CORRELATION BETWEEN HRCT TEMPORAL BONE FINDINGS AND SURGICAL FINDINGS IN PATIENTS WITH CHRONIC SUPPURATIVE OTITIS MEDIA

Dissertation submitted for

MASTER OF SURGERY

BRANCH IV

(OTO-RHINO-LARYNGOLOGY)

APRIL 2013

THE TAMIL NADU Dr. M.G.R. MEDICAL UNIVERSITY

CHENNAI

CERTIFICATE

This is to certify that this dissertation entitled **" CORRELATION BETWEEN HRCT TEMPORAL BONE FINDINGS AND SURGICAL FINDINGS IN PATIENTS WITH CHRONIC SUPPURATIVE OTITIS MEDIA"** presented herewith by **Dr. SOWMYA RAJA** to the faculty of otorhinolaryngology in the Tamilnadu Dr. MGR Medical University , Chennai, in partial fulfillment of the requirements for the award degree of the Master of Surgery Branch IV (Otorhinolaryngology) April 2013 session is a bonafide work carried out by her under my direct supervision and guidance during the period of 2010-2013.

DR. K.R.

Kannappan,M.S.,MCh.,D.L.O

Professor and Head of the Dept.,
Dept. of Otorhinolaryngology,
Madurai medical college,
Madurai- 625020

DECLARATION

I hereby declare that this dissertation **entitled " CORRELATION BETWEEN HRCT TEMPORAL BONE FINDINGS AND SURGICAL FINDINGS IN PATIENTS WITH CHRONIC SUPPURATIVE OTITIS MEDIA"** has been prepared by me under the expert guidance and supervision of **Dr.K.R. KANNAPPAN MS, DLO, M.Ch**, Prof and HOD, Department of ENT Diseases, Govt Rajaji Hospital,Madurai.

This dissertation is submitted to the Tamilnadu Dr. M.G.R Medical University in partial fulfillment of the university regulations for the award of " The Master of Surgery" in Otorhinolaryngology.

This work has not formed the basis of the award of any Degree/ Diploma previously to me by any other university.

Place :

Date :

ACKNOWLEDGEMENT

I would like to express my deepest sense of gratitude to **PROF. Dr. K.R. KANNAPPAN, M.S., D.L.O., M.Ch.**, Professor and Head of the Department of ENT Diseases, Government Rajaji Hospital and Madurai Medical College, Madurai for his kind encouragement and valuable guidance during the course of preparation of this dissertation.

I gratefully acknowledge and sincerely thank **THE DEAN Dr.N.MOHAN,M.S.,F.I.C.S.,F.A.I.S** Govt Rajaji Hospital, Madurai, for granting me permission to utilize the resources of this institution for my study.

I am very much obliged to **Dr. RADHAKRISHNAN M.S., D.L.O** and **Dr. THANGARAJ M.S., D.L.O**, Assistant Prof of Dept of ENT, who helped me in preparing and bringing a shape to this work.

I would also like to express my sincere gratitude to the Asst Profs of Dept of ENT**, Dr. ALAGUVADIVEL M.S., D.L.O, Dr. SIVASUBRAMANIAN M.S., D.L.O., and Dr. RAJAGANESH M.S.**, for their help and guidance.

I wish to acknowledge my thanks to my postgraduate colleagues and friends as well.

I am conscious of my indebtedness to all my patients for their kind cooperation which enabled me to do this study.

CONTENTS

INTRODUCTION

Chronic otitis media [COM] is an inflammation of the middle ear cleft of long duration. It involves inflammation of the mastoid air cell system also due to its anatomical connection to the middle ear. Due to the location of the tympanomastoid compartment, separated from the middle and posterior cranial fossae by thin bony partitions, otitis media has the potential for intracranial extension. So it is very important to know the location and extent of the disease before planning surgical management. Radiological examination of the temporal bone helps us to achieve this objective.

The various modalities of temporal bone imaging are conventional radiography, CT scan and MRI.

The petrous temporal bone is a complex structure containing the middle and inner ear and various contained structures like the ossicles . This challenges the limits of resolution by imaging techniques. Good spatial resolution by imaging to allow adequate demonstration of these bony structures in the middle and inner ears has made management of otitis media much simpler these days.

Otitis media can be diagnosed clinically to a certain extent. Radiology acts as an adjuvant diagnostic modality. It is useful in identifying bony erosion in acute and chronic mastoiditis ,extent of pneumatization of temporal bone and relationship of the pathology to adjacent critical anatomical structures like dura , internal carotid artery , lateral sinus and facial nerve . Diagnosis of a pathology like acquired cholesteatoma with attic perforation is considered largely clinical. Radiology was rarely thought to be required to establish the diagnosis. But nowadays it is being claimed that a cholesteatoma as small as 3mm in size can be diagnosed much earlier by the use of CT .

Each patient with chronic otitis media has to be clinically assessed and managed on an individual basis. Radiological imaging of the temporal bone would assess the disease extent and determine the type of surgery suitable for the particular individual.

The present work, has been undertaken to study the role of high resolution computed tomography temporal bone as a diagnostic modality in chronic otitis media and its usefulness in determining the management strategy like the type of surgical intervention required.

REVIEW OF LITERATURE

Nowadays conventional radiography is limited in its use for evaluation of mastoid pneumatisation . The high resolution computed tomography (HRCT) of temporal bone provides minute bony details and excellent demonstration of the location of the soft tissue density but cannot differentiate the type of substance producing the abnormal density . Magnetic resonance is superior to CT in the identification of soft tissue pathology in the temporal bone . However bony structures like ossicles , scutum and labyrinthine capsule are better delineated on CT temporal bones. Hence CT temporal bones has been considered the imaging modality of choice for assessment of middle ear pathology.[1]

During the earlier days, X-rays were used, but with its limitations as an imaging modality for the investigation of diseases of the ear . Nowadays, improved spatial resolution has meant that high resolution computed tomography (HRCT) using thin sections gives excellent bone detail in petrous temporal bone . Proton magnetic resonance imaging (MRI) roduces sectional images similar to CT, and the reconstruction methods are also

identical. But CT is superior in imaging the temporal bone due to its s ability to demonstrate both soft tissue abnormalities and fine bone detail.[2]

HRCT temporal bones is now considered the most useful radiological imaging modality in demonstration of bony detail in the petrous temporal bone and soft tissue density in the middle ear and the extension of the pathology into the cranial cavity. CT scanning is extremely helpful in the detection of intracranial complications.[3]

With the introduction of high resolution computed tomography, CT has become a very useful imaging technique for the temporal bone .[4]

Jackler RK et al (1984) conducted a study in forty-two patients with chronic otitis media who underwent preoperative CT scanning followed by surgical exploration of the middle ear and mastoid. The CT finding of abnormal soft tissue density with bony erosion showed high correlation with the surgical finding of cholesteatoma. On the contrary,

total absence of abnormal soft tissue density on CT essentially excluded cholesteatoma. They concluded that CT scan does have a role in the evaluation of selected patients with chronic otitis media, but needed to be interpreted keeping in mind its associated limitations and pitfalls.[5]

Mafee MF et al (1986) conducted a study of the microdissections of 250 fresh temporal bones and review of over 1,000 high-resolution computed tomography (CT) scans of the temporal bones. The anatomy was described, and the role of the tympanic diaphragm and isthmus in the determination of the degree of progression of middle ear pathogy stressed. The appearance of pathological lesions as seen on CT temporal bones like otomastoiditis, tympanosclerosis,cholesterol granuloma, attic retraction pocket, and acquired cholesteatoma were illustrated.[6]

Yamasoba T et al (1991) used axial scans of HRCT temporal bones to examine the structures of the anterior epitympanic recess and the surrounding tissues. The length and width of the recess and the cog was also imaged. The bony structure of the recess was found to be seldom

influenced by inflammatory processes. Chronic otitis media was found to be associated with suppression of pneumatisation of the temporal bone. The cells around the recess were also found to be less pneumatised than the mastoid cells.[7]

Leighton SE et al (1993) conducted a prospective study on 20 patients suspected to have cholesteatoma in order to establish the indications for CT imaging in these patients. A management plan was made in these patients following a thorough clinical evaluation. The plan so made was altered if needed, on the basis of radiological findings. Surgical findings were recorded and correlation with CT appearances evaluated. CT altered the management plan in 10 and was found to be useful in another 6 patients enrolled in the study. They concluded that CT temporal bones could be used routinely in children, medically unfit patients, only or better hearing ears, in those patients in whom the tympanic membrane was not visualized properly during clinical examination, patients who have undergone previous mastoid surgery but the operative records of the same not available, and patients with intratemporal or intracranial complications .[8]

Garber LZ et al (1994) conducted a retrospective study on 44 patients who underwent surgery for cholesteatoma to compare CT with the operative findings. Results showed that though CT could detect abnormalities in the temporal bone, it could not diagnose cholesteatoma efficiently. They concluded that CT would be useful in certain special situations as in those patients presenting diagnostic dilemmas or when an associated pathology like complications, recurrent disease , etc. is suspected.[9]

The study conducted by Luchikhin LA et al on 30 patients with chronic otitis media (1995) compared temporal bone computed tomography findings with the surgical findings . The study showed that CT temporal bones provided excellent information on the pathological process and was found to be of immense value before subjecting the patients for surgery.[10]

Walshe P et al (2002) conducted a study on twenty patients awaiting presenting with chronic suppurative otitis media who underwent preoperative HRCT of the temporal bones and subsequently mastoid

surgery was done. The HRCT temporal bone findings were compared with the intraoperative findings. They suggested that CT was useful in demonstrating the anatomy of the middle ear and mastoid, and the extent of the pathological disease in the sinus tympani and facial recess. However, it could not distinguish between cholesteatoma, mucosal disease and fluid, and it did not contribute much to the surgical management of the patients. They concluded that CT temporal bones as a routine preoperative investigation in uncomplicated mastoid surgery was of questionable value.[11]

Similar studies conducted by Sandeep Berry et al (1998) on 30 patients of unsafe chronic suppurative otitis media with pre-operative CT scanning and surgical exploration of the middle ear and mastoid, and comparison of CT findings with the surgical findings. The study showed that CT scan was highly sensitive for soft tissue density mass in the tympanomastoid compartment. They concluded that the CT scan of the temporal bone was best to depict pathology which is not clinically evident.[12]

Zelikovich EI (2004) used CT of the temporal bone to study thirty eight patients with chronic otitis media . The study of 52 CTs of the temporal bone with otoscopic and operative findings helped to distinguish CT signs of non-cholesteatomic chronic otitis media which included sclerosis of the mastoid (82.7%), defective pneumatisation of the tympanic cavity - 80.7% , erosion of the auditory bones (50%), alterations of the walls of the middle ear cavities (21%). The study also detected such anomalies as presentation of the sigmoid sinus (36.5%), high jugular bulb (3.8%), diverticulum of the jugular vein (3.8%), low position of the middle cranial fossa (7.7%).[13]

Zelikovich EI (2004),et al used temporal bone CT to examine 87 patients with chronic otitis media . The patients' age ranged from 2 to 74 years. The CT signs of chronic purulent otitis media with and without cholesteatoma were identified. CT shows changes in the walls of the middle ear cavity, including the roof and allows labyrinthine fistula and intracranial complications to be detected .[14]

Wang LE et al (2007) conducted a study to evaluate the methods of preoperative diagnosis and differentiation of pathological tissue found in the middle ear and mastoid. They concluded that CT was not reliable to diagnose and differentiate pathological tissue in middle ear and mastoid. But CT value can still be considered to provide significant information.[15]

Gerami H et al (2009) conducted a cross- sectional study on 80 patients with chronic suppurative otitis media between 2000-2004 and their preoperative CTtemporal bone findngs were compared with the intraoperative findings during mastoidectomy. Sensitivity, specificity, positive and negative predictive value of CT scan temporal bones with regard to tympano mastoid cholesteatoma, ossicular erosion, tegmen tympani erosion, dehiscence of facial canal, lateral semicircular canal (LSCC) fistula were assessed followed by calculation of correlation between radiological findings and intra-operative findings. They concluded that preoperative CT scan would be helpful in planning surgical management in cases of cholesteatoma and ossicular erosion. Hence CT scanning is a useful adjunct to management of CSOM.[16]

Firas Q. Alzoubi et al (2008) conducted a retrospective study in 50 patients between January 2003 and December 2007 to compare preoperative CT scans with surgical findings. They reported that CT scan could not differentiate cholesteatoma from chronic mucosal disease. It should be used as a preoperative tool only if complications of the disease suspected.[17]

Boyraz E et al (2009) conducted a study to show ability of CT temporal bones to detect tympanosclerotic plaques on 19 tympanoplasty cases between January 2006 and May 2006. The tympanosclerotic plaques obtained from surgical specimens were sent for histopathological examination and preoperative temporal bone CT scans were evaluted.

This study showed that temporal bone CT scan is a valuable tool to diagnose the localize the tympanosclerosis, in patients with chronic otitis media and conductive hearing loss. When combined with clinical findings, CT scans can be useful for preoperative evaluation of tympanosclerosis.[18]

Shim HJ et al (2010) undertook a study in order to evaluate the cross-sectional area of the air space in the Eustachian tube (ET) on computed tomography (CT) images and to predict the postoperative aeration of the middle ear in 80 patients with chronic otitis media who underwent tympanomastoid surgery from 2006-2007 and were followed up for more than 1 yr. The control group had 100 ears of 50 individuals with normal tympanic membranes and those who had got CT done for other causes (such as tinnitus or hearing loss).they concluded that the cross-sectional area of the aerated ET, measured by preoperative coronal images of temporal bone CT scans, could be useful to predict the postoperative condition of the tympanic cavity.[19]

AIMS AND OBJECTIVES OF THE STUDY

1. To study the findings of HRCT temporal bone in patients with chronic otitis media with and without cholesteatoma .
2. To evaluate the extent of pathological process and sites of involvement of the middle ear and the mastoid air cell system in these patients .
3. To study the relationship of the tympanomastoid compartment to the adjacent , critical neurovascular structures .
4. To evaluate the results of our study and compare with similarly published studies.

MATERIALS AND METHODS

Source of data

The present work was undertaken to study the radiological findings of temporal bone in patients diagnosed as having chronic otitis media at Government Rajaji Hospital attached to the department of ENT , Madurai Medical college, madurai between December 2011 and November 2012.

Methods of collection of data

Sample size : A minimum of 50 patients were enrolled for the study.

50 patients with Chronic otitis media presenting to ENT outpatient department at Government Rajaji Hospital attached to Madurai Medical College were taken up for study.

As soon as the patient presented to the hospital, detailed clinical history and examination were carried out as per the proforma prepared.

Laboratory investigations were done. All patients were subjected to HRCT temporal bones, 1mm axial and coronal slices.

Once the radiological findings were noted and extent of disease established, management was done accordingly.

Inclusion Criteria

50 patients of both sexes and all age groups presenting with chronic otitis media

Exclusion criteria

1. Patients with previous surgery for chronic otitis media were excluded.
2. Chronic otitis media requiring MRI and
3. Patients with a history of prior temporal bone trauma were excluded.

All patients entering the present study underwent certain investigations.

Routine investigations : Complete hemogram, bleeding time, clotting time, urine analysis, RBS, renal function tests Specific investigations : X-ray mastoids-lateral oblique view, HRCT of temporal bones.

Duration of study- 12 months

ANATOMY OF THE TEMPORAL BONE

The temporal bone consists of the following five parts:
squamous, mastoid, petrous, tympanic, and styloid process.

Squamous Portion

Its external surface is smooth and convex and gives attachment to the temporalis muscle; zygomatic process arises from the lower portion of the squama and its lateral surface is convex and lies beneath the skin and subcutaneous tissue. The medial surface of the zygomatic process gives origin to the masseter muscle. The anterior portion of the zygomatic process articulates with the zygomatic bone and its posterior portion is divided into an anterior and a posterior root. The posterior root of zygoma is continuous with the suprameatal crest. The anterior rootof zygoma forms the articular tubercle of the condylar (glenoid or mandibular) fossa.

