistent otitis media. He also concluded on study involving 200 patients that significant cause for the chronic nasopharyngeal inflammation being chronic sinusitis. J D Swrts 2003 international journal of pediatric ORL. ELSIVER.³

Dr. Anand Shah at Bombay hospital in 2002 study, revealed that nose and paranasal sinuses by their anatomical relation cause most of diseases of ear. Prompt and diligent diagnosis and treatment is essential for successful treatment of ear pathology. This may lead to avoidance of unnecessary ear surgeries and reduced failure rates. Patient in trying out a conservative treatment before surgery is a necessary virtue. Hence it is

mandatory to be able to perform a diagnostic nasal endoscopy to detect the nasal and paranasal pathology causing persistence of symptoms in chronic active mucosal otitis media.

M Miura and H Takashi in 1995 studied on the influence of upper respiratory infection including sinusitis on tubal compliance in children and adolescents with otitis media. They concluded that 72% of patient with refractory tubal compliance due to chronicity of upper respiratory infection including sinusitis leading to persistence of otitis media. *Acta oto laryngological*.1997.M Miura and H Takashi.⁴

In 1996 in the book *operative techniques in otolaryngology* Desouza and colleagues that chronic inflammation of nose and paranasal sinuses are often felt in the middle ear and chronic otitis media is often secondary to dysfunction of the Eustachian tube resulting from sinusitis. He then suggested to do surgery to correct nasal and para nasal sinuses problems to restore the normal functioning of nose and paranasal sinuses and then it restores the normal functioning of Eustachian tube resulting in assisting in treating the patients with OME and COM.

Desouza and co workers also suggested that nasal and paranasal pathology can cause otitis media as a result of edema in proximity to Eustachian tube and subsequent blockage of the orifice and by

insufflations of contaminated nasal secretions into the middle ear. They support the use of surgical interventions such as middle meatal antrostomy, turbinoplasty, septoplasty and functional endoscopic sinus surgery to correct the anatomical variants that cause the chronic and recurrent sinusitis leading to otitis media.

Degan R and Leibovitch E, Fliss DM on a study involving treatment failures in chronic otitis media has suggested the prompt diagnosis and effective surgical management of focal sepsis like deviated septum, chronic sinusitis, adeno tonsillitis for effective management of otitis media and recurrences.

In an observation made by M.J. Lorensen in 2002, when persistent ear discharge is found, it is extremely important to rule out history of upper respiratory infection, colds and sinusitis.⁵

As otologists, the primary aim to cure the ear pathology like chronic otitis media active mucosal type, it is imperative to look for the focal sepsis in nose and paranasal sinuses and treat them surgically for obtaining good result.

PROFORMA

Name : Age : Sex :

IP/OP.No.

Address :

Occupation :

Chief Complaints :

EAR

1. Discharge

Duration

Onset

Nature

Colour

Amount

Smell

Blood stained

Aggravating / Relieving Factors

Associated Symptoms

2. Hard of Hearing

Onset

Unilateral / Bilateral

Gradual / Fluctuating

3. Earache

4. Vertigo / Tinnitus

NOSE

1. Nasal Obstruction

Onset

Duration

Nature

Intermittent / Continuous

Unilateral / Bilateral

Associated Symptoms

2.Nasal Discharge

Onset

Duration

Nature

Intermittent / Continuous

Unilateral / Bilateral

Scanty / Profuse

Colour

Smell

3. Headache

4. Anosmia

5. Post Nasal Discharge

6. Sneezing

H/o Previous Treatment - Medical / Surgical

Clinical Examination :

EAR

Right

Left

Pinna

Preauricular Region

Postauricular Region

External Auditory Canal

Tympanic Membrane

Perforation

Site

Size

Large/Subtotal

Middle Ear Mucosa

Moist(wet)/Edematous

Boggy (Polypoidal)

NOSE

Anterior Rhinoscopy

Posterior Rhinoscopy

Sinus Tenderness

Cold Spatula Test

THROAT

Oral cavity

Oropharynx

Hypopharynx

Posterior Pharyngeal Wall - Normal / Granular / Congested /

Postnasal Drip

DIGANOSTIC NASAL ENDOSCOPY

Date :

NAME :

AGE/SEX :

S.NO :

Scope used :

Endoscopist :

Anesthesia :

Provisional diagnosis:

Septal deviation

Right :

Left :

First Pass :

Inferior turbinate

Ridges and

Eustachian tube Orifice

Nasopharynx

Choana

Second Pass

Head of Middle turbinate

Uncinate process

Ethmoidal bulla

Erontal recess area

Third Pass

Sphenoethmoidal Recess

Superior Turbinate

Superior Meatus

Others

CT SCAN PNS (According to Mark May)

Grade 0 : Normal

Grade 1 : Minimal – Disease limited to OMC

Grade 2 : Moderate – Incomplete opacification of one or more

Sinuses (Frontal, maxillary, sphenoid)

Grade 3 : Maximal – Complete opacification of one or more

major sinuses, but not all

Grade 4 : Most sever – Total opacification of all sinuses

OTOENDOSCOPY

1. Perforation : Large / Subtotal
2. Ear Discharge : Scanty / Copious
3. Middle Ear Mucosa : Moist or wet (inflamed) / Boggy(polypoidal)

Medical management of Chronic Sinusitis :

- Antibiotics
- Antihistamines
- Decongestants

Surgery : FESS / FESS with septoplasty

Otoendoscopy after clearance of sinus disease:

Middle Ear Mucosal Status : Improved mucosal status / No Improvement

OBSERVATIONS AND INFERENCES

Observation of 60 patients who had chronic otitis media active mucosal type and underwent functional endoscopic sinus surgery for clearance of concomitant sinus disease is as follows:

Age of patients included in this study are from 18-49 years. Out of 60 patients, 27 were males and 33 were females.

1. Socio Economic Status wise Distribution of Cases

Economic Status	No. of Cases	Percentage %
Upper class	42	4
Middle Class	16	26
Lower Class	44	73

2. Regional wise Distribution of Cases

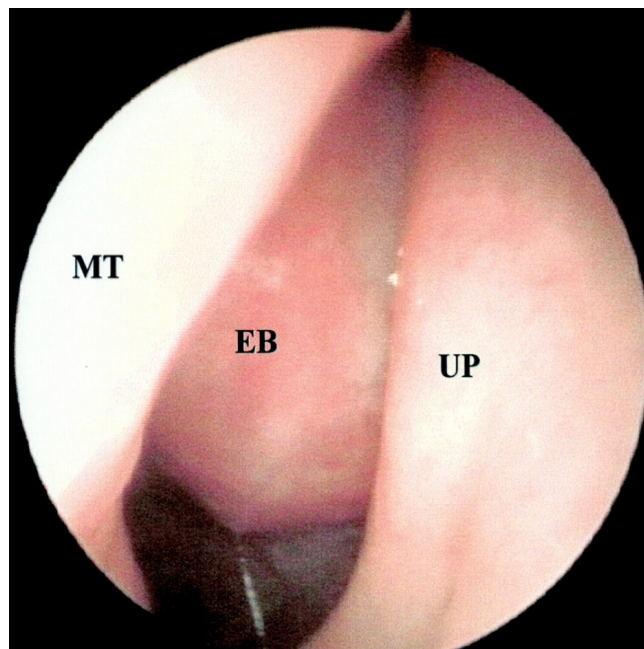
Regional	No. of Cases	Percentage %
Urban	16	27
Rural	44	73