The internal surface of the squama is grooved by the meningeal essels. Meningeal vessels groove the inner surface

Mastoid Portion

It gives attachment to the sternocleidomastoid, splenius capitis, and ongissimus capitis muscles. It is marked on its medial surface by a groove, the mastoid notch or digastric groove, which gives attachment to the posterior belly of the digastric muscle. The intracranial surface of the mastoid presents a deeper groove, the sigmoid sulcus, that contains part of the transverse sinus.

The mastoid process contains the mastoid cells, that vary greatly in size and number. The largest of these cells is the tympanic antrum which communicates with the epitympanum (attic), situated by way of the additus ad antrum.

Petrous Portion

The petrous pyramid liesbetween the sphenoid bone anteriorly and the occipital bones. It is a highly dense bone containing the senory organs of the inner ear. The petrous portion of the temporal bone can be seen from the superior, medial and posterior views.

SUPERIOR VIEW

Marked by

1. Arcuate eminence (corresponds to superior semicircular canal)

2. meatal plane(IAC)

3. foramen spinosum

4. facial hiatus

The petrous apex is indicated by transition of petrous to intracranial portion of internal carotid artery, bony end of Eustachian tube orifice and trigeminal ganglion in meckels cave.

MEDIAL VIEW

Porus acousticus

POSTERIOR VIEW

Marked by porus acousticus, operculum and subarcuate fossa.

INFERIOR VIEW

Forms a portion of the skull base, a very important landmark being the jugular foramen.

SURGICAL ANATOMY OF MIDDLE EAR CLEFT

Middle ear cleft consists of tympanic cavity, Eustachian tube, mastoid air cell system

TYMPANIC CAVITY

Irregular air filled space in the temporal bone lined by mucous membrane.

LATERAL WALL

Tympanic membrane overlies the mesotympanum while bone forms the outer lateral walls of the epitympanum & hypotympanum superiorly and inferiorly respectively. Scutum is a wedge shaped bone that forms the outer lateral wall of epitympanum. The pearly white tympanic membrane is 0.1 mm thick, oval in shape forms an angle of 55 degrees with the floor of the external auditory canal. Its longest diameter from posterosuperior to anteroinferior is 9.1mm and the shortest diameter perpendicular to it is 8.9mm. the circumference of pars tensa is thickened to form a fibrocartilaginous rim, the tympanic annulus which sits in the

tympanic sulcus. The lax area above the anterior and posterior malleolar folds is the pars flaccid.

Arterial supply- deep auricular branch of maxillary artery, anterior tympanic branch of maxillary artery, stylomastoid branch of posterior auricular artery and middle meningeal artery. Venous drainage- external jugular vein, tranverse sinus, dural veins and venous plexus around Eustachian tube

Nerve supply- anterior portion: auriculotemporal nerve Posterior portion: auricular branch of vagus Medial portion: tympanic branch of glossopharyngeal nerve.

ROOF OF TYMPANIC CAVITY

The tegmen tympani separates the middle cranial fossa from tympanic cavity

FLOOR OF TYMPANIC CAVITY

Formed by a convex plate of bone separating the tympanic cavity from the superior bulb of internal jugular vein. Occasionally the bone is deficient and the uncovered vein may lie in a dangerously exposed position separated from the middle ear cavity by only mucosa; extremely important in view of middle ear disease and surgery.

MEDIAL WALL OF TYMPANIC CAVITY

The central portion of middle ear formed by the promontory that overlies the basal turn of cochlea. The oval window lies below and behind the promontory which Is occupied by the footplate of stapes surrounded by the annular ligament. The oval window lies below and behind the oval window covered by secondary tympanic membrane of 0.7 mm thickness. The tympanic segment of facial nerve runs above the oval window, maybe dehiscent canal here; hence its worthy of note during surgery. The sinus tympani lying posterior to the round window is a hidden site for cholesteatoma hence needs to be explored meticulously during mastoid surgery.

ANTERIOR WALL OF TYMPANIC CAVITY

Superiorly, consist of two canals- one for tensor tympani above & for Eustachian tube below.

POSTERIOR WALL OF TYMPANIC CAVITY

Superiorly lies the aditusad antrum bounded below by the fossa incudis that houses the short process of incus. Below the fossa incudis and medial to chorda tympani lies the pyramid that gives attachment to the stapedius tendon, alo serves as a landmark for the second genu of the facial nerve . the sinus tympani and facial recess are important areas in posterior wall of tympanic cavity; they need thorough exploration during mastoid surgery for complete clearance of cholesteatoma.

CONTENTS OF TYMPANIC CAVITY

The ossicles- malleus, incus and stapesTwo muscles- tensor tympani and stapedius Nerves- chorda tympani and tympanic plexus of nerves.

MALLEUS:-

The most lateral of the ossicles. It has a head, neck, lateral process, anterior process and manubrium. The malleus is held in position by five ligaments, one articulation at the incudiomalleolar joint, tensor tympani tendon and the tympanic membrane.

THE INCUS:-

The largest of the ossicles, consists of a body, short process, long process and lenticular process. The body of incus lies in the epitympanumin association with the head of malleus. The short process of incus occupies the fossa incudes. Three ligaments provide anchorage for incus namely the incudal ligament, and the medial & lateral incudomalleal ligaments. The long process of incus is highly susceptible to osteitic erosion in chronic otitis media.

THE STAPES:-

The smallest and most medial link of the ossicular chain. It consists of a head, footplate and two crura. The anterior crus is straighter and more delicate than the posterior crus.

The muscles of the tympanic cavity help in stabilizing the ossicles, augmentation of sound signals and protection of inner ear. The tensor tympani and stapedius exert a dampening effect on the amplitude of the vibratory wave protecting the cochlea from excess stimulation.

COMPARTMENTS OF MIDDLE EAR

THE EPITYMPANUM

Superiorly bounded by tegmen tympani, medially by the prominence of the lateral semicircular canal and horizontal portion of facial nerve, laterally by the scutum and posteriorly by the fossa incudes. It contains the head of malleus, body of incus and their associated mucosal ligaments and mucosal folds.

THE MESOTYMPANUM

Contains the stapes, long process of malleus and incus, oval and round windows. The regions of surgical importance in the mesotympanum as far as mastoid surgery is concerned are the facial recess and the sinus tympani

THE HYPOTYMPANUM

That portion of middle ear that lies below the level of the floor of the bony meatal wall. A dehiscent jugular bulb is of considerable importance here before embarking on surgery

MUCOSAL SPACES OF MIDDLE EAR

The mucous membrane is thrown into a series of folds by the intratympanic structures dividing the middle ear into mucosal spaces of surgical importance.

The attic is almost completely separated from the mesotympanum by the ossicles nd their folds except for two small, constant opening called isthmus tympani anticus and isthmus tympani posticus.

The superior malleolar fold divides the attic into a small anterior malleolar space and a larger posterior compartment. The posterior compartment is further subdivided by the superior incudal fold into a superior incudal space(lateral to the fold) and a medial incudal space. The entrance into Prussak's space is between lateral malleolar fold and lateral

incudal fold. The latter fold would arrest the passage of cholesteatoma through a posterosuperior retaction pocket into the attic.

THE INFERIOR INCUDAL SPACE

Bounded superiorly by the lateral incudal fold, medially by the posterior malleolar foldand anteriorly by the interosseus fold, which lie between the long process of incus and upper 2/3rd of handle of malleus.

THE ANTERIOR POUCH OF VON TROLTSCH

Between the anterior malleolar fold and that portion of tympanic membrane anterior to the handle of malleus.

THE POSTERIOR POUCH OF VON TROLTSCH

Between posterior malleolar fold and that portion of tympanic membrane posterior to the handle of malleus.

PRUSSACK'S SPACE

Small space lying between pars flaccida laterally and the neck of malleus medially.it is bounded below by the short process of malleus and

above by the lateral malleolar fold. Cholesteatoma may extend from Prussack's space under the lateral incudal fold into the posterior mesotympanum.

The mucosal folds limit the spread of infection into adjacent compartments of middle ear thus preserving the integrity and function of adjacent structures.

Cholesteatoma from Prussack's space can spread in 3 directions.

POSTERIOR ROUTE

Commonest route. There would be extension into superior incudal space lateral to the body of incus in the posterolateral portion of the attic and then through the aditus into the mastoid.

INFERIOR ROUTE

Occurs via the inferior incudal space or posterior pouch of Von Troltsch into the posterior mesotympanum. Then spread occurs into the region of stapes, round window, sinus tympani and facial recess.

ANTERIOR ROUTE

Less common. Extension anterior to the head of malleus leads to involvement of anterior epitympanum and supratubal recess.

MASTOID ANTRUM, ADITUS AD ANTRUM AND AIR CELLS

The mastoid antrum and its air cells lie within the petrous part of temporal bone.

The roof of the mastoid antrum and air cells are related to the middle cranial fossa. The medial wall is related to the posterior cranial fossa. The posterior belly of digastric muscle forms a groove in the base of the mastoid bone. The corresponding ridge inside the mastoid lies lateral to the sigmoid sinus and the facial nerve and serves as a useful landmark to find the nerve itself. The periosteum of the digastric groove on the undersurface of the mastoid bone continues anteriorly and part of it becomes the endosteum of the tylomastoid foramen and subsequently of the facial nerve canal.

The outer wall of the mastoid lies just below the skin and easily palpable behind the pinna. Suprameatal triangle (MacEwans triangle) formed by

posterior prolongation of the line of the zygomatic arch and a tangent to this that passes through the posterior border of the external auditory meatus. The mastoid antrum lies 15mm deep to this triangle.

ADITUS AD ANTRUM

Narrow communicating passage from the epitympanum into the mastoid antrum. The horizontal semicircular canal lies between its medial wall and the floor and the short process of incus lies on its floor. The facial nerve lies on a plane below and deep to the opening of the aditus fom the attic.

MASTOID AIR CELLS

Classified into following groups

- Zygomatic
- Tegmen
- Sinodural angle
- Marginal: behind the sigmoid sinus
- Perisinus
- Periantral

- Retrofacial
- Perilabyrinthine
- Supralabyrinthine, infralabyrinthine and retrolabyrinthine
- Tip
- Peritubal

Radiological evidence of pneumatisation is usually not preent till the age of 3 years

FACIAL NERVE

Nerve of the second branchial arch. The intratemporal portion of facial nerve divided into

-labyrinthine portion

- tympanic portion

- mastoid portion

Facial nerve is a mixed nerve containing motor, sensory and parasympathetic fibres.

The facial nerve enters the temporal bone through the porus acousticus and internal auditory canal with the cochlear nerve, the nervus intermedius, and the internal auditory artery artery and veins; all these being ensheathed in a prolongation of the subarachnoid space with its meninges.

At the fundus of the internal auditory meatus, it enters the bony Fallopian canal(the labyrinthine portion ; the narrowest part of facial canal, 0.7mm in diameter at the site of entry) . on reaching the medial wall of the epitympanic recess, it bend sharply backwards above the promontory. This point is the first genu where it is marked by the geniculate ganglion.

From the geniculate ganglion, it runs posteriorly and slightly inferiorly in the medial wall of the tympanum forming the tympanic portion of the nerve. The anterior limit of this segment being formed by the processus cochleariformis with its emerging tensor tympani tendon, a valuable landmark.

In the bony floor of the aditus , the facial nerve make a gradual bend, the second genu, turning inferiorly 1 or 2 mm behind the pyramid to the commencement of the mastoid segment.

BRANCHES OF FACIAL NERVE

-greater superficial petroal nerve : comes off at the geniculate ganglion

- nerve to stapedius arises opposite the pyramidal eminenceon the posterior wall of the mesotympanum.

- the chorda tympani nerve; usually arises 6 mm from the stylomastoid foramen, but highly variable ; it may be anywhere from 1-2 mm below the nerve to stapedius to the stylomastoid foramen.

- the posterior auricular nerve: supplies the occipitofrontalis and external auricular muscles

- branches to the posterior belly of digastric and the stylohyoid muscle; arise close to the stylomastoid foramen

The extratemporal course of the nerve finally gives out a fanwise branching as follows

-zygomatic

- temporal

-buccal

-mandibular

-cervical branch

FACIAL RECESS

Portion of posterior wall , lies between the pyramid , facial nerve and annulus of tympanic membrane. Bounded laterally by the chorda tympani, and the tympanic annulus, and medially by facial nerve. It acts as a window to the middle ear by the posterior tympanotomy approach.

STAPEDIUS MUSCLE

Arises from apex of pyramid and inserted into the stapes.supplied by facial nerve.

THE TENSOR TYMPANI MUSCLE

Arises from the bony canal above the Eustachian tube also from its cartilaginous portion as well as from the greater wing of sphenoid. Then it enters the processus cochleariformis where it takes a turn and gets inserted into the medial aspect of the malleus handle. It is supplied by the mandibular nerve via its branch to medial pterygoid muscle.

THE CHORDA TYMPANI NERVE

It is a branch of facial nerve that supplies the anterior two-thirds of the tongue. It enters the middle ear cavity through the posterior canaliculus and runs across the medial surface of tympanic membrane medial to the handle of malleus and exit the tympanic cavity through the anterior canaliculus which then joins the petrotympanic fissure.

THE MUCOSA OF THE TYMPANIC CAVITY

Consists of mucus secreting respiratory pseudostratified ciliated columnar epithelium. There are three mucociliary pathways

-epitympanic

- promontorial

-hypotympanic

THE EUSTACHIAN TUBE

It is 36 mm in length. It consists of two unequal cones connected at their apices. The lateral 1/3rdis bony while the medial 2/3rd is cartilaginous, its narrowest portion being the isthmus. The nasopharyngeal end of the tube is lined by ciliated respiratory mucoa and towards the tympanic end the number of cilia decrease a well as the number of goblet cell and glands.

THE TYMPANIC PLEXUS

It is formed by the caroticotympanic nerves derived from the sympathetic plexus around the internal carotid artery and the tympanic branch of glossopharyngeal nerve(Jacobson's nerve). It forms a plexus on the promontory and supplies the mucosa of the tympanic cavity.

MUSCLES ATTACHED TO THE EUTACHIAN TUBE

-tensor palati supplied by mandibular nerve

-salpingopharyngeus

- levator veli palatini

The salpingopharyngeus and levator veli palatine derive their blood supply from the pharyngeal plexus.

APPLIED PHSIOLOGY OF MIDDLE EAR

Acoustic signals are transmitted from air of the external environment to the fluid filled inner ear which are of entirely different impedance values. This transfer of sound between two media of very different impedance values is invariably accompanied by a major loss of energy since the sound wave gets reflected from the interface.

The middle ear acts as a transformer which helps to increase the sound pressure at the footplate relative to that at the tympanic membrane. This occurs at the expense of a reduction in the stapes volume velocity relative to that of the velocity of the tympanic membrane volume

The transformer mechanism of middle ear can be divided into

1. That provided by the tympanic membrane
2. That provided by the ossicular lever
3. That provided by the area difference between the tympanic membrane and footplate of the stapes.

CANTENARY LEVER

The curved structure of the head of the tympanic membrane acts as a cantanery lever which when it is stretched , exerts a large force at its point of attachment. As the fibrous annulus is immobile, sound energy applied at the tympanic membrane gets amplified at its central attachment, the malleus.

OSSICULAR LEVER

It refers to the lever action produced due to the different lengths of the malleus and long process of incus around the axis of rotation of the ossicles, which is an imaginary line joining the anterior malleal ligament to the incudal ligament which anchors the short process of incus. This pressure gain as a result of the area ratio and the ossicular lever , can be quantified and measured by the ratio of sound pressure in the vestibule to that of the sound pressure within in the external auditory canal .

AREA RATIO

The SOund pressure that is collected over the large area of the tympanic membrane and transmitted to the smaller stapes footplate area results in an increase in the force that is proportional to the ratio of the area.

CANTANERY LEVER- force acting on TM/ force acting on malleus : 2

Ossicular lever- force acting on malleus/ force acting on stapes : 1.15

AREA RATIO- area of TM/ area of stapes footplate : 21

TOTAL LEVER ADVANTAGE- force acting on stapes footplate/ force acting on the ear drum : 48.3

The theoretical (ideal) middle ear gain is 28 Db, whereas the actual(ie the measured) middle ear gain is about 20 dB . the actual middle ear sound gain is frequency dependent, with a maximum gain of only about 20 dB near 1000 Hz, with lower gains at other frequencies.

BONE CONDUCTION

Occurs when the skull Iis set in vibration by the subject's own voice, by ound waves in the surrounding atmosphere or by a tuning fork applied to the mastoid.

The vibration of the cochlear fluids and the basilar membrane is due to

1. Inertia of the ossicular chain 2
2. Compression effects on the labyrinth due to deformities of the skull
3. Inertia of the mandible , which causes acoustic vibration of the xternal auditory canal

The tensor tympani muscle and stapedius regulate the amount of sound energy incident on the oval window and hence protect the inner ear from very loud sounds.

Even a simple perforation of the tympanic membrane would hamper the conduction of sound waves by interfering with the ‘baffle’ effect of the round window. Similarly middle ear pathological lesions likemucosal edema, granulation tissueosteitis, cholesteatoma and ossicular necrosis would also interfere with the conduction mechanism of the middle ear.

It has been seen that a patient with chronic otitis media does not only presnt with conductive hearing loss, but can also come with senorineural hearing impairment due to diffusion of toxins into the scala tympani through theround window membrane.

PRESSURE EQUALISATION

This is the important function of the Eustachian tube. The Eustachian tube causes pressure equalization between the middle ear and the external environment by the action of the levator palate and tensor palate muscles

which in turn dilate the pharyngeal opening and the cartilaginous end respectively. The Eustachian tube also plays an important role in the mucociliary clearance of middle ear secretions.

So a malfunctioning of the Eustachian tube results in retraction of the tympanic membrane in the early stages due to longstanding negative middle ear pressure. The retained secretions act as a culture medium for recurrent infections and otorrhea.

PERCEPTION OF SOUND

Resting conditions

Perilymph has a chemical composition similar to that of other extracellular fluids and to CSF with minor differences. It is formed as a blood infiltrate within the labyrinth.

Endolymph has high potassium and low sodium levels like intracellular fluids. It is secreted and reabsorbed in the stria vascularis. Circulation of the endolymph is radial through the ductus to the endolymphatic sac.

Dynamic conditions

1. **Hydrodynamic**

   Vibration of the stapes produces flow of perilymph through the scala vestibule, helicotrema, scala tympani to the round window. High frequency sound causes maximal displacement of the basilar membrane at the basal turn while low frequency sounds cause it at the apex of the cochlea.

MECHANISM OF EXCITATION OF THE HAIR CELLS

Vibration of the basilar membrane causes a shearing movement between the tectorial membrane and the reticular lamina. this motion produces the cochlear microphonic.

ELECTRICAL ACTIVITY IN RESPONSE TO ACOUSTIC STIMULATION

Microphonic potentials occur in the cochleawhen acoustic stimulation occurs. They can be analysed into

1. Cochlear microphonic potentials- arise in the vicinity of the hair cells being stimulated
2. Summation potentials- arise from inner hair cells.
3. Action potentials-

LOCALIZATION OF SOUND

The direction from which a sound comes is perceived by correlation within the CNS of differences between the sound patterns on both sides of the head. It occurs by

1. Loudness difference- important for high frequencies
2. Difference in time of reception- for complex sounds
3. Phase difference- for low frequencies

THE VESTIBULAR SYSTEM

It consists of the utricle, saccule and the three semicircular canals oriented at perpendicular planes to each other. The macular receptors in the utricle and saccule are concerned with the linear acceleration and static head position while the semicircular canals sense angular acceleration of the head, these information being subsequently analysed by the brain to maintain balance.

PATHOLOGY OF CHRONIC OTITIS MEDIA

Chronic otiti media is an inflammatory process in the middle ear space that results in long term , permanent changes in the tympanic membrane, including atelectasis, dimer formation, perforation, tympanosclerois, retraction pocket development, or cholesteatoma.

CLASSIFICATION OF CHRONIC OTITIS MEDIA

1. Healed otitis media- thinning and/ or local or generalized opacification of the pars tensa without perforation or retraction
2. Inactive (mucosal) COM ; Perforation- permanent perforation of the pars tensa but the middle ear mucosa is not inflamed

3. Inactive (squamous) COM; retraction-retraction o pars flaccida or pars tensa (usually poterosuperior) which has the potential to become active with retained debris.
4. Active(mucosal) COM; - permanent defect of the pars tensa with an inflamed middle ear mucosa which produces mucopus that may discharge.
5. Active (squamous) COM; Cholesteatoma - retraction of pars flaccida or tena that has retained squamous epithelial debris and is associated with inflammation and the production of pus, often from the adjacent mucosa

PATHOLOGY OF SUBTYPES OF CHRONIC OTITIS MEDIA

1. **INACTIVE MUCOSAL COM(DRY PERFORATION)-** perforation is completely surrounded by remnant of pars tensa. Lamina propria is thickened by fibrous proliferation. Mucocutaneous junction at the margin of the perforation.

2. **ACTIVE MUCOSAL COM(PERFORATION WITH OTORRHEA)-** Chronic inflammation of middle ear mucosa and mastoid with edeme, submucoal fibrosis, hypervascularity, infiltration by lymphocytes, plasma cells and histiocytes. Areas of the mucosa may ulcerate with proliferation of blood vessels, Fibroblasts and inflammatory cells leading to formation of granulation tissue. Mucosal changes may progress and coalesce to form aural polyps. Resorptive osteitis of ossicular chain can occur; the mechanism of which is similar in both active mucosal and active squamous types of COM. A nuber of triggers like infection, inflammation, pressureand keratin leads to elaboration of cytokines likeIL-6, IL-1, TNF, and non-protein mediators like prostaglandins, neurotransmitters and nitric oxide that lead to the recruitment, development and activation of osteoclasts which results in bone resorption.

3. **INACTIVE SQUAMOUS EPITHELIAL COM (RETRACTION, ATELECTASIS AND EPIDERMIZATION) -** occurs due to negative static middle ear pressure. Epidermization is an advanced form of retraction with replacement of middle ear mucosa by keratinizing squamous epithelium without retention of keratin debris.

4. **ACTIVE SQUAMOUS EPITHELIAL COM (CHOLESTEATOMA)-** The hallmark of a cholesteatoma is its retention of keratin debris. Histologically, the squamous epithelial lining or 'matrix' is surrounded by a layer of inflamed, vascular, subepithelial connective tissue.

5. **HEALED COM:**

- Healed perforation
- Tympanosclerosis
- Fibrocystic and fibro osseous sclerosis

COMPLICATIONS OF CHRONIC OTITI MEDIA

1. **INTRATEMPORAL –**

a. Middle ear:

- Facial nerve paralysis
- Ossicular lesions
- Perforation of tympanic membrane

b. Mastoid

- Petrositis
- Reduced pneumatisation
- Coalescent mastoiditis

c. Inner ear

- Labyrinthitis
- Sensorineural hearing loss

d. Extracranial

- Bezold's abscess
- Zygomatic abscess
- Postauricular abscess

INTRACRANIAL

- Extradural abscess
- Subdural abscess
- Brain abscess
- Meningitis
- Lateral sinus thrombophlebitis
- Otitic hydrocephalus

1. EXTRACRANIAL

- Extratemporal: bezold's abscess, subperiosteal abscess
- Intratemporal: mastoiditis, labyrinthitis, sensorineural hearing loss, petrositis, facial paralysis, cholesteatoma, labyrinthine fistula.

RADIOLOGICAL ANATOMY OF TEMPORAL BONE- HRCT

Original plane of sections. The scan angle is chosen such that it covers the temporal bone but avoids the lens of the eye.

Nowadays, the introduction of multidetector spiral CT Scanner has meant that an entire volume of the temporal bone can be visualized by passing the scanner just once in one plane. The data set can be sectioned in virtually any plane.

The plane of the reformatted image is not governed by ease of patient positioning, but by the optimal plane for visualizing a Structures. Since the plane of the final image does not depend on theoriginal scan angle, the scan needs to be performed avoiding the lens of the eye.

The following images detail the anatomy of the temporal bone in various planes of section.

ANALYSIS OF RESULTS

The study conducted at our institute within the specified time period showed the following results.

TABLE 1

Variable	CT scan	Surgery	Cases in agreement	FP	FN	Sensitivity	Specificity	PPV	NPV
Ossicular erosion Malleus handle	4	5	4	0	1	80	100	100	66
Malleus head	3	4	3	0	1	75	100	100	97.9
incus	15	18	15	4	3	83.3	87.5	78.9	93.2

FP-false positive

FN- false negative

PPV-positive predictive value

NPV- negative predictive value

TABLE 2

Variable	CT scan	Surgery	Cases in agreement	FP	FN	Sensitivity	Specificity	PPV	NPV
Facial canal dehiscence	3	9	3	3	6	66.66	92.6	50	86.3
LSCC erosion	1	1	1	3	0	100	93.7	25	0
Mastoid cortex dehiscence	7	9	7	0	2	77.7	100	100	95.3
Cholesteatoma	18	11	11	4	7	61.11	89.7	73.3	83.3
Tegmen erosion	2	1	1	1	0	100	97.9	50	100

FP- false positive

FN- false negative

PPV- positive predictive value

NPV- negative predictive value

LSCC- lateral semicircular canal

TABLE 3

Variable	CTscan	Surgery	Cases in agreement	FP	FN	Sensitivity	Specificity	PPV	NPV
Anat variations									
Korner's septum	2	2	2	0	0	100	100	100	100
High jugular bulb	1	1	1	0	0	100	100	100	100
Ant. Sigm sinus	8	8	8	0	0	100	100	100	100

Anat variations- anatomical variations

Ant. Sigm sinus- anteriorly placed sigmoid sinus

FP- false positive, FN- false negative

PPV- positive predictive value

NPV- negative predictive value

The results of our study conducted on 50 cases of chronic suppurative otitis media at GRH, Madurai between December 2011 and November 2012 at the department of otorhinolaryngology were found to be as given below.

The correlation between high resolution CT temporal bone findings and surgical findings of the following variables were studied over a course of 1 year as mentioned above.

The variables studied were

Ossicular erosion: malleus handle

Malleus head

Incus

Facial canal dehiscence

Lateral semicircular canal erosion

Mastoid cortex dehiscence

Cholesteatoma

Tegmen plate erosion

Anatomical variations : korner's septum

High jugular bulb

Anteriorly lying sigmoid sinus

OSSICULAR EROSION

Malleus handle erosion was found in 4 cases on HRCT scans while surgery revealed the same in 5 patients. . so the sensitivity and specificity of the investigation were 80% and 100% respectively.

Malleus head erosion was seen intraoperatively in 4 cases . CT scans detected it in 4 cases. Such that the sensitivity came to be 75% and specificity of the test being 100% Incus erosion – imaging by HRCT temporal bones showed erosion of incus in 15 cases while the same was seen in 18 cases during surgery. Hence it was found that the sensitivity to detect ossicular erosion of incus was 83.3% and specificity was 87.5%.

As far as ossicular chain disruption on CT temporal bones in cases of chronic suppurative otitis media was concerned, incus erosion was most commonly detected followed by malleus and stapes.

FACIAL CANAL DEHISCENCE

Out of the 50 cases studied, p cases showed facial canal dehiscence during surgery; most of them involving the tympanic segment. HRCT

temporal bones detected the same in only 3 cases. The sensitivity was 66.6% and specificity was found to be 92.6%

LATERAL SEMICIRCULAR CANAL DEHISCENCE

The most common semicircular canal eroded by cholesteatoma is the lateral semicircular canal. 4 cases on CT scan were suggestive of LSCC erosion; intraoperatively only 1 case confirmed the findings. So the sensitivity and specificity of HRCT temporal bones as an imaging tool in patients with chronic suppurative otitis media were 100% and 93.7% respectively.

MASTOID CORTEX DEHISCENCE

The sensitivity of HRCT temporal bones to demonstrate mastoid cortex dehiscence was 77.7% while the specificity was found to be 100%; wherein 9 cases revealed the same during surgery , but CT scans could pick up only 7 of these cases.

CHOLESTEATOMA

A total of 11 cases of cholesteatoma were found on table intraoperatively, while CT scan was suggestive opf cholesteatoma in 18 of

the total 50 cases studied. Hence it was computed that the sensitivity to detect cholesteatoma by HRCT temporal bones was 61.11% while the specificity was 89.7%.

TEGMEN EROSION

A total of 2 cases on CT scan were suggestive of tegmen erosion while only 1 case showed the same intraoperatively. The reults were such that sensitivity was 100% and specificity was 97.9%

ANATOMICAL VARIATIONS

Like korner's septum, forward lying sigmoid sinus and high jugular bulb showed good correlation between HRCT scans and surgical findings in patients with chronic suppurative otitis media.

DISCUSSION

CT scan is a very useful diagnostic tool these days. Slices obtained by CT can be used to understand the complex relationship of anatomical structures. Slices less than 1 mm can be used for detailed examinations. Multislice CT helps to get coronal and sagittal reformatted slices . A CT with good spatial resolution, slice thickness of 2 mm and high quality image reformatting programs helps in better evaluation of inflammatory middle ear pathologies .

The most important advantage of spiral CT in temporal bone imaging is its better delineation of bony structures and the air in the middle ear. In addition assessment of soft tissue components can also be made.

But CT cannot differentiate between cholesteatoma, granulation tissue and neoplastic tissue. Cholesteatoma is better demonstrated on MR images.

Chronic suppurative otitis media can be classified as

- tubotympanic type
- atticoantral type

TUBOTYMPANIC TYPE

Chronic inflammatory condition of the middle ear cleft cofined to Eustachian tube, anteroinferior portion of mesotympanum and hypotympanumdue to unresolved acute suppurative otitis media characterized by intermittent, mucopurulent, non-foul smelling , non blood stained dischargeaggravated by episodes of recurrent upper respiratory tract infection or when water enter the ear.

Pathogenesis is described as below

Bacteria adhere to nasopharyngeal mucosa, enter the Eustachian tube and then multiply in the middle ear.

It presents with symptoms like ear discharge, deafness and pain with fever.

The signs are

Ear discharge

Central perforation in tne pars tensa

Tuning fork tests-

- Rinne's negative
- Weber 's lateralized to the diseased ear
- Absolute bone conduction test : normal

STAGES OF TUBOTYMPANIC DISEASE

Active stage

Quiescent stage - no discharge for 3 to 6 months

Inactive stage - no discharge for more than 6 months

Healed stage - permanently controlled middle ear inflammation

SEQUELAE OF CSOM

Perforation syndrome

Tympanosclerosis

Resolution

Ossicular necrosis

ATTICOANTRAL DISEASE

It is a condition confined to the posterosuperior part of the mesotympanum , attic and antrum associated with bone eroding disease or choleteatoma characterized by thick, purulent, foul smelling, blood tained persistent discharge associated with perforation in pars flaccida or attic.

CHOLESTEATOMA

A sac of keratinizing squamous epithelium containing desquamated epithelium in the middle ear cleft, with bone eroding property , which has lost the self cleaning capacity.

Bone erosion in cholesteatoma is due to pressure necrosis, or elaboration of various enzymes.

SYMPTOMS

Ear discharge- due to osteitis and saprophytic infection. When water enters the ear, the growth and desquamation of keratin is accelerated. This moist keratin is good culture media for bacterial growth and predisposes to secondary bacterial or fungal infection.

- Tinnitus
- Bleeding from granulation or polyps
- Hearing loss
- Earache
- Dizziness

SIGNS

- Foul smelling discharge in external auditory canal
- Attic perforation or marginal perforation
- Retraction pocket in attic
- Cholesteatoma flakes
- Granulation tissue in posterosuperior quadrant of tympanic embrane.
- Aural polyp

TECHNIQUES TO VISUALISE FUNDUS OF RETRACTION POCKET

- Probing with right angled probes
- Toynbee or Valsalva maneuver
- Otoendoscopic examination

IMPORTANCE OF EXAMINATION UNDER MICROSCOPE

To confirm the diagnosis

For suction cleaning

Confirm site and margins of perforation

Examination of attic and retraction pocket

Site of granulation tissue

Secondary acquired cholesteatoma

CT SCAN FINDING IN CHOLESTEATOMA

1.Soft tissue mass with homogenous opacity

2. mass with sharp defined border

3. blunting of scutum

4. erosion of ossicles

5. erosion of lateral wall of attic- normal figure of 8 pattern is lot

6. Erosion of anterior tympanic spine

7. erosion of sigmod sinus plate

8. erosion of posterior superior meatal wall

9. erosion of facial canal

10. erosion of labyrinth

Chronic suppurative otitis media is a very common pathological entity that an otorhinolaryngologist encounters in day to day practice. As far as developing countries like India is concerned it is common in the poor socioeconomic groups and affects almost all age groups especially the economically productive strata .