DIAGNOSTIC NASAL ENDOSCOPY

PURULENT DISCHARGE FROM MIDDLE MEATUS



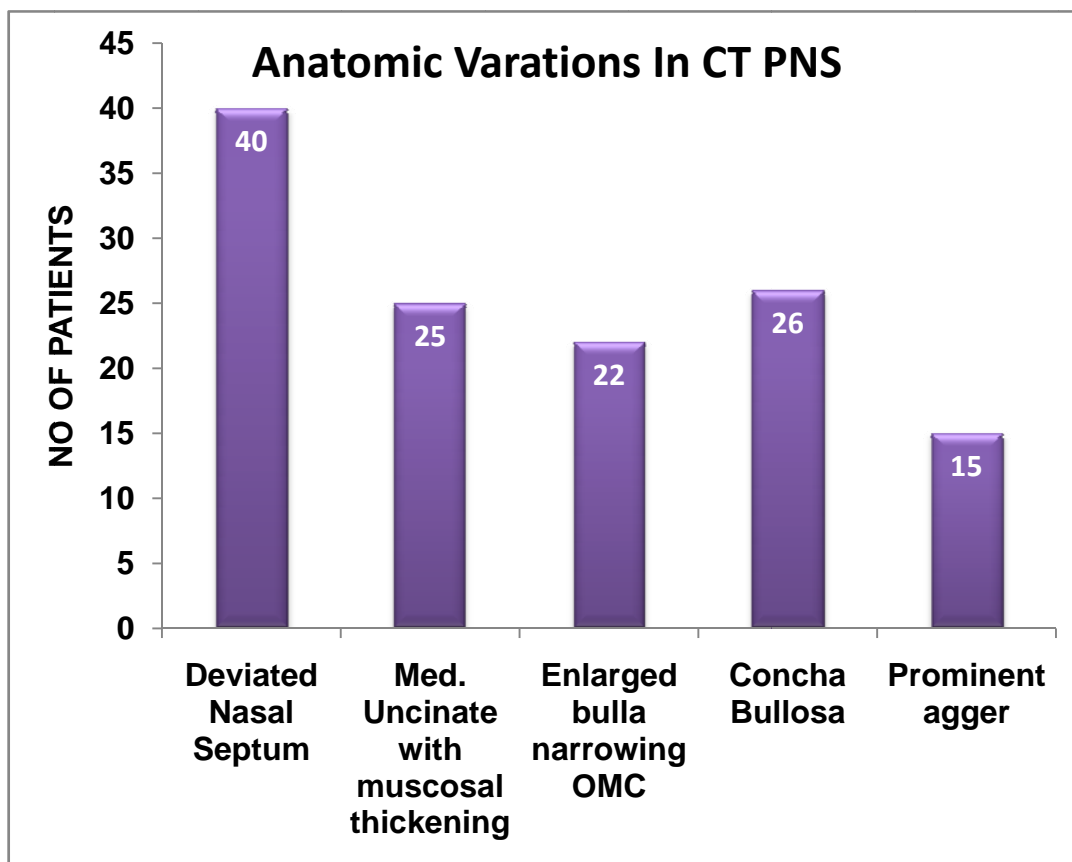
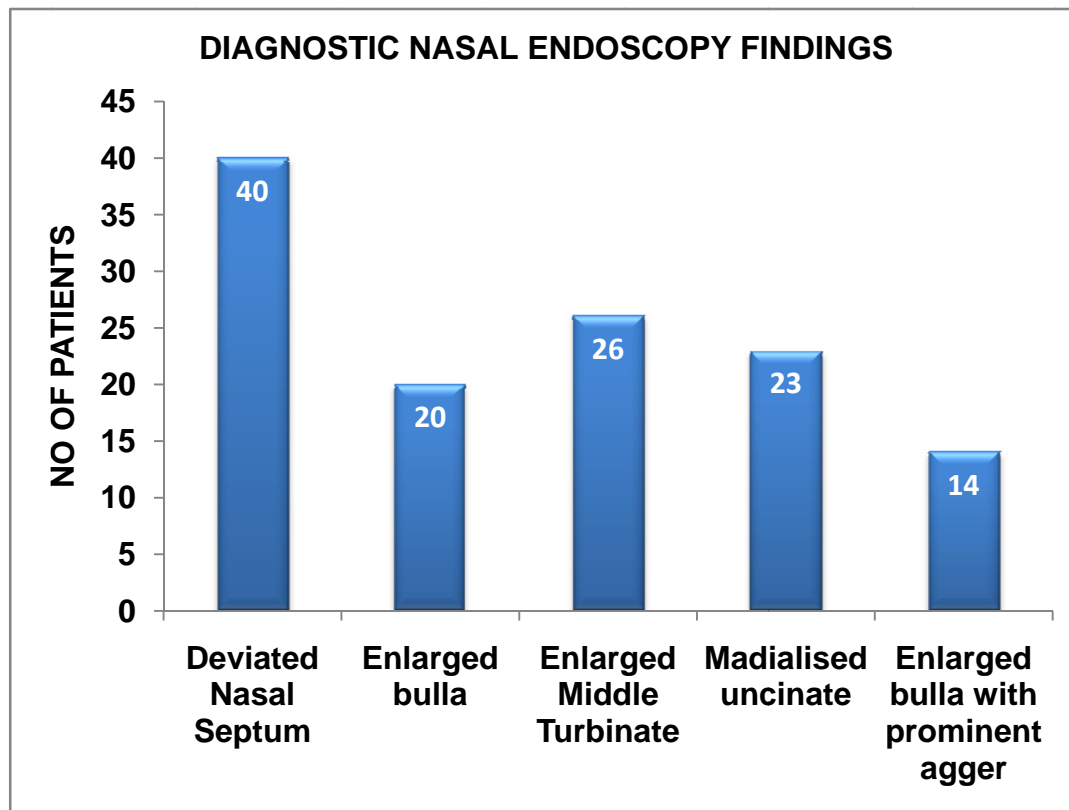
ENLARGED BULLA WITH OMC NARROWING



3. Diagnostic Nasal Endoscopy:

On DNE the following common anatomical variant noted was deviated nasal septum and turbino septal deformity in 73% of patients, followed by enlarged bulla in 33%, medialised uncinate 35%, enlarged middle turbinate 37%, enlarged bulla with prominent agger 25% and paradoxical middle turbinate 24%.

Anatomical Variants	Patients	Percentage%
Deviated nasal septum and turbino septal deformity	40	73
Enlarge middle turbinate	26	37
Medialised uncinate	23	35
Enlarged bulla	20	33
Enlarged bulla with prominent agger	15	25
Paradoxial middle turbinate	14	24



4. Diagnostic Nasal Endoscopy: Site of Accessory Ostium

Site of Accessory Ostium	No.of Patients	Percentage
Anterior Fontanel	12	18
Posterior Fontanel	25	40