A chronically discharging ear with an offensive smell can also turn out to be a social stigma which would affect the day to day functioning of an individual especially at his workplace where the patient has to carry out his work.

Apart from the patient being affected socially, in developing nations the affected individuals tend to neglect the disease and ultimately the relentless progression of the pathology over the years would not only result in progressive hearing impairment which is initially conductive in nature then progresses to sensorineural hearing loss. Hence it becomes imperative that chronic suppurative otitis media is effectively diagnosed and managed as the need be.

There are various investigations to be done before deciding the line of management which could be either medical or surgical. They include the baseline blood and urine investigations and various types of imaging modality. In the earlier times X ray mastoid lateral oblique view was the primary radiological investigation that was available and thus used. It could only give an idea about the extent of pneumatisation of the mastoid and a

rough indication about the level of the dural plate and the sinus plate. But it could not evaluate the extent of pathology and the presence of early signs of complications could not be elucidated.

With the passage of time various newer techniques and methods of radiological investigations came into vogue like the computed tomography, magnetic resonance imaging, positron emission tomography, single photon emission tomography.

A thorough evaluation regarding the audiological status of the patient also is essential which is carried out by a pure tone audiometry, acoustic reflexes and further specialized audiological tests if indicated.

Initjially , in cases of uncomplicated otitis media, the patients are treated medically using antibiotics both oral and topical. Most patients respond well to the medical line of management.

Good response to medical management in otitis media is seen in tubotympanic type of otitis media. But if atticoantral disease is the

pathology, then treatment with antibiotic alone would not suffice since the cholesteatoma has bone eroding property which would progress even under antibiotic cover and result in complications. Hence surgery is the modality of management indicated in cholesteatoma.

Hence before subjecting a patient with cholesteatoma for surgery, the location , extent and type of the pathology needs to be delineated , by the available tools and the best that can done for the patient needs to be fulfilled. This is important since complete clearance of the disease needs to be done since cholesteatoma is notorious for its recurrence if residual pathology is left behind.

The study conducted during the 1 year period on 50 patients of chronic suppurative otitis media with and without cholesteatoma to evaluate the correlation of HRCT temporal bone findings with the surgical findings and find out the usefulness of CT scan as a preoperative imaging tool.

HRCT scan were done with 1mm slices in coronal and axial planes and the following variables were studied and it was seen whether they were

seen during surgery also and a data was compiled for the specified variables wherein the specificity and sensitivity of HRCT for each of them was elucidated. The data so compiled was compared with similarly published studies.

We would now have a look at the previously published studies.

Gerami et al conducted a study on the usefulness of CT scan in patients undergoing surgery and the preoperative CT scan findings compared with that of the surgical findings of cholesteatoma, ossicular chain erosion, facial canal dehiscence, tegmen erosion and lateral semicircular canal fistula.

They found that the sensitivity and specificity of detection of cholesteatoma was 65% and 87%. Hence it showed good correlation . their study showed the correlation to be moderate to good for ossicular chain erosion, and it was found to be weak for facial canal dehiscence, tegmen erosion and lateral semicircular canal fistula.

The results of the aforementioned study was tabulated as follows

	Sensitivity	Specificity	Correlation
Ossicular chain erosion	92	54	Moderate to good
Facial canal dehiscence	0	84	Weak
LSCC fistula	0	95	Weak

Chee et al study also was based on correlation between the radiological and intraoperative findings . their findings were as follows

Ossicular erosion	Correlation excellent for malleus and stapes	Correlation good for incus
Ossicular status		Excellent
Anatomical variations		Good
Semicircular canal fistula		Excellent
Tegmen erosion		good
Facial canal dehiscence		poor
Extent and location of disease		good

It was found that incus erosion was more commonly seen than that of malleus and stapes.

Anatomical variations like anteriorly placed sigmoid sinus, high and dehiscent jugular bulb and low lying dura were shown very well in the CT images and proved helpful during surgery to avoid complications.

CT images can be considered suspicious of cholesteatoma when it presents as a well demarcated soft tissue mass associated with bony erosion. In such cases the correlation for cholesteatoma was found to be good.

OSSICULAR STATUS

Showed excellent to good correlation in their study. It was seen that hearing improvement following surgery was better if the stapes suprastructure of the ossicular chain was found to be intact. Hence when a surgeon , on preoperative CT temporal bone images sees that the stapes suprastructure is intact, it gives an indication of a better hearing being likely following surgery.

LABYRINTHINE FISTULA

The study by Chee et al also showed that a true labyrinthine fistula was more likely to be detected on CT temporal bones when both the axial and coronal sections were studied, since partial volume averaging effects give rise to misinterpretation of the images.

TEGMEN EROSION

Was found to be bet visualize on coronal sections. Volume averaging effects affect the detection of tegmen plate erosion as well, thus giving rise to a high number of false positives and false negatives.

FACIAL CANAL DEHISCENCE

It showed a poor radiological correlation with surgical findings. The soft tissue mass in the tympanic cavity interferes with the detection of dehiscence of the adjacent bony Fallopian canal of the facial nerve.

CT scan is a very useful tool especially in the detection of pathological lesion in surgically hidden areas like sinus tympani and facial recess . If the disease process is found to have been involved in these areas it implies that these regions need to be explored during surgery though they are relatively inaccessible ; since residual disease would then linger and ultimately result in recurrence.

Chronic suppurative otitis media, if neglected has the potential to result in life threatening complications. CT scan is a very useful diagnostic

modality to detect even impending complications prior to it becoming frankly apparent and mostly incurable.

The last mentioned study also states that anatomical variations like high and dehiscent jugulr bulb and an anteriorly placed sigmoid sinus seen on preoperative HRCT images gives the surgeon a warning before embarking on surgery so as to be careful not to injure these critical structures which itself may complicate the procedure planned and affect the surgical outcome.

Keeping in view the various studies published, our study showed the following

BONY DESTRUCTION

HRCT temporal bones showed good correlation for ossicular destruction during surgery , as has been the results of most studies; the incus being seen to eroded in more cases than malleus or stapes.

Similarly, our study showed moderate correlation for facial canal dehiscence and tegmen plate erosion and cholesteatoma, good correlation for lateral semicircular canal erosion and excellent correlation for congenital anomaly like Korner's septum and other anatomical variations.

Hence HRCT temporal bones as a preoperative tool demonstrates fine bony details and the extent of the disease process along with minute details about the hidden areas within the tympanic cavity which could not be assessed adequately prior to the advent of high resolution CT temporal bones.

So complete disease clearance has become a reality these days. In addition the better understanding of the temporal bone anatomy with reference to the adjacent critical neurovascular structures results in avoidance of inadvertent complications.

Our study also found CT scan a good tool to assess the extent of disease process so that the surgeon could plan preoperatively itself regarding the best surgical approach for complete exenteration of the

pathology which would ultimately result in better quality of life for the patient.

Nevertheless, there are certain inherent limitations of CT scan like its high cost especially in a setting like our setup where the vast majority of patients constitute the population of the lower socioeconomic strata. And of course the inevitable radiation exposure and its adverse effects. CT temporal bones also cannot give a clear cut differentiation between fluid, mucosal pathology and cholesteatoma.

CONCLUSION

Chronic suppurative otitis media is a disease entity that an otorhinolaryngologist encounters frequently in his day to day practice. HRCT temporal bones is emerging as an imaging tool that would guide the surgeon regarding the extent and location of the pathology in these patients such that the appropriate line of management can be chalked out in the mind of the treating surgeon.

The study conducted at our centre regarding the role of CT temporal bones in patients with CSOM with respect to the variables like ossicular erosion- malleus handle, malleus head, incus; facial canal dehiscence, LSCC erosion, mastoid cortex dehiscence, cholesteatoma, and anatomical variants like Korner's septum, high jugular bulb and forward lying sigmoid sinus were as follows

It showed excellent correlation for anatomical variantions like Korner's septum, anteriorly placed sigmoid sinus; good correlation for ossicular destruction – incus being the most commonly eroded ossicle.

A moderate correlation was seen in cases of diagnosis of cholesteatoma on CT and on table. CT was found to be more accurate in detection of atticoantral pathology when there were associated changes of bony destruction.

CT temporal bones was not found to be so reliable for predicting facial canal dehiscence and lateral semicircular canal dehiscence due to the partial averaging effects of the imaging modality.

HRCT temporal bones is a useful preoperative tool in patients who present with chronic suppurative otitis media due to

-Its ability to demonstrate fine bony details

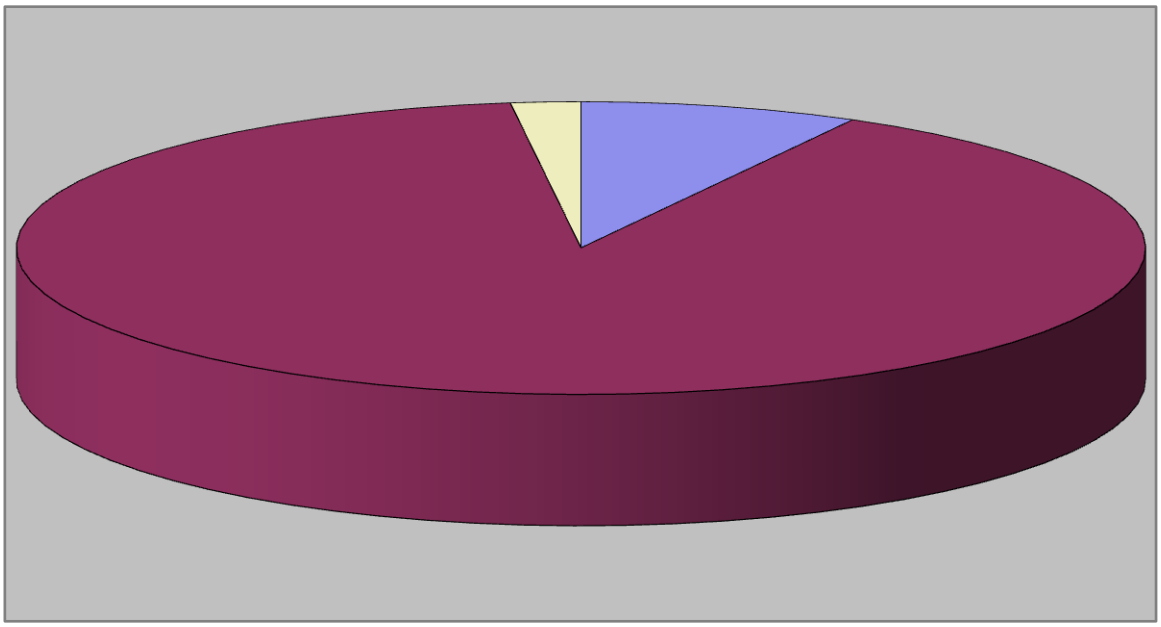
- delineation of important adjacent anatomical structures and avoid inadvertent injury.

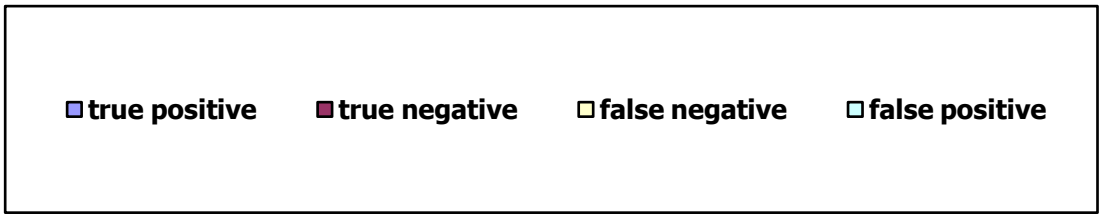
- plan the surgical approach

- detect complications

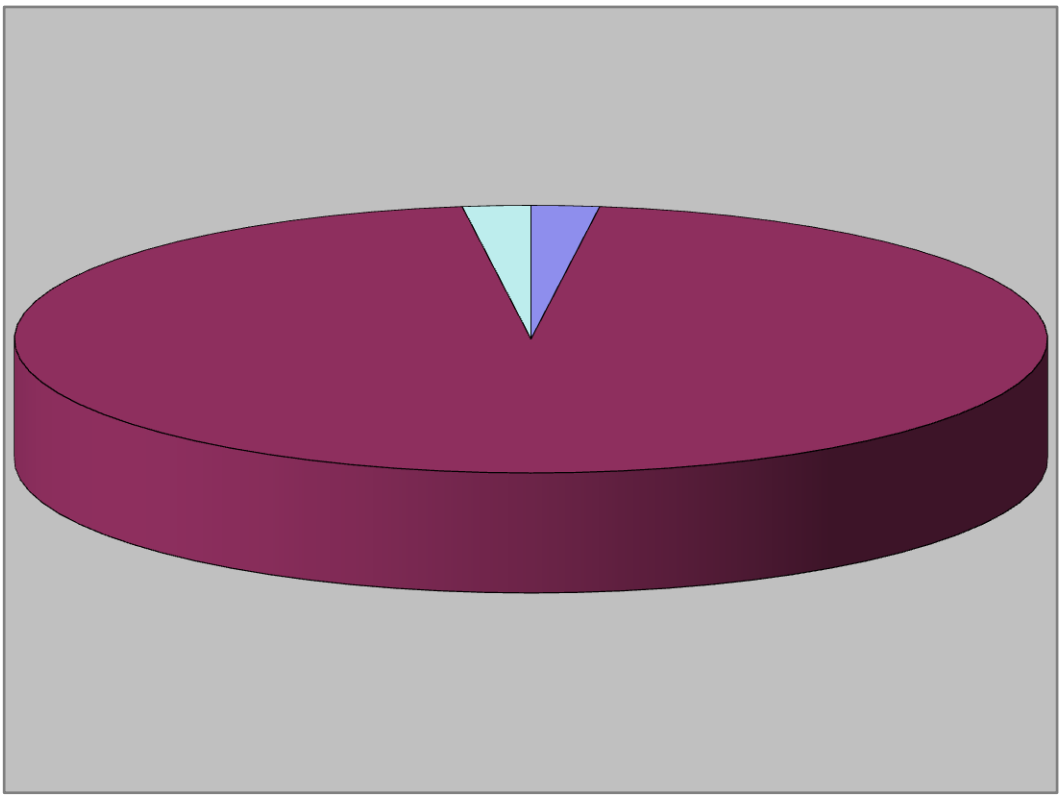
- aids in good and effective surgical clearance.

OSSICULAR EROSION- MALLEUS HANDLE
True negative- 45
False negative-1
True positive-4
False positive-0



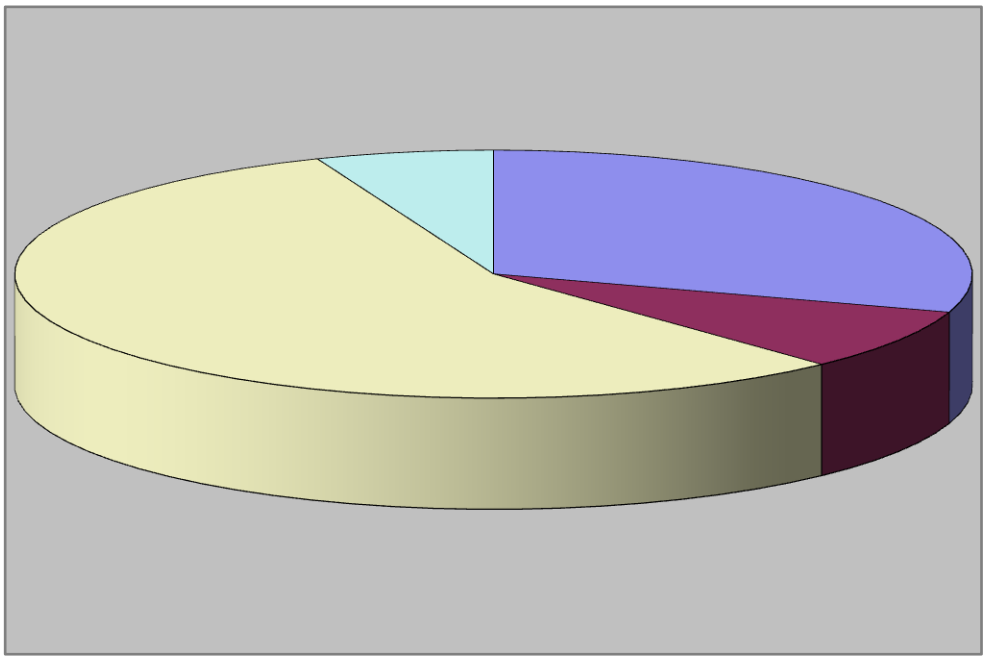


OSSICULAR EROSION- MALLEUS HEAD
True negative-45
False negative- 1
True positive-3
False positive- 0

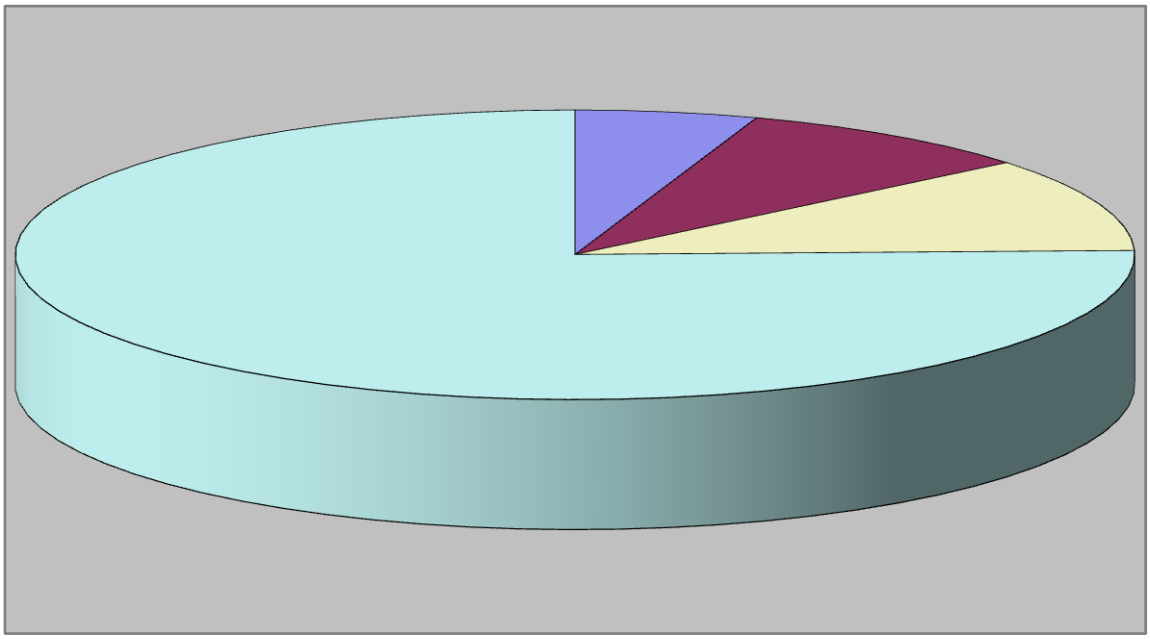


FALSE NEGATIVE TRUE NEGATIVE FALSE POSITIVE FALSE NEGATIVE

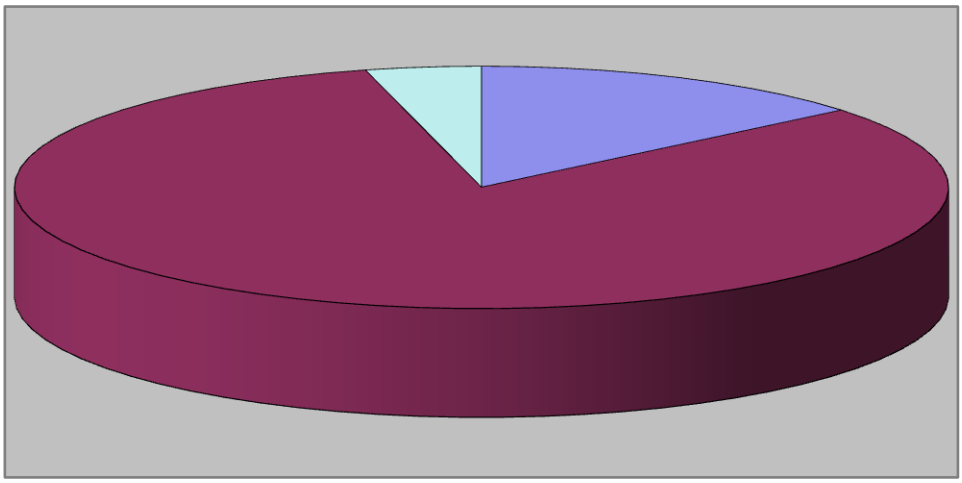
OSSICULAR EROSION- INCUS
True positive- 15
True negative-28
False positive-4
False negative- 3

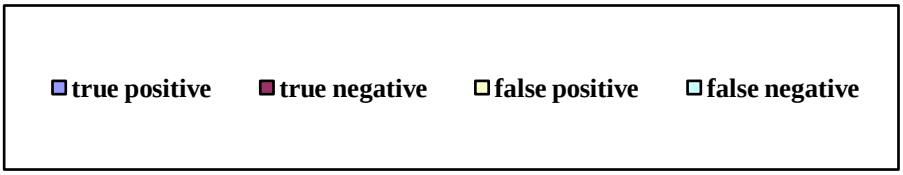


FACIAL CANAL DEHISCENCE
True positive- 3
False positive-5
False negative- 6
True negative-43

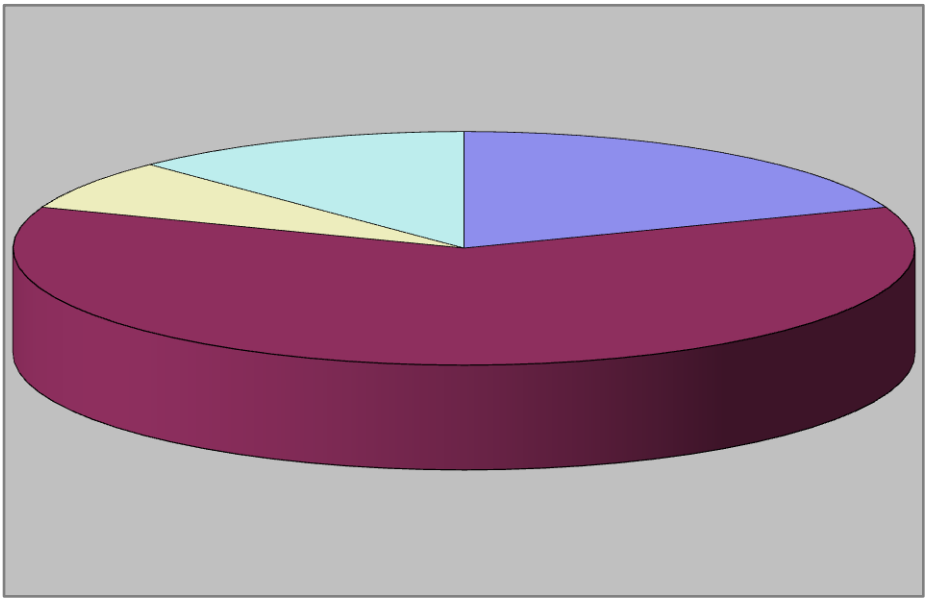


MASTOID CORTEX DEHISCENCE
True positive- 7
False positive- 0
True negative-41
False negative-2

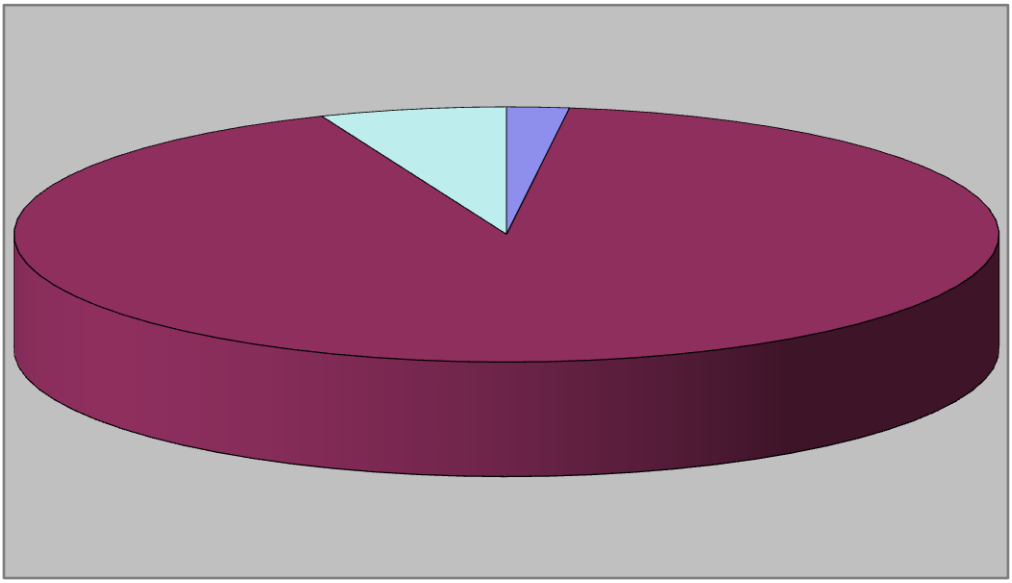




CHOLESTEATOMA
True positive- 11
False positive-4
True negative-35
False negative-7



LATERAL SEMICIRCULAR CANAL EROSION
True positive-1
False positive- 3
False negative- 0
True negative-45