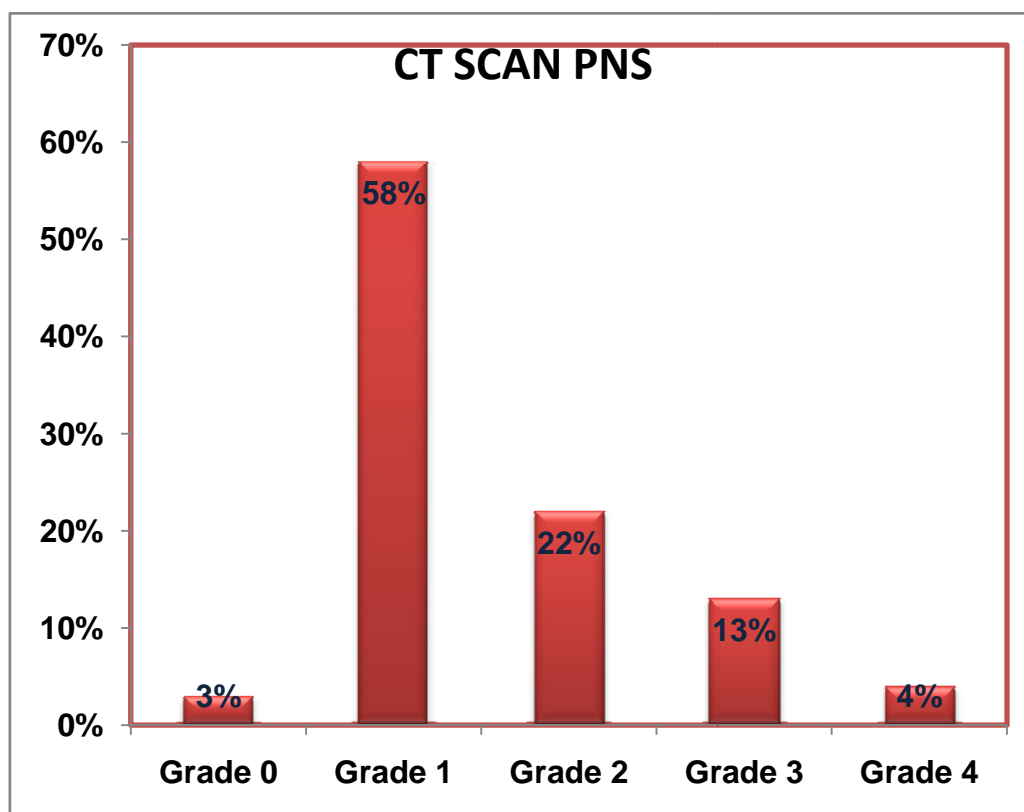
5. Diagnostic Nasal Endoscopy: Discharge in Middle Meatus

Nature of discharge	Patients	Percentage%
Mucopurulent	35	58
Purulent	18	30
Mucoid	7	12

6. CT PNS findings

Most of the patients had grade I findings 58% i.e disease limited to OMC, 22% had grade II, 13% had grade III, 4% had grade IV findings and 3% had normal CT findings.

CT Scan PNS finding	Patients	Percentage%
Grade 0	2	3
Grade I	35	50
Grade II	12	22
Grade III	8	13
Grade IV	3	4

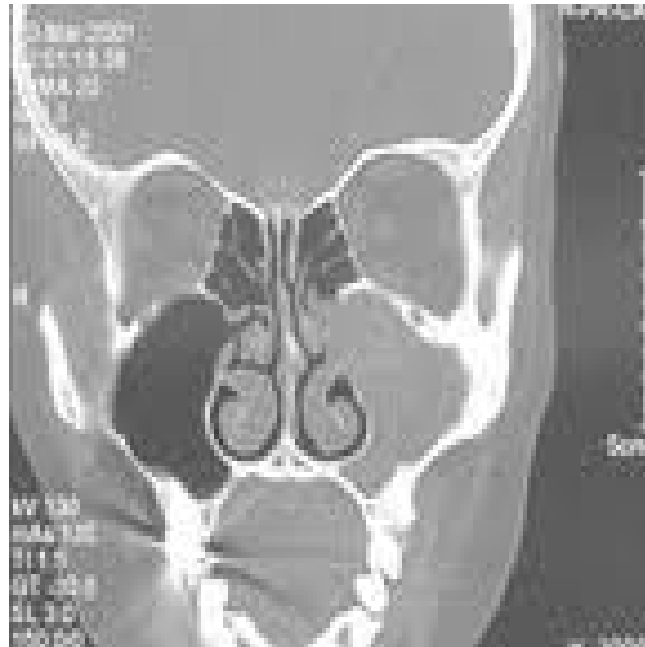


7. CT PNS: Findings

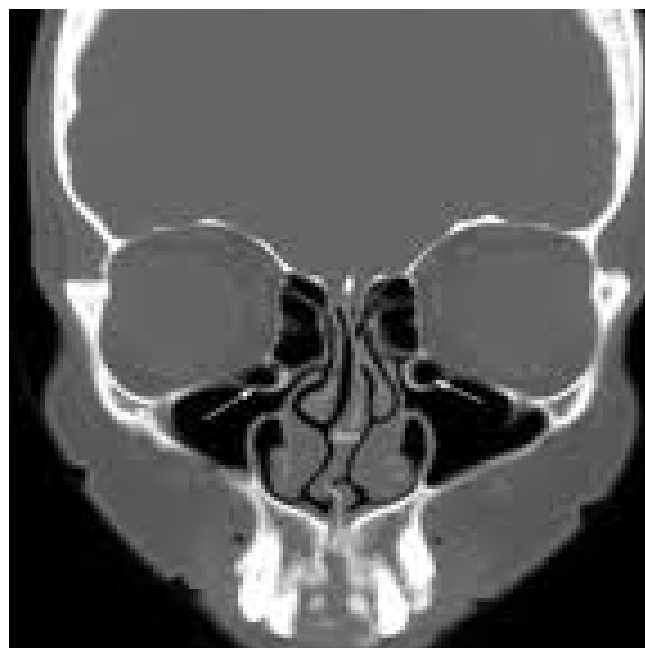
Anatomic Variants	Patients	Percentage
Deviated Nasal septum	40	73
Concha bullosa	26	37
Med. uncinate with maxillary mucosal thickening	25	36
Enlarge bulla narrowing OMC	22	34
Prominent agger/frontal cell obstructing frontal recess	15	25

COMPUTER TOMOGRAPHY OF PARANASAL SINUSES

LEFT UNILATERAL MAXILLARY SINUSITIS

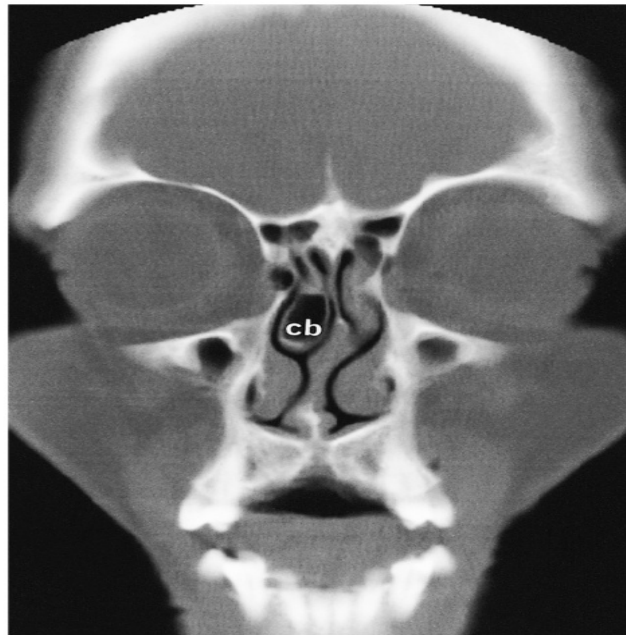


HALLER CELLS CAUSING OMC NARROWING

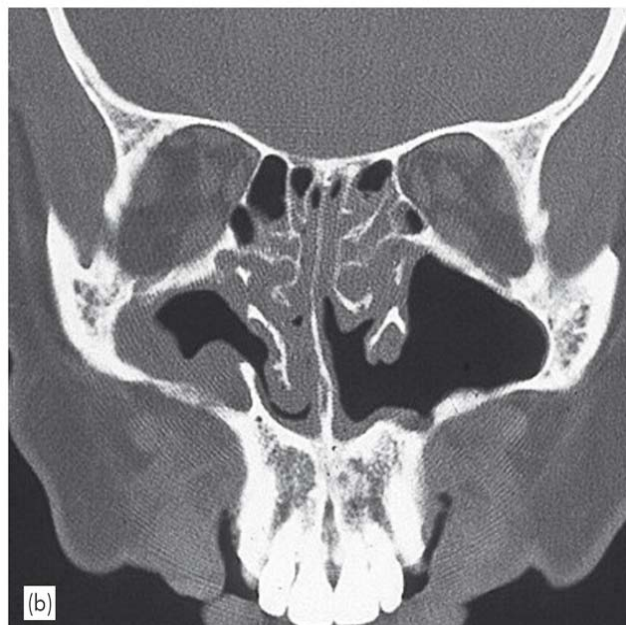


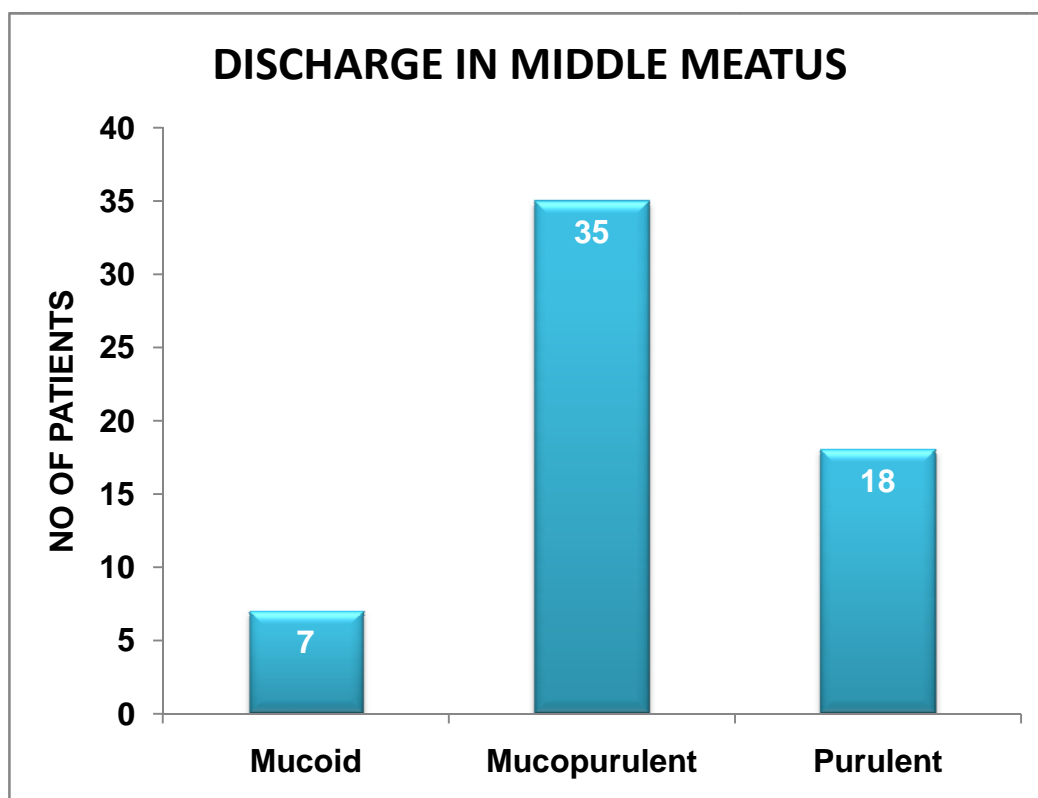
COMPUTER TOMOGRAPHY OF PARANASAL SINUSES

CONCHA BULLOSA WITH OMC CROWDING



PARADOXICAL MIDDLE TURBINATE WITH PAN SINUSITIS



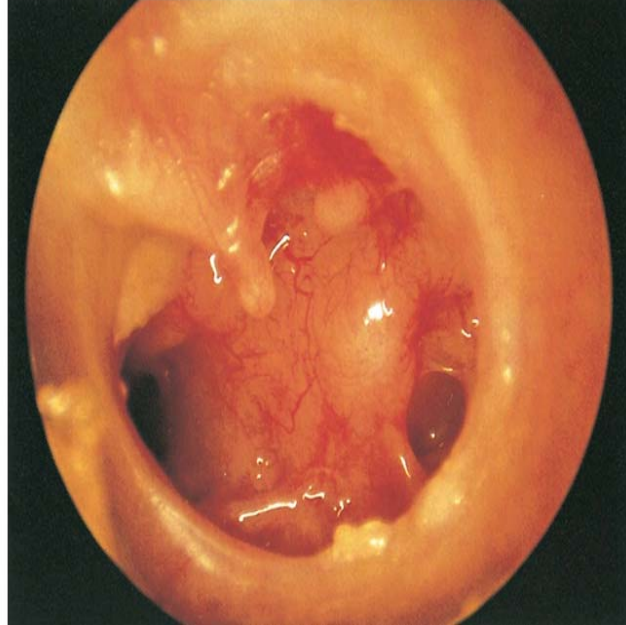


8. Otoendoscopy: Type of Performance

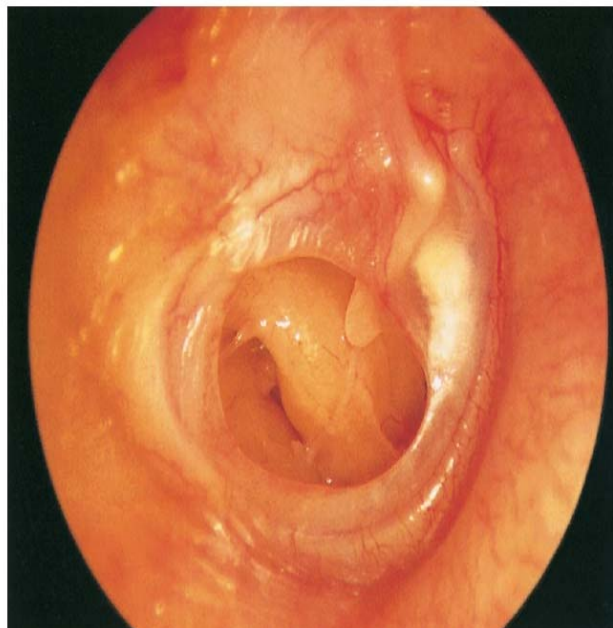
Type of performance	Patients	Percentage%
Large CP	40	74
Subtotal CP	20	26