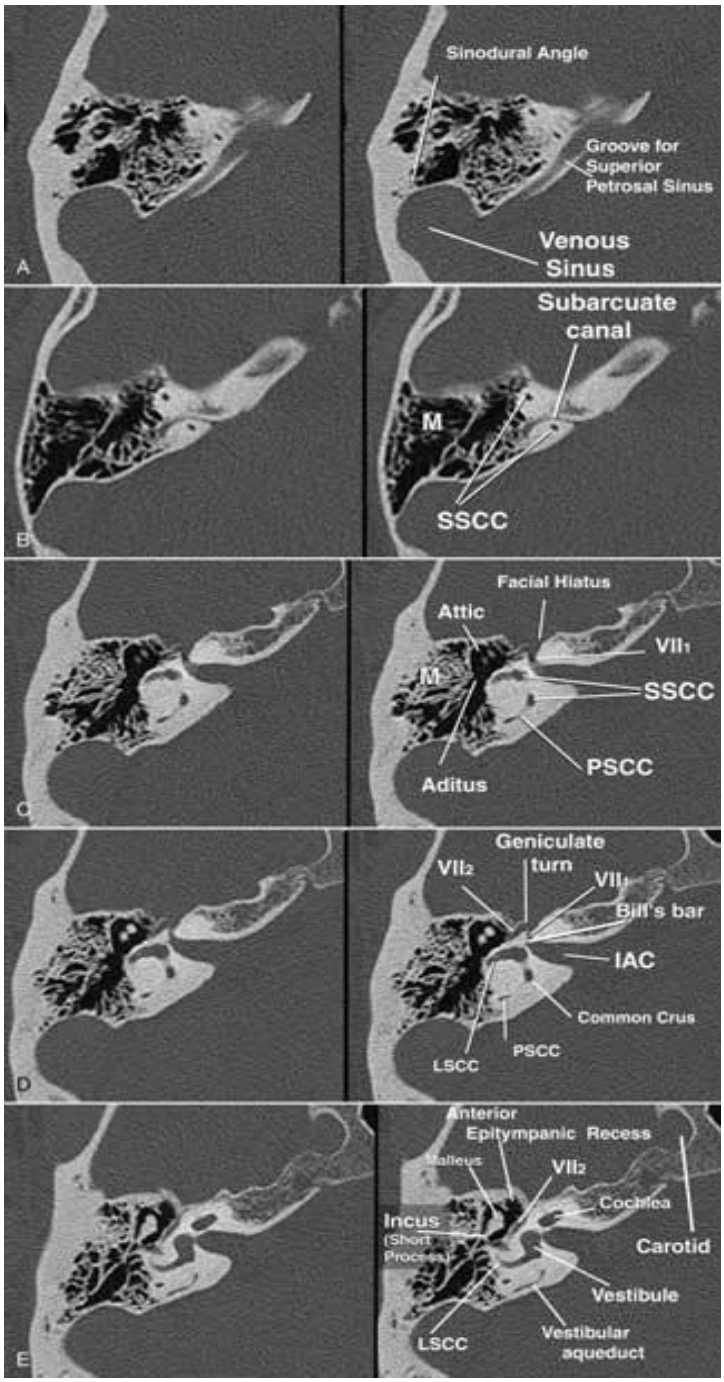


FIGURE 1 HRCT TEMPORAL BONES

Axial images taken from superior to inferior sections

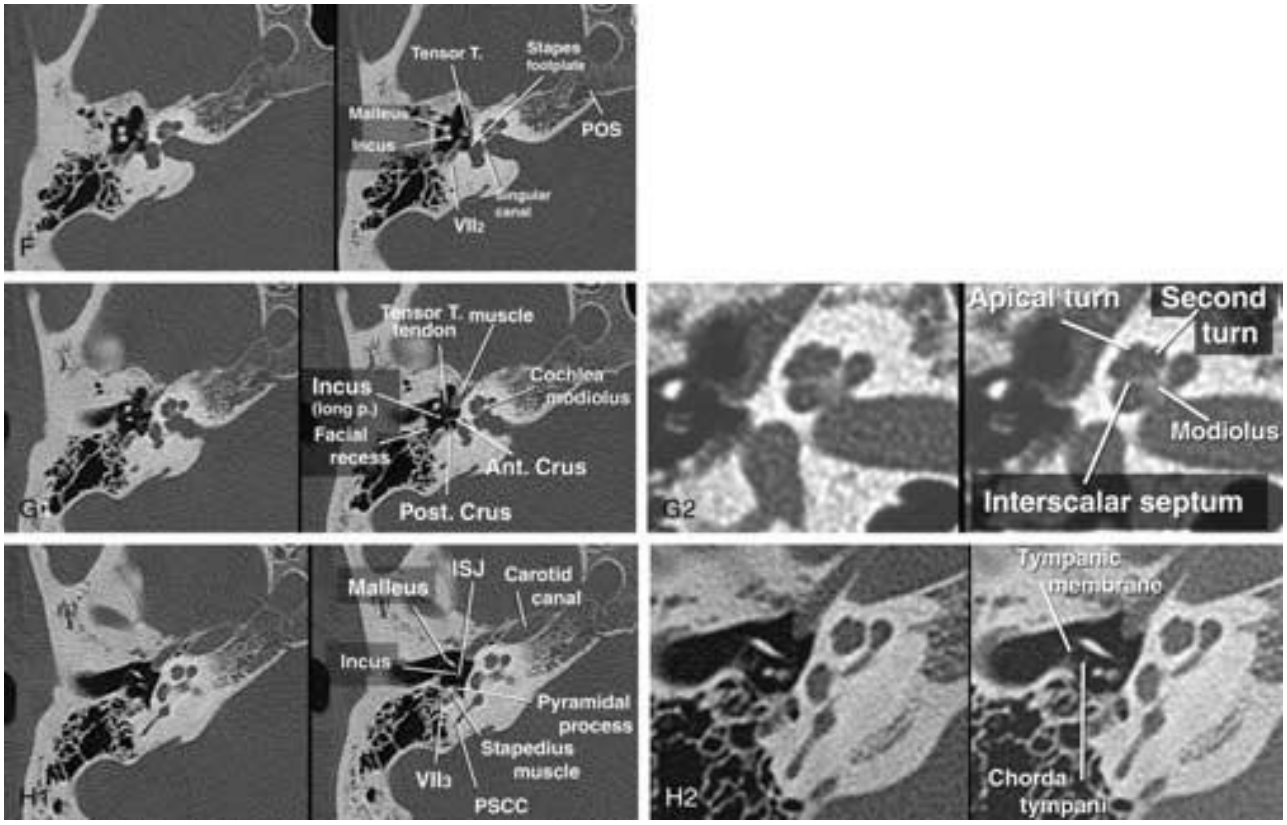


FIGURE 2

AXIAL IMAGES

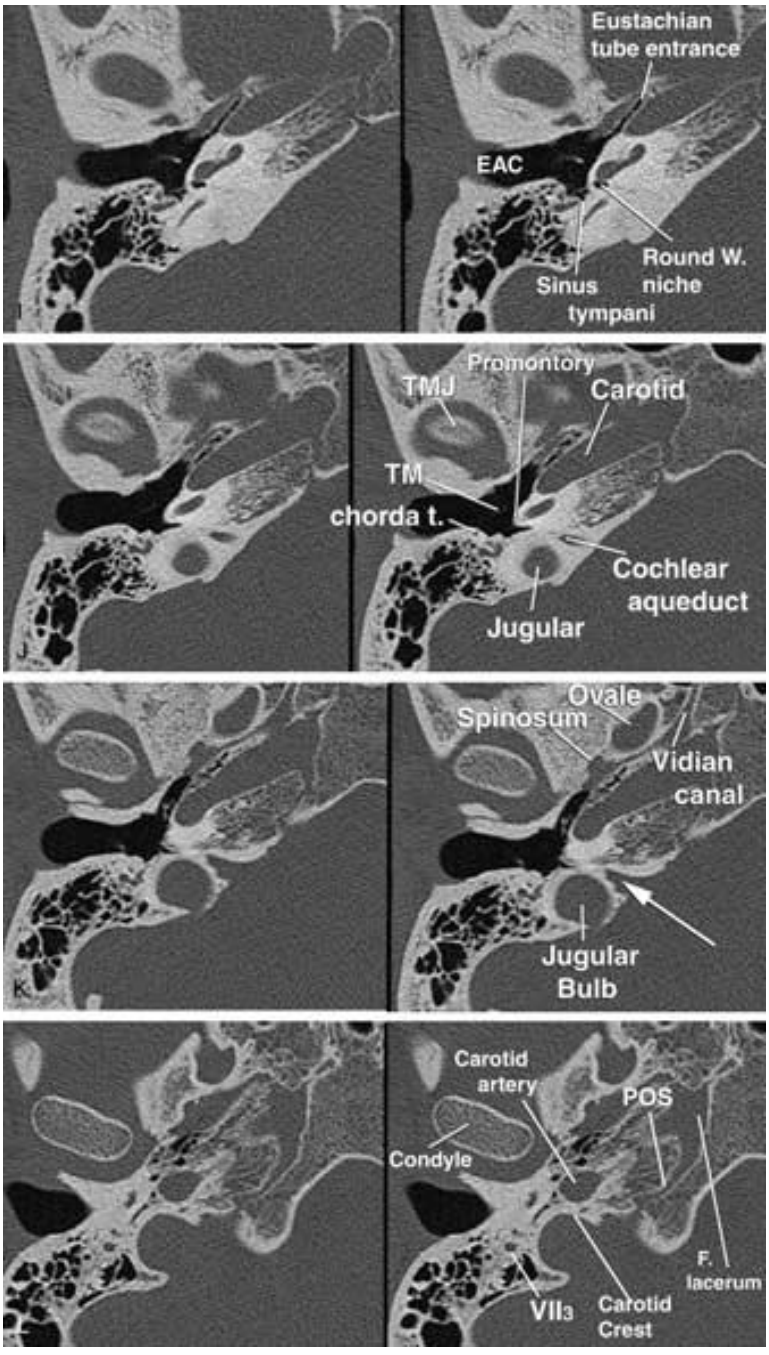


FIGURE 3

AXIAL IMAGES

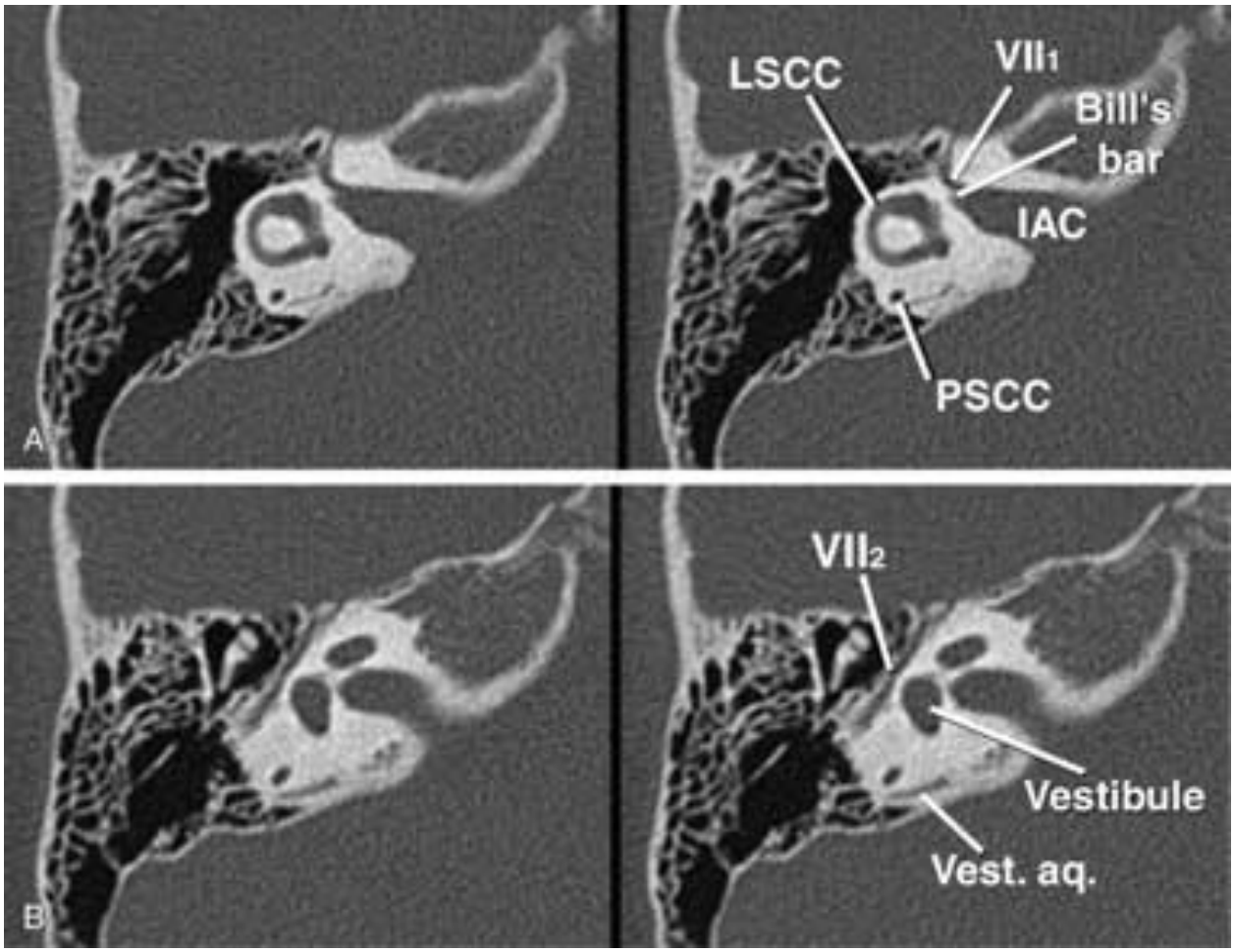
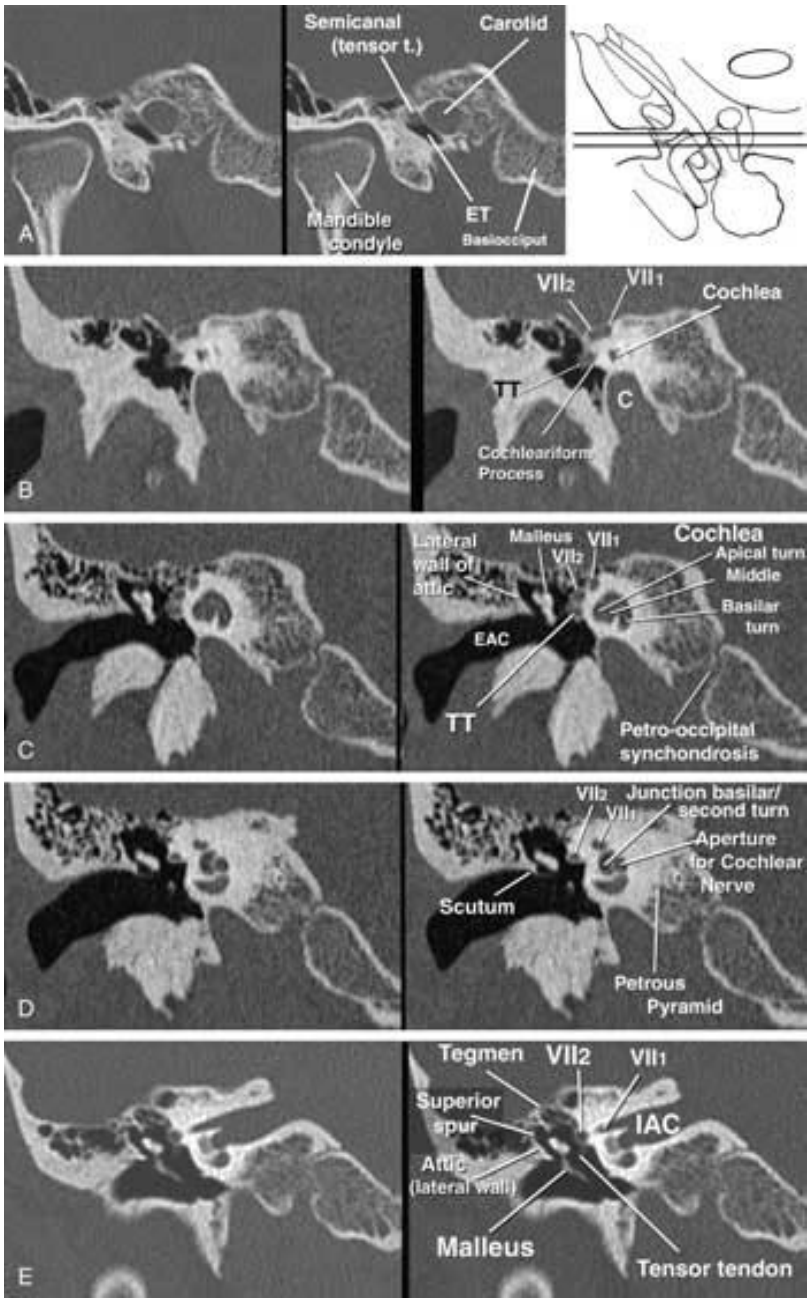
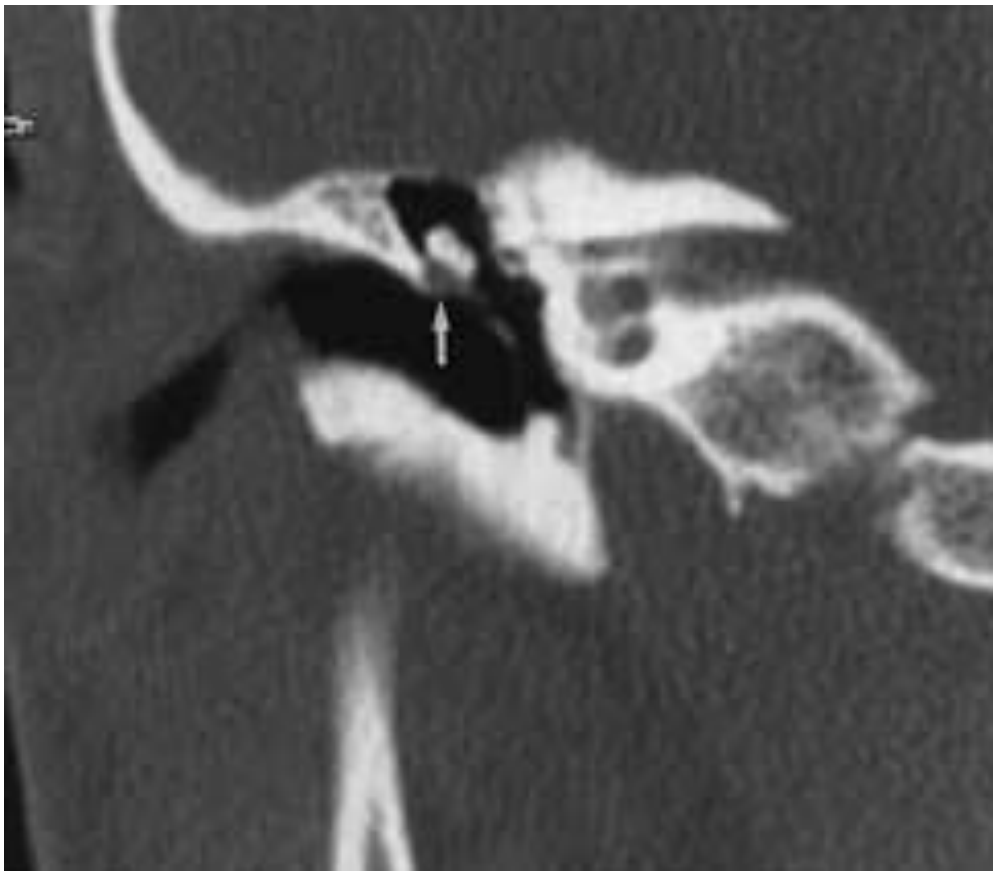


FIGURE 4 Axial section reformatted parallel to the lateral semicircular canal.