OTOENDOSCOPY

MUCOID EAR DISCHARGE WITH WET(INFLAMMED) MIDDLE EAR MUCOSA



NORMAL MUCOSA OF THE MIDDLE EAR AFTER CLEARANCE OF SINUSITIS

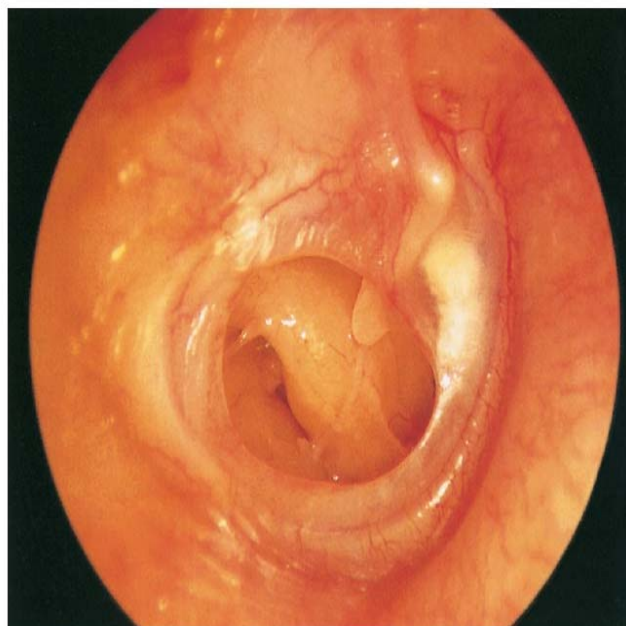


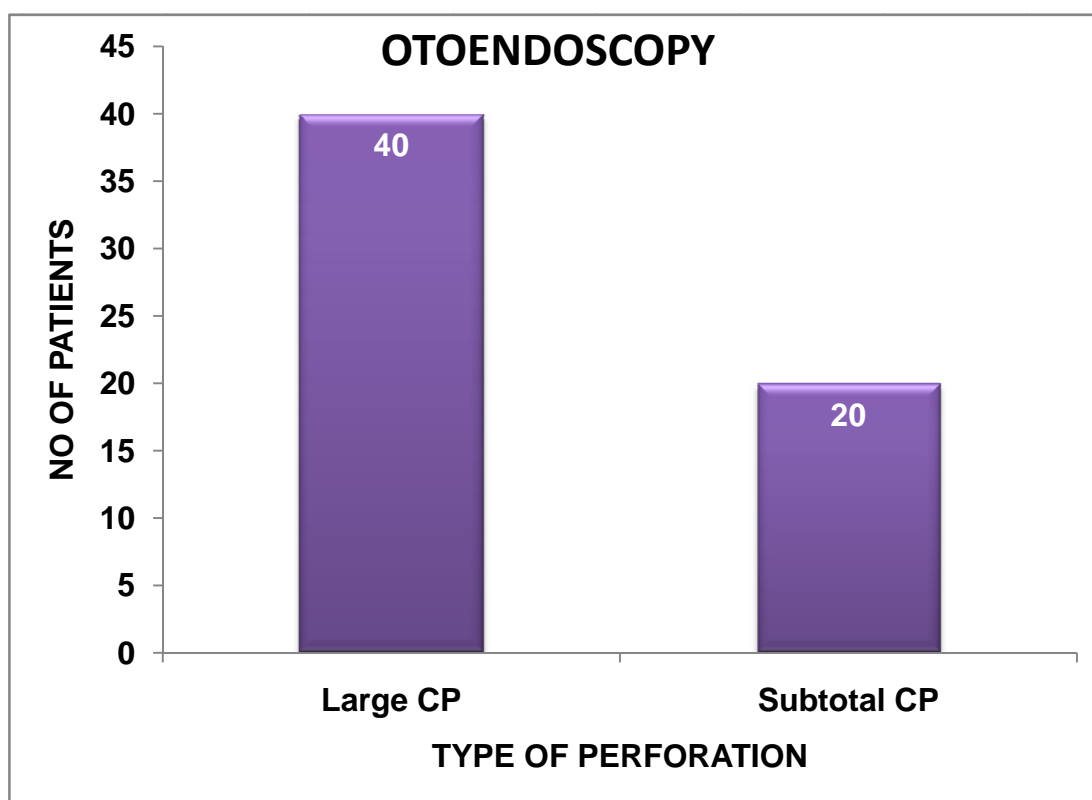
OTOENDOSCOPY

MIDDLE EAR MUCOSA STATUS AFTER FESS SUBTOTAL PERFORATION



LARGE PERFORATION





9. Otoendoscopy : Middle Ear Mucosal Status

Middle ear mucosa	Patients	Percentage%
Edematous (Moist)WET	40	74
Polypoidal(Boggy)	20	26

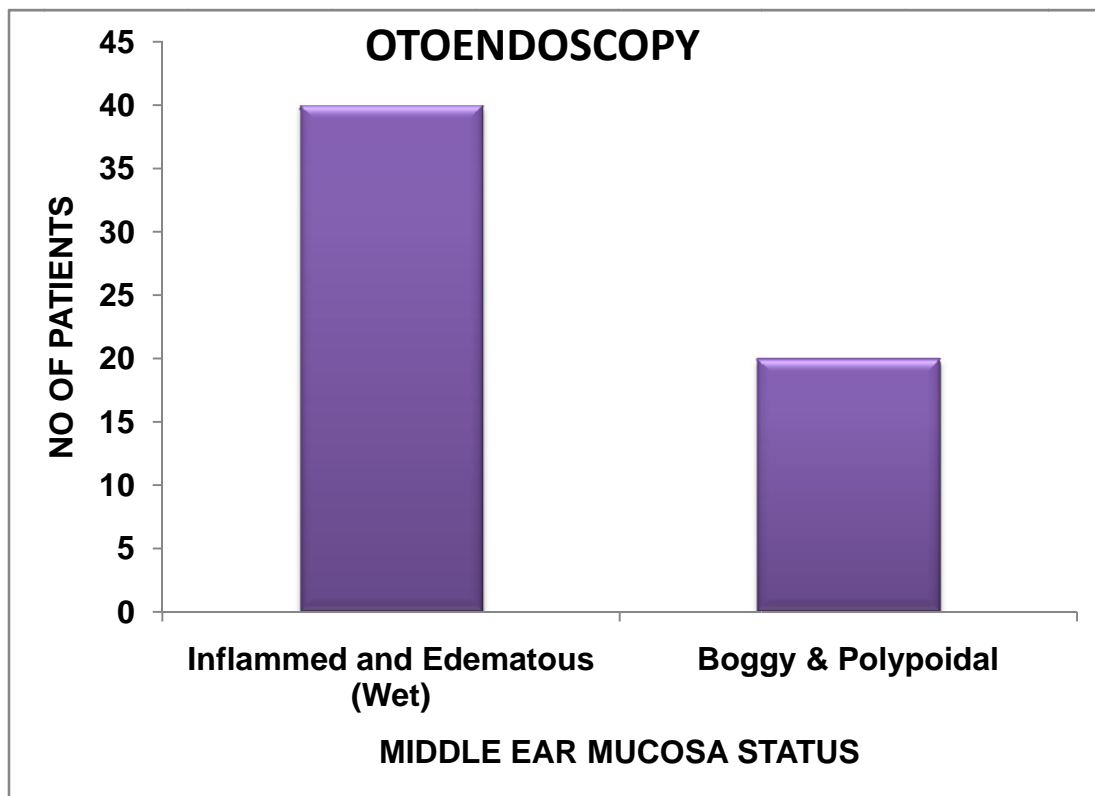
OTOENDOSCOPY

PURULENT DISCHARGE WITH BOGGY MUCOUSA



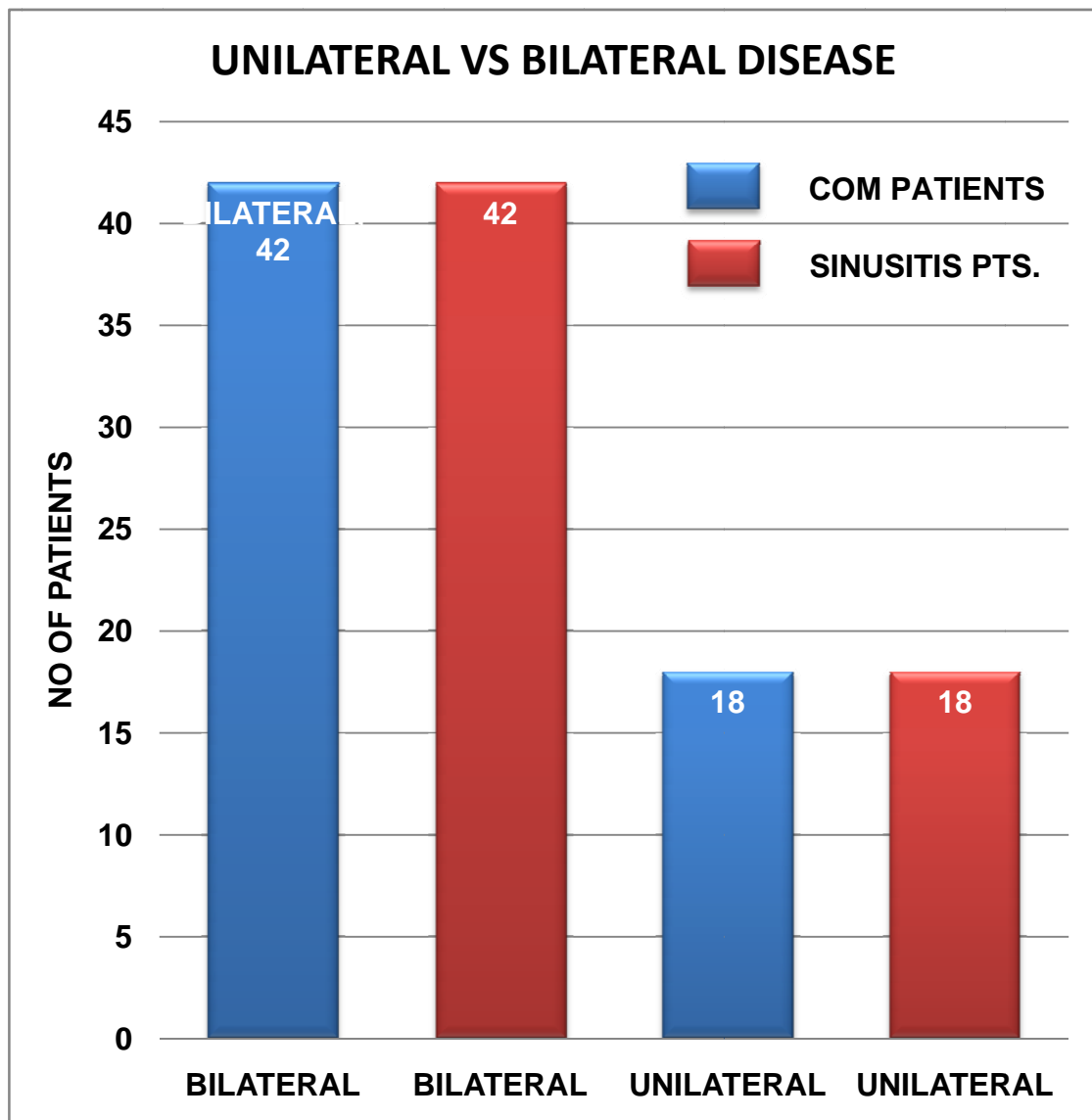
POLYPOIDAL MIDDLE EAR MUCOUSA





10. Incidence of Unilateral / Bilateral disease

Pathology	Patients with Persistent C.S.O.M	Patients with Sinusitis	Percentage %
Unilateral	18	18	26
Bilateral	42	42	74



11. Surgical Procedure done for clearance of sinusitis

Surgical procedure	Patients	Percentage%
FESS	17	32
FESS with septoplasty	43	68

12.Improvement of middle ear mucosal status with clearance of sinusitis.

Nature of mucosa prior to treatment	Nature of mucosa after treatment	After FESS
Inflamed and Wet (Moist)	Improved	34
	Not improved	6
Boggy and polypoidal	Improved	14
	Not improved	6

DISCUSSION

A total of 60 patients were selected for this study. These patients with Chronic Otitis Media Active mucosal type had persistent ear discharge even after adequate medical treatment.

In this study, we wanted to ascertain the role of sinusitis in the pathogenesis of Chronic Otitis Media Active mucosal type of disease. Even though other septic foci like chronic tonsillitis, adenoids exist, the percentage is insignificant in adults when compared to sinusitis.

In this study, 60 patients were treated and followed during the study period of June 2010 to Nov 2011 including 27 males and 33 females.

Forty Four cases (73%) belonged to the lower socio-economic group. The poor living conditions and poor personal hygiene in this group was the reason for its higher prevalence in this group. 16 cases (26%) belonged to middle economic group and 2 cases (6%) belonged to the higher socio-economic group.

Of the 60 cases, 44 cases were from the rural region and 16 cases from the urban region. The poor unhygienic living conditions in rural region were the predisposing factors for the high prevalence in that region.

In our study, all the patients underwent diagnostic nasal endoscopy. Of these, 40 patients (73%) had septal deviation and turbinoseptal deformity and this was the most common anatomical variant, 37% had enlarged middle turbinate, 35% had medialised uncinate, 33% had enlarged bulla, 25% had enlarged bulla with prominent agger and 24% had paradoxical middle turbinate.

Accessory ostium which is one of the diagnostic sign of chronics sinusitis was found in 37 patients. Of these 25 patients had the accessory ostium in the posterior fontanel and 18 patients had accessory ostium in the anterior fontanel.

All patients had discharge in middle meatus. The discharge was mucopurulent in 35 patients (58%), it was purulent in 18 patients (30%) and mucoid in 7 patients (12%). In 20% of cases the discharge was seen above the Eustachian tube and in 80% of cases, the discharge was seen below Eustachian tube orifice.

On CT paranasal sinuses, most of cases had Grade I disease (58%) i.e. minimal disease limited to Osteo Meatal Complex followed by Grade II 22% (incomplete opacification of one or more sinuses), 13% had Grade III (complete opacification of one or more major sinuses, not all) and 4% of patients had Grade IV disease- total opacification of all sinuses. In 3% of patients CT PNS was normal.

The commonest anatomic variant on CT scan was deviated nasal septum in 40 patients (73%). Concha bullosa was found in 26 patients (37%). Medialised uncinate with maxillary mucosal thickening was found in 25 patients (36%). Enlarged bull narrowing OMC was seen 22 patients (35%). Prominent agger cell obstructing the frontal recess was found in 15 patients (25%).

All the patients had findings and signs strongly suggestive of chronic sinusitis on diagnostic nasal endoscopy and Computed Tomography scan of Paranasal Sinuses.

On otoendoscopy, 40 patients (74%) had a large central perforation, while 20 patients (26%) had a subtotal central perforation.

The Middle ear mucosal status by otoendoscopy, 40 patients had edematous Wet / Inflamed mucosa, while 20 patients had polypoidal (boggy) mucosa. This indicates poor Eustachian tube function.

The incidence of unilateral and bilateral ear discharge in the selected patients, it was found to be 18 (26%) and 42 (74%) respectively. When the incidence of unilateral and bilateral sinusitis was compared in these patients, it was found to be identical. The patients with unilateral ear discharge had signs of chronic sinusitis and discharge around the Eustachian tube orifice of ipsilateral side only.

The patients underwent functional endoscopy sinus surgery by Stammberger technique for the treatment of chronic sinusitis. Patients with unilateral sinusitis underwent surgery only on the disease side. 43 (68%) patients also underwent septoplasty.