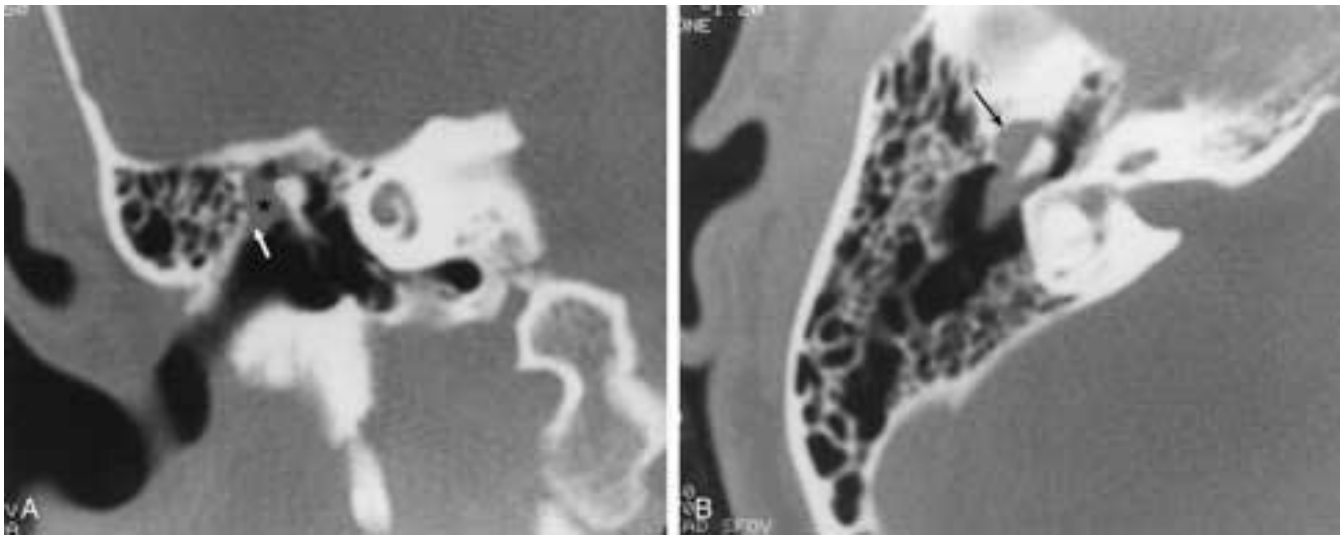


Coronal plane images through the temporal bone from anteriorly to posteriorly

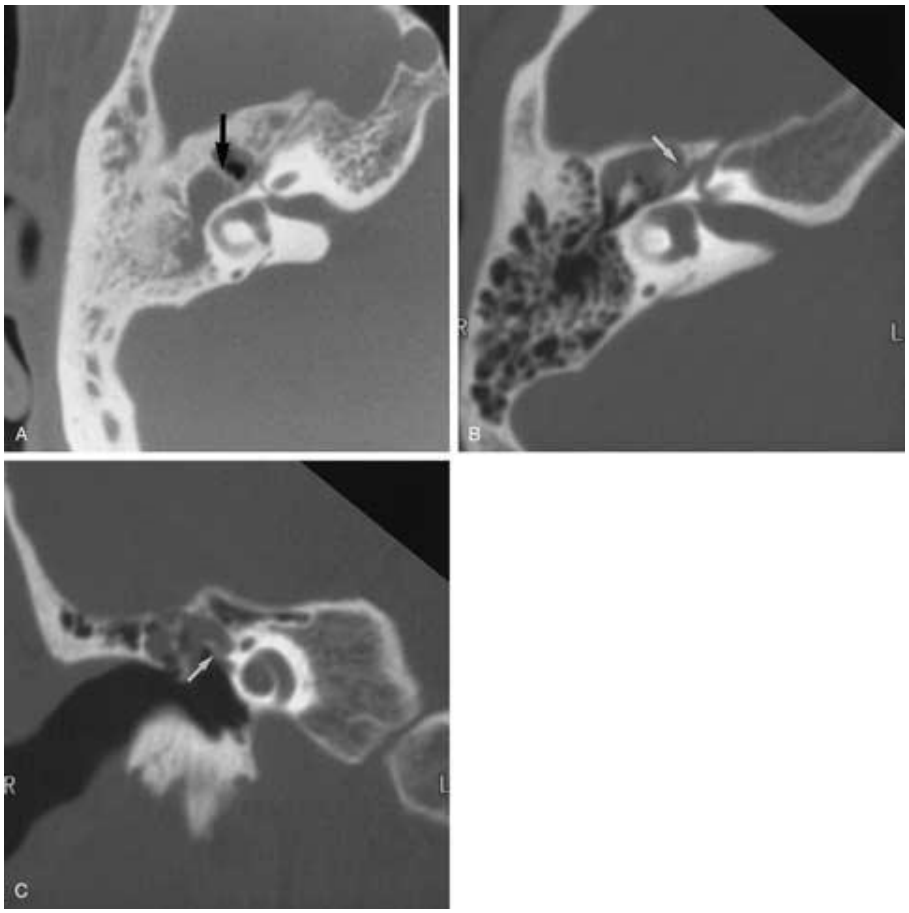
RADIOLOGICAL FINDINGS ON HRCT TEMPORAL BONES IN CHRONIC OTITIS MEDIA



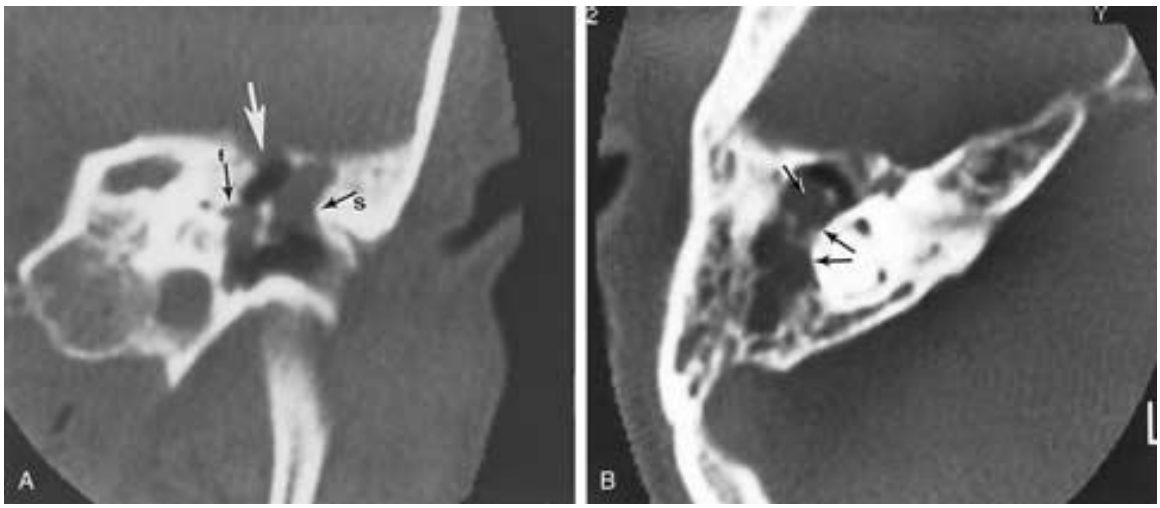
Pars flaccida retraction pocket with small cholesteatoma



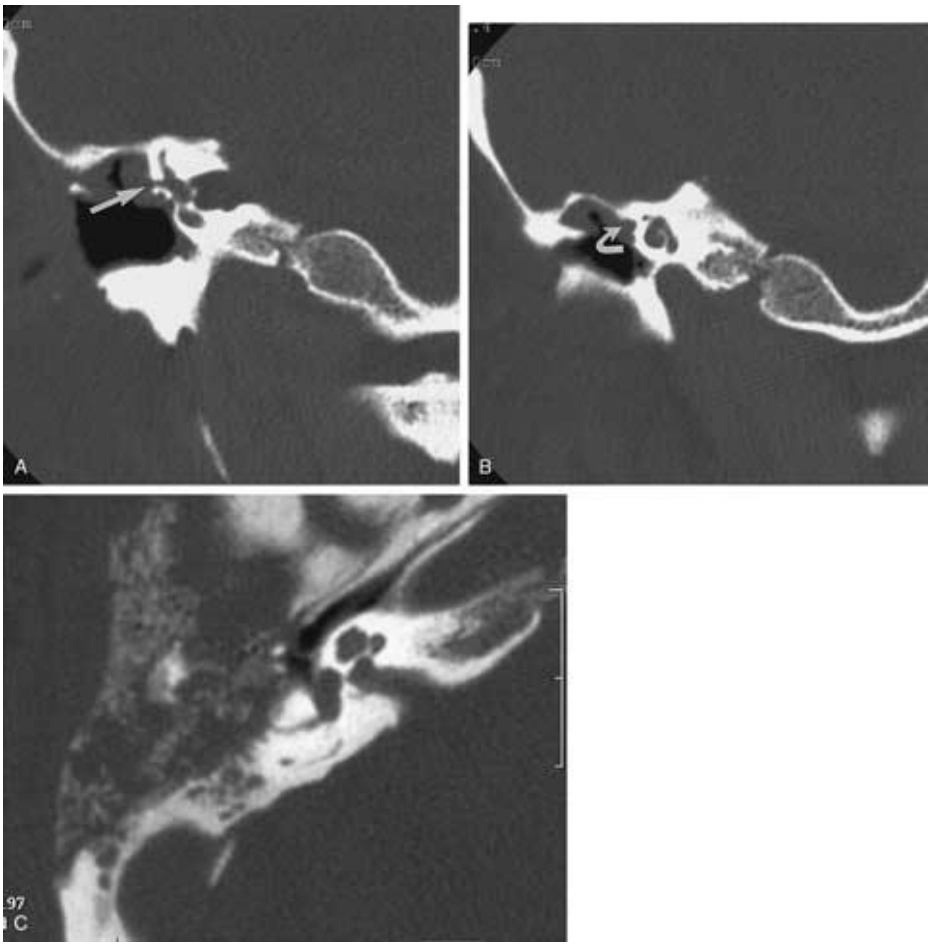
ACQUIRED CHOLESTEATOMA, PRUSSAK'S SPACE. A, Coronal CT image demonstrates a soft-tissue mass (*asterisk*) interposed between the lateral attic wall and the malleus head with blunted scutum (*arrow*). B. Axial CT image demonstrates a soft-tissue mass Extending posteriorly through the aditus into the mastoid antrum.



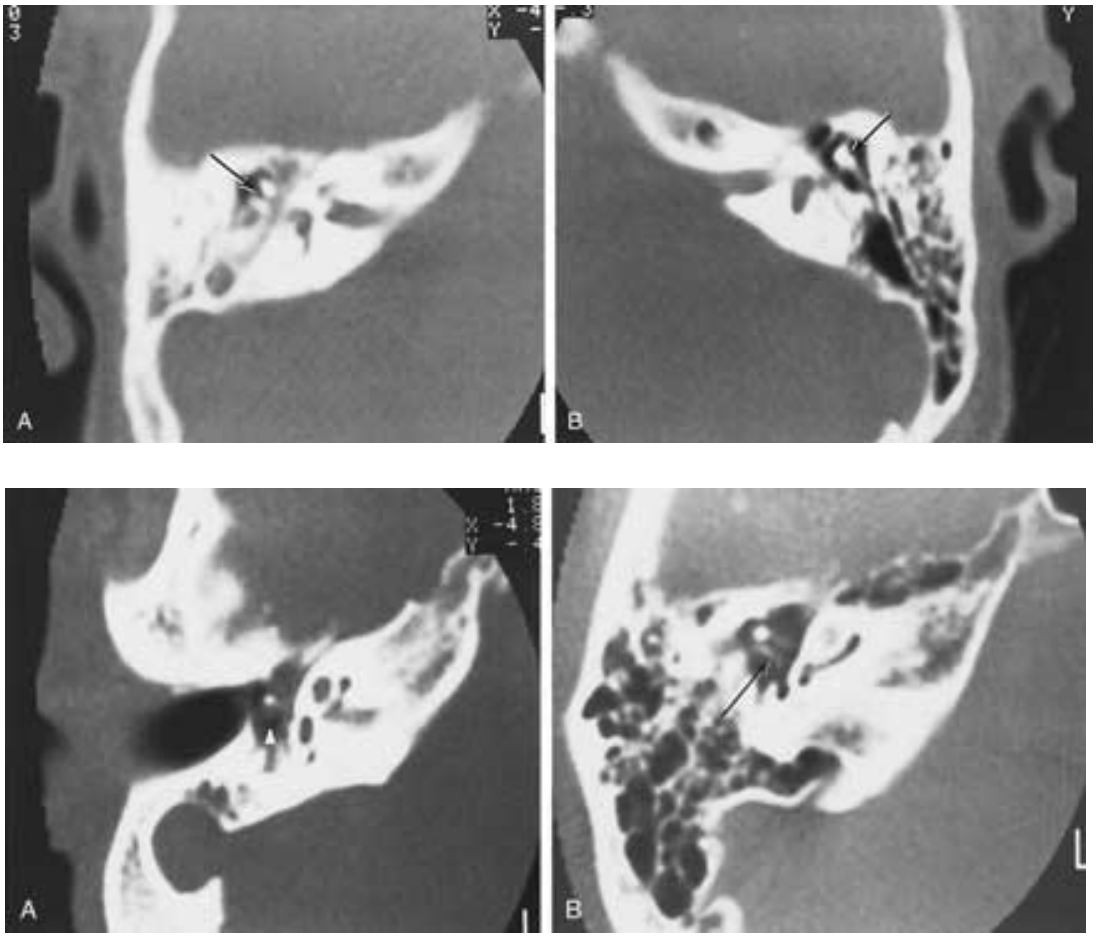
CHOLESTEATOMA. A, Cholesteatoma with erosion of ossicles but sparing of the anterior epitympanic recess, which is protected by an intact ‘‘cog’’ (*arrow*). Second case (B) (axial) and (coronal CT) (C). Cholesteatoma in the anterior epitympanic recess (supratubal recess), with involvement of the proximal tympanic facial nerve canal (*arrow*).



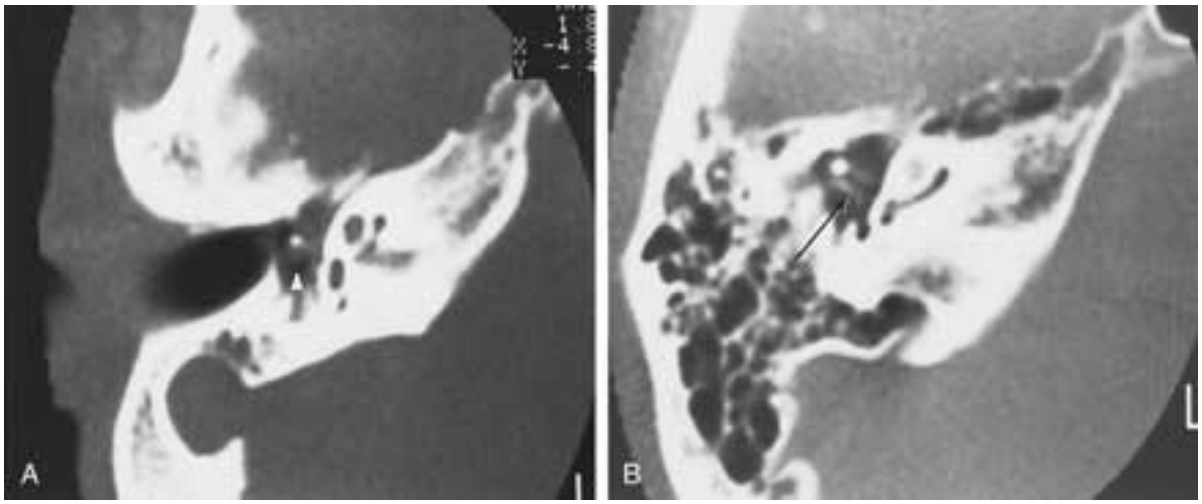
AGGRESSIVE ACQUIRED CHOLESTEATOMA. A, Coronal image demonstrates a mass displacing the malleus head medially with erosion of the scutum (*S, arrow*). This image also demonstrates a tegmen defect (*white arrow*). The mass has extended medially and is in direct apposition to the proximal tympanic segment of the facial nerve canal (*f, arrow*). B, Axial image demonstrates that the ossicular mass in the attic essentially has been destroyed (*single arrow*). The lateral semicircular canal (*double arrows*) is intact, indicating absence of afistula.