Following clearance of sinusitis, improvement in the middle ear mucosal status was assessed. Out of 40 patients with moist / wet and inflamed mucosa, 34 patients showed improved mucosal status while 6 patients had no improvements in mucosal status. Further treatment by aural toileting and culture directed topical antibiotics improved the mucosal status of 2 more patients.

Out of 20 patients with boggy and polypoidal mucosa, 16 patients showed improved mucosal status after surgery alone, while 3 more patients had improved mucosal status with oral antibiotic, with culture directed topical antibiotics and aural toileting.

Out of 60 patients, 52 patients (87%) had improved middle ear mucosal status after clearance of sinusitis, while 8 patients (13%) showed no improvement at all in the middle ear mucosal status. These patients with improved middle ear mucosal status are further treated with cortical mastoidectomy or myringoplasty as the case may be, will definitely improve the outcome.

Of the 8 patients, who had no improvement of middle ear mucosal status were further investigated, three patients had dysfunction of the eustachian tube as demonstrated by the dye test and 5 patients had recurrence of sinusitis due to failure of the surgical procedure.

CONCLUSION

- ❖ In the adult population sinusitis is the most important focal sepsis in case of persistent ear discharge in Chronic Otitis Media active mucosal type of disease.
- ❖ A proper diagnostic nasal evaluation of all Chronic Otitis Media active mucosal type of patients is necessary in comprehensive management of the disease.
- ❖ Deviated nasal septum, enlarged middle turbinate, medialised uncinate are the most common anatomical variants of nose and Paranasal sinuses predisposing to sinusitis.
- ❖ The clearance of sinusitis has improved the middle ear mucosal status.
- ❖ Unilateral ear discharge is associated with sinusitis only on the corresponding side, which is in concurrence with our study.
- ❖ The clearance of sinusitis by functional endoscopic sinus surgery in Chronic Otitis Media active mucosal type of diseased patients results in good outcome of the middle ear disease clearance by further ear surgery.
- ❖ Functional endoscopic sinus surgery has emerged as the best procedure for clearance of sinusitis.

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MASTER CHART

S.No.	Name IP/OP No.	Age/Sex	Otoendoscopy		DNE Findings	Diagnosis	Surgery	Middle Ear Mucosal Status after surgery
			Type of Central Perforation	Middle Ear Mucosal Status				
1.	Kokila 909410	26/F	Large	Wet/Inflamed	TS II/Enlarged middle turbinate/Enlarged bulla with prominent agger	DSR with Ch. Sinusitis with B/L COM-AM	FESS with Septoplasty	Improved
2.	Lakshmi 11966	28/F	Large	Polypoidal/ Boggy	TS I/ Medialised uncinate/Enlarged bulla with prominent agger	DSR with Spur with Ch. Sinusitis with B/L COM-AM	FESS with Septoplasty	No improvement
3	Loganathan 972139	21/M	Subtotal	Wet/Inflamed	TS I/Enlarged bulla/Paradoxical M T	DSL with Ch. Sinusitis with B/L COM-AM	FESS with Septoplasty	Improved
4.	Ramalingam 961548	25/M	Subtotal	Wet/Inflamed	TS II/ Medialised uncinate/Paradoxical M T	DSL with LT Sinusitis with LT COM-AM	FESS with Septoplasty	Improved
5.	Priya 909519	30/F	Subtotal	Polypoidal/ Boggy	TS I/ Enlarged middle turbinate Medialised uncinate	DSL Ch. Sinusitis with B/L COM- AM	FESS with Septoplasty	No improvement
6.	Valli 963579	28/F	Large	Wet/Inflamed	TS II//Enlarged bulla/Paradoxical M T	DSR with Ch. Sinusitis with B/L COM-AM	FESS with Septoplasty	Improved
7.	Balaji 963864	26/M	Subtotal	Wet/Inflamed	Enlarged middle turbinate/Paradoxical M T	Ch. Sinusitis with B/L COM- AM	FESS	Improved

8	Alamelu 964885	40/F	Subtotal	Wet/Inflamed	TS II/ Enlarged middle turbinate/Paradoxical M T	DSR with spur with RT Sinusitis with RT COM-AM	FESS with Septoplasty	Improved
9	Hemachandran 966503	19/M	Large	Polypoidal/ Boggy	TS I/ Medialised uncinata/Enlarged bulla	DSR with Ch. Sinusitis with B/L COM-AM	FESS with Septoplasty	No improvement
10	Valarmathy 966710	25/F	Subtotal	Wet/Inflamed	TS I/ Enlarged middle turbinate/Paradoxical M T	DSL with Ch. Sinusitis with B/L COM-AM	FESS with Septoplasty	Improved
11	Sarpu Matha 966995	47/F	Large	Polypoidal/ Boggy	TS II/ Medialised uncinata/Enlarged bulla with prominent agger	DSR with Spur with RT Sinusitis with RT COM-AM	FESS with Septoplasty	Improved
12	Devadass 967309	22/M	Large	Wet/Inflamed	TS II/ Enlarged middle turbinate	DSR with Ch. Sinusitis with B/L COM-AM	FESS with Septoplasty	Improved
13	Latha 967815	37/F	Subtotal	Polypoidal/ Boggy	TS I/ Medialised uncinata/Enlarged bulla with prominent agger	DSL with LT Sinusitis with LT COM-AM	FESS with Septoplasty	Improved
14	Murali 968320	49/M	Subtotal	Polypoidal/ Boggy	TS I/Enlarged bulla/Paradoxical M T	DSL with Ch. Sinusitis with B/L COM-AM	FESS with Septoplasty	Improved
15	Selvi 968530	30/F	Large	Wet/Inflamed	Enlarged middle turbinate/Paradoxical M T	Ch. Sinusitis with B/L COM-AM	FESS	Improved
16	Shanthi 141690	46/F	Large	Wet/Inflamed	TS II/ Medialised uncinata/Enlarged bulla with prominent agger	DSL with LT Sinusitis with LT COM-AM	FESS with Septoplasty	Improved
17	Swarnalatha 139771	39/F	Large	Polypoidal/ Boggy	TS I/Enlarged bulla/Paradoxical M T	DSL with Ch. Sinusitis with B/L COM-AM	FESS with Septoplasty	Improved
18	Balaji 961052	24/M	Subtotal	Wet/Inflamed	TS II/ Medialised uncinata/Enlarged bulla with prominent agger	DSR with RT Sinusitis with RT COM-AM	FESS with Septoplasty	No improvement

19	Geetha 104855	25/F	Subtotal	Wet/Inflamed	TS I/ Enlarged middle turbinate	DSR with Spur with RT Sinusitis with RT COM-AM	FESS with Septoplasty	Improved
20	Shanthi 155361	27/F	Large	Wet/Inflamed	Medialised uncinata/Enlarged bulla	Ch. Sinusitis with B/L COM-AM	FESS	Improved
21	Rafuja 964073	28/F	Large	Polypoidal/ Boggy	TS II/v Enlarged middle turbinate	DSR with RT Sinusitis with RT COM-AM	FESS with Septoplasty	Improved
22	Thandapani 901261	40/M	Large		Medialised uncinata/Enlarged bulla	Ch. Sinusitis with B/L COM-AM	FESS	Improved
23	Murugan 124090	22/M	Large	Wet/Inflamed	TS I/ Medialised uncinata/Paradoxical M T	DSR with Spur with RT Sinusitis with RT COM-AM	FESS with Septoplasty	Improved
24	Senthilkumar 174091	26/M	Large	Polypoidal/ Boggy	Medialised uncinata/Enlarged bulla	RT Ch. Sinusitis with RT COM-AM	FESS	Improved
25	Venketesan 180277	28/M	Large	Wet/Inflamed	TS II/ Enlarged middle turbinate Medialised uncinata	DSR with RT Sinusitis with RT COM-AM	FESS with Septoplasty	No improvement
26	Devadoss 183723	22/M	Subtotal	Polypoidal/ Boggy	TS I/Enlarged bulla	DSR with Ch. Sinusitis with B/L COM-AM	FESS with Septoplasty	Improved
27	Swarnalatha 966504	30/F	Large	Wet/Inflamed	Enlarged middle turbinate/Paradoxical M T	Ch. Sinusitis with B/L COM-AM	FESS	No improvement
28	Sundaramoorthy 967818	27/M	Large	Wet/Inflamed	Medialised uncinata/Enlarged bulla with prominent agger	Ch. Sinusitis with B/L COM-AM	FESS	Improved
29	Selvam 968782	43/M	Subtotal	Wet/Inflamed	TS II/Enlarged bulla	DSR with Ch. Sinusitis with B/L COM-AM	FESS with Septoplasty	Improved

30	Devi 961021	25/F	Large	Polypiodal/ Boggy	TS I/ Enlarged middle turbinate	DSR with Ch. Sinusitis with B/L COM-AM	FESS with Septoplasty	Improved
31	Dhanalakshmi 901221	33/F	Subtotal	Wet/Inflamed	Medialised uncinate/Enlarged bulla with prominent agger	Ch. Sinusitis with B/L COM- AM	FESS	No improvement
32	Chitra 909921	28/F	Large	Wet/Inflamed	TS I/ Medialised uncinate/Enlarged bulla with prominent agger	DSR with Ch. Sinusitis with B/L COM-AM	FESS with Septoplasty	Improved
33	Ravi 912018	32/M	Large	Polypiodal/ Boggy	Enlarged middle turbinate/Enlarged bulla	Ch. Sinusitis with B/L COM- AM	FESS	Improved
34	Panchali 102189	32/F	Large	Wet/Inflamed	TS II/ Enlarged middle turbinate	DSR with RT Sinusitis with RT COM-AM	FESS with Septoplasty	Improved
35	Jeganathan 102212	21/M	Large	Wet/Inflamed	TS I/ Enlarged middle turbinate	DSL with LT Sinusitis with LT COM-AM	FESS with Septoplasty	No improvement
36	Satishkumar 961029	24/M	Subtotal	Polypiodal/ Boggy	Enlarged bulla/Paradoxical M T	Ch. Sinusitis with B/L COM- AM	FESS	Improved
37	Mahindiran 17 9215	22/M	Large	Wet/Inflamed	TS II/ Enlarged middle turbinate	DSR with Spur with RT Sinusitis with RT COM-AM	FESS with Septoplasty	Improved
38	Sakthikumar 15870	25/M	Subtotal	Polypiodal/ Boggy	Enlarged middle turbinate/ Medialised uncinate	Ch. Sinusitis with B/L COM- AM	FESS	Improved
39	Hemavathy 16438	34/F	Large	Wet/Inflamed	Medialised uncinate/Enlarged bulla with prominent agger	Ch. Sinusitis with B/L COM- AM	FESS	No improvement
40	Mumtaj 18170	43/F	Large	Wet/Inflamed	TS II/Enlarged bulla	DSL with Ch. Sinusitis with B/L COM-AM	FESS with Septoplasty	Improved
41	Durgadevi 17883	20/F	Large	Polypiodal/ Boggy	Enlarged middle turbinate/Paradoxical M T	Ch. Sinusitis with B/L COM- AM	FESS	Improved

42	Devi 17958	28/F	Subtotal	Wet/Inflamed	TS I/ Medialised uncinate	DSR with RT Sinusitis with RT COM-AM	FESS with Septoplasty	No improvement
43	Rajkumar 18137	23/M	Large	Wet/Inflamed	Enlarged middle turbinate/Paradoxical M T	Ch. Sinusitis with B/L COM-AM	FESS	Improved
44	Jayaprakash 19574	21/M	Subtotal	Wet/Inflamed	Enlarged middle turbinate/Enlarged bulla	LT Ch. Sinusitis with LT COM-AM	FESS	Improved
45	Sandya 19617	33/F	Large	Wet/Inflamed	TS II/Enlarged bulla	DSL with LT Sinusitis with LT COM-AM	FESS with Septoplasty	Improved
46	Tamilarasi 19314	52/F	Large	Polypoidal/ Boggy	Medialised uncinate/Enlarged bulla	Ch. Sinusitis with B/L COM-AM	FESS	Improved
47	Shobana 20479	39/F	Large	Wet/Inflamed	TS II/ Enlarged middle turbinate	DSL with Spur with RT Sinusitis with RT COM-AM	FESS with Septoplasty	Improved
48	Shakunthala 20371	45/F	Subtotal	Wet/Inflamed	TS I/Enlarged bulla	DSL with LT Sinusitis with LT COM-AM	FESS with Septoplasty	Improved
49	Vanaja 20491	35/F	Large	Wet/Inflamed	Enlarged middle turbinate /Paradoxical M T	Ch. Sinusitis with B/L COM-AM	FESS	Improved
50	Biswajith 20131	24/M	Large	Wet/Inflamed	TS III/ Enlarged bulla with prominent	DSR with Ch. Sinusitis with B/L COM-AM	FESS with Septoplasty	No improvement
51	Lavanya 21910	20/F	Subtotal	Polypoidal/ Boggy	TS I/Enlarged bulla	DSR with RT Sinusitis with RT COM-AM	FESS with Septoplasty	Improved

52	Suguna 21985	32/F	Large	Wet/Inflamed	TS III/ Enlarged middle turbinate	DSL with Ch. Sinusitis with B/L COM-AM	FESS with Septoplasty	Improved
53	Karthik 22108	23/M	Large	Wet/Inflamed	TS II/Enlarged bulla with prominent agger	DSL with Ch. Sinusitis with B/L COM-AM	FESS with Septoplasty	Improved
54	Murugammal 968840	22/M	Large	Polypiodal/ Boggy	TS I/Enlarged bulla	DSL with LT Sinusitis with LT COM-AM	FESS with Septoplasty	Improved
55	Jaganathan 972139	21/M	Subtotal	Wet/Inflamed	Medialised uncinata/Enlarged bulla with prominent agger	DSL with Ch. Sinusitis with B/L COM-AM	FESS with Septoplasty	Improved
56	Srinivasan 976982	22/M	Large	Wet/Inflamed	TS II/ Enlarged middle turbinate	DSR with Spur with RT Sinusitis with RT COM-AM	FESS with Septoplasty	Improved
57	Karthik 978674	20/M	Large	Polypiodal/ Boggy	TS II/ Enlarged middle turbinate	DSR with Spur with Ch. Sinusitis with B/L COM-AM	FESS with Septoplasty	Improved
58	Rajeshwari 979243	39/F	Large	Wet/Inflamed	TS I/ Medialised uncinata	DSR with Ch. Sinusitis with B/L COM-AM	FESS with Septoplasty	Improved
59	Chinammal 97997 1	45/F	Large	Wet/Inflamed	TS II/ Medialised uncinata/Enlarged bulla with prominent agger	DSL with Ch. Sinusitis with B/L COM-AM	FESS with Septoplasty	No improvement
60	Rukku 980174	40/F	Large	Polypiodal/ Boggy	TS I/ Enlarged middle turbinate	DSL with Ch. Sinusitis with B/L COM-AM	FESS with Septoplasty	Improved