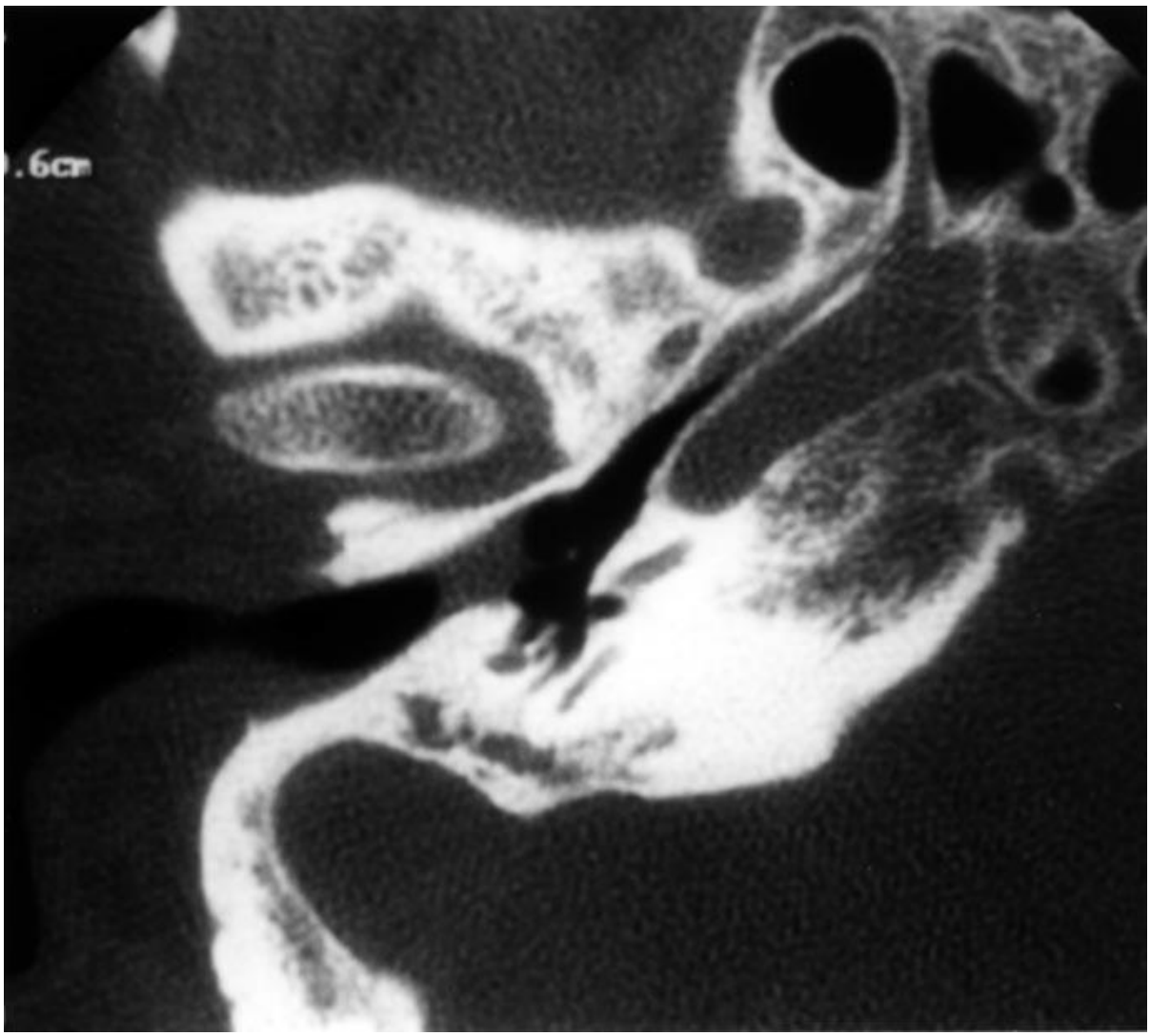
EROSIVE CHOLESTEATOMA. A, Coronal CT image shows a soft-tissue mass eroding the lateral semicircular canal (*arrow*). B, Coronal image demonstrates cholesteatoma invading and expanding the proximal tympanic segment of the facial nerve canal (*curved arrow*). C, Different patient with an extensive erosive cholesteatoma simulating neoplasm



NONCHOLESTEATOMATOUS EROSION. A, There is an erosion of the head of the malleus and body of the incus in the vicinity of the malleoincudal articulation (*arrow*). B, Normal axial section for comparison (malleoincudal articulation indicated) (*arrow*



NONCHOLESTEATOMATOUS EROSION. A, Axial image (right ear) indicates an absent lenticular process (*white arrowhead*). B, Normal patient for comparison (right ear). Normal lenticular process and stapes head are present. The incudostapedial articulation is indicated (*arrow*).



FORWARD LYING SIGMOID SINUS

BIBLIOGRAPHY

1. Galdino E. Vavassori, MD. 'Imaging of Temporal Bone'. Chapter 11, Part 2 in Clinical Evaluation, by Glasscock, Shambaugh, 5th edition, 2003; 227-33.

2. P.D. Phelps.'Imaging and radiology'. Chapter 17 in Basic sciences, Volume 1, Scott Brown's Otolaryngology, 6th Edition, 1997; 1-7.

3. P.D. Phelps.'Radiology of ear'. Chapter 2 in Otology, Volume 3, Scott Brown's Otolaryngology, 6th Edition, 1997; 1-9.

4. Gerald B. Brookes and John B. Booth. 'Diseases of temporal bone'. Chapter 15 in Otology, Volume 3, Scott Brown's Otolaryngology, 6th Edition, 1997; 2.

5. Jackler RK , Dillon WP.'Computed Tomography in suppurative ear disease: a correlation of surgical and radiographic findings'.Laryngoscope.1984 Jun; 94(6):746-52.

6. Maffee MF, Almi k, 'Chronic otomastoiditis: a conceptual understanding of CT findings'.Radiology.1986 Jul; 160(1):193-200.

7. Yamasoba T, Kikuchi S , Takeuchi N , Harada T , Nomura Y.‘CT evaluation of the anterior epitympanic recess-comparison among non-inflammatory ear,chronic otitis media with central perforation and cholesteatoma’. Nippon Jibinkoka Gakkai Kaiho 1991 Feb; 94(2):177-82.

8. Leighton SE, Robson AK ‘The role of CT imaging in the management of Chronic suppurative otitis media’.Clin Otolaryngol Allied Sci.1993 Feb;18(1):23-9.

9. Garber LZ, Dort JC.‘Cholesteatoma: diagnosis and staging by CT scan’.J.Otolaryngol.1994 Apr; 23(2):121-4.

10. Luchikhin LA. ‘Effectiveness of CT of temporal bone in diagnosis of CSOM’. Vestn Otolaryngol.1995 MAY-Jun; (3):31-4.

11. Walshe P, McConn.‘The role of CT in preoperative assessment of CSOM’.Clin Otolaryngol. Allied Sci.2002 Apr; 27(2):95-7.

12. Sandeep Berry, S.C.Gandotra and N.C.Saxena.‘Role of computed tomography in unsafe chronic suppurative otitis media’.Indian journal

Of Otorhinolaryngology and head and neck surgery.1998; 50(2):135-39.

13. Zelikovich EL.'CT temporal bone in diagnosis of otitis media chronica purulenta'.Vestn Otolaryngol.2004 ; (4):25-9

14. Zelikovich EL.'Potentialities of temporal bone CT in the diagnosis of chronic purulent otitis media and its complications'.Vestn Rentgenol Radiol.2004 Jan-Feb; (1):15-22.

15. Wang LE, Gu YF. 'Significance of CT in diagnosis of CSOM'.Zhonghua ErBi Yan HouJing Wai Ke Za Zhi.2007 Jul; 42(7):494-8.

16. Gerami H, Naghavi E 'Comparison of pre-operative computed tomography scan imaging of temporal bone with the intra-operative finding in patient undergoing mastoidectomy'. SaudiMed J.2009 Jan; 30(1):104-8.

17. Firas Q.Alzoubi , Haaitham A.Odat , Hassan A.Al-balas and S.R.Saeed 'The role of preoperative CT scan in patients with chronic

otitis media' European Archives of Oto-rhino-laryngology.2009 Jun; 266(6):807-9.

18. Boyraz E, Erdogan, Boyraz I, Kazikdas C, Etit D, Uluc E. 'The importance of computed tomography examination of temporal bone in detecting tympanosclerosis'.Kulak Burun Bogaz Lhtis Derg 2009 Nov-Dec; 19(6): 294-8.

19. Shim HJ, Choi AY, Yoon SW, Kwon KH, Yeo SG.'The value of measuring ET aeration on temporal bone CT in patients with chronic otitis media' Clin Exp Otorhinolaryngol.2010 Jun; 3(2):59-64.

20. 20.Smyth GDL. Treatment of cholesteatoma. Acat Otorhinolarynol Belg. 1973;25:970–971

21. Dulac GL, Claus E, Barrois J (1973) Otoradiology, *x*-ray bulletin. Agfa Gevaert LTd, 137.

22. Mafee MF, Levin BC, Applebaum EL, Campos M, James CF. Cholesteatoma of the middle ear and mastoid. A comparison of CT scan and operative findings. OCNA. 1988;21(2):265–293.

23. O'Reilly BJ, Chevratton EB, Wylie I, Thakkar C, Butler P, Sathanathan N, Morrison G, Kenyon GS. The Value of CT scanning in chronic Suppurative otitis media. J Laryngol Otol. 1991;105:990
24. Jackler RK, Dillon WP, Schindler RA. Computed tomography in suppurative ear disease: a correlation of surgical and radiographic findings. Laryngoscope. 1984;94:746–25. O'Donoghue GM. Imaging the temporal bone (Editorial) Clin Otolaryngol. 1987;12:157–160. doi: 10.1111/j.1365-2273.1987.tb00181.x.
25. Schwartz JD. High-resolution computed tomography of the middle ear and mastoid. Part I: Normal radioanatomy including normal variations. Radiology. 1983;148(2):449–454.
26. *Lee Sh, Rao KCVG. Cranial computed tomography and MRI. Mac Graw-Hill Book Company, New York 1987:477- 508.*
27. *Littleton JT, Shaffer KA, Callahan WP, Durizch ML. Temporal bone: Comparison of pluridirectional tomography and high resoluton computed tomography. AJR 1981; 137:835-45.*
28. *Shaffer KA, Volz DJ, Haughton VM. Manipulation of CT data for temporal bone imaging. Radiology 1980;137:825- 9.*

29. *Winter J. Edge enhancement of computed tomograms by digital unsharp masking. Radiology 1980;135:234-5.*

30. *Zonneveld FW. The value non-reconstructive multiplanar CT for the evaluation of the petrous bone. Neuroradiology 1983;25:1-10.*

31. *Akan H. Baş ve Boyun Radyolojisi. MN Medikal- Nobel, 2008;2:104.*

32. *Watts S, Flood LM, CliVord K. A systematic approach to interpretation of computed tomography scans prior to surgery of middle ear cholesteatoma. J Laryngol Otol 2000;114:248-53.*

33. *Mafee MF. MRI and CT in the evaluation of acquired and congenital cholesteatomas of the temporal bone. J Otolaryngol 1993;22:239-48.*

34. *O'Donoghue GM, Bates GJ, Anslow P, Rothera MP. The predictive value of high resolution computerized tomography in chronic suppurative ear disease. Clin Otolaryngol 1987;12:89-96.*

35. *Ayache D, Williams MT, Lejeune D, et al. Usefulness of delayed postcontrast magnetic resonance imaging in the detection of residual cholesteatoma after canal wall-up tympanoplasty. Laryngoscope 2005;115:607-10.*

36. *De Foer B, Vercruysse JP, Pouillon M, et al. Value of high-resolution computed tomography and magnetic resonance imaging in the detection of residual cholesteatomas in primary bony obliterated mastoids. Am J Otolaryngol 2007;28:230-34.*

37. *Williams MT, Ayache D, Alberti C, et al. Detection of postoperative residual cholesteatoma with delayed contrast-enhanced MR imaging: initial findings. Eur Radiol 2003; 13:169-74.*

38. *Krestan C, Czerny C, Gstöttner W, Franz P. The role of high-resolution computed tomography (HRCT) and magnetic resonance imaging (MRI) in the diagnosis of preoperative and postoperative complications caused by acquired cholesteatomas. Radiologe 2003;43(3):207-12.*

39. *Swartz JD, Wolfson RJ, Marlow FI, Popky GL. Post inflammatory ossicular fixation: CT analysis with surgical correlation. Radiology 1985;154:697-700.*

40. *Holliday RA. İnflammatory diseases of the temporal bone: evaluation with CT and MRI. Seminars in Ultrasound, CT, MRI 1989;10(3):213-95.*

41. *Swartz JD, Berger AS, Zwillenberg S, Popky GL. Ossicular erosions in the dry ear: CT diagnosis. Radiology 1987;*

Ref. No. 6087 /E4/5/2011

Govt.Rajaji Hospital,Madurai.20.
Dated: 29.01.2012

Institutional Review Board / Independent Ethics Committee.
Dr. A. Edwin Joe, M.D (FM), BL.,
Dean, Madurai Medical College & 2521021 (Secy)
Govt Rajaji Hospital, Madurai 625020.
Convenor
grhethossecy @gmail.com.

Sub: Establishment-Govt. Rajaji Hospital, Madurai-20-
Ethics committee-Meeting Agenda-communicated-regarding.

The next Ethics Committee meeting of the Govt. Rajaji Hospital, Madurai was held at 11.00 Am to 1.00Pm on 08.12.2011 at the Dean Chamber, Govt. Rajaji Hospital, Madurai. The following members of the committee have been attended the meeting.

1. Dr.N.Vijayasankaran,M.ch(Uro.) 094-430-58793 0452-2584397	Sr.Consultant Urologist Madurai Kidney Centre, Sivagangai Road,Madurai	Chairman
2. Dr.P.K. Muthu Kumarasamy, M.D., 9843050911	Professor & H.O.D of Medical Oncology(Retired)	Member Secretary
3. Dr.I.Meena,MD 094-437-74875	Professor of Physiology, Madurai Medical College	Member
4. Dr. S. Thamilarasi, M.D (Pharmacol)	Professor of pharmacology	
5.Dr.Moses K.Daniel MD(Gen.Medicine) 098-421-56066	Professor of Medicine Madurai Medical College	Member
6.Dr.M.Gobinath,MS(Gen.Surgery) 097-871-50040	Professor of Surgery Madurai Medical College	Member
7.Dr.S. Dilshadh, MD(O&G)	Professor of OP&Gyn Madurai Medical College	Member
8.Dr.S.Vadivel Murugan., M.D. 097-871-50040	Professor of Medicine Madurai Medical College	Member
9.Shri.M.Sridher,B.sc.B.L 099-949-07400	Advocate, 623-B,II Floor,East II Cross, K.K.Nagar,Madurai.20.	Member
10.Shri.O.B.D.Bharat,B.sc., 094-437-14162	Businessman Plot No.588, K.K.Nagar,Madurai.20.	Member
11.Shri. S.sivakumar,M.A(Social) Mphil 093-444-84990	Sociologist, Plot No.51 F.F. K.K. Nagar, Madurai.	Member

Sl. No	Name of P.G.	Course	Name of the Project	Remarks
1.	Swomya Raja,	PG, M S (ENT)	Correlation between CT temporal bone findings with that of clinical & operative findings in patients with chronic suppurative otitis media.	Approved

Please note that the investigator should adhere the following: She/He should get a detailed informed consent from the patients/participants and maintain Confidentially.

1. She/He should carry out the work without detrimental to regular activities as well as without extra expenditure to the institution to Government.
2. She/He should inform the institution Ethical Committee in case of any change of study procedure site and investigation or guide.
3. She/He should not deviate for the area of the work for which applied for Ethical clearance.

She/He should inform the IEC immediately, in case of any adverse events pr Serious adverse reactions.

4. She/he should abide to the rules and regulations of the institution.
5. She/He should complete the work within the specific period and apply for if any Extension of time is required She should apply for permission again and do the work.
6. She/He should submit the summary of the work bto the Ethical Committee on Completion of the work.
7. She/He should not claim any funds from the institution while doing the word or on completion.
8. She/He should understand that the members of IEC have the right to monitor the work with prior intimation.

DEAN

To
All the above members and Head of the Departments concerned.
All the Applicants.

PROFORMA

NAME : AGE :
SEX : ADDRESS :
OCCUPATION :
SOCIOECONOMIC STATUS

Date of Admission

Date of Procedure

Date of Discharge

HISTORY:

PRESENTING COMPLAINTS:

1. Ear discharge : Side, Onset, Duration, Amount, Type of discharge, Aggravating / Relieving Factors, Response to treatment
2. Hard of hearing /continuous/ : Side, Acute / Insidious, Degree Progressive Intermittent , Whether handicapping, Family history,
   H/o trauma to ear,
   H/o exposure to loud nice.
3. Earache : Duration, Side, Mild/Server, More on movement of ear / during mastication, Increase during ear discharge or not
4. Giddiness with : Duration, Intermittent / Continuous, Associated posture, H/o intake of ototoxic drugs, Aggravating / relieving factors.
5. Tinnitus : Side, Unilateral / Bilateral, Duration, Sudden / Gradual,

Progression – Severe / Static / Decreasing, Continuous / intermittent/ Pulsatile/ Clicking, Aggravating / Relieving factors.

6. Headache/ vomiting
7. Fever
8. Facial weakness

MENSTRUAL HISTORY

PERSONAL HISTORY:

FAMILY HISTORY :- H/O HOH, H/O Consanguinous marriage

PAST HISTORY :- H/O Previous surgery,
H/O Ototoxic drug intake as in TB.
H/O DM/HTN

EXAMINATION OF EAR:

	R	L
Pinna		
Preauricular area		
Postauricular area		
EAC		
Tympanic Membrane:		
Mastoid tenderness		
Tragal tenderness		
Fistula test		

TUNING FORK TESTS

Rinne’s

Weber’s

ABC

Facial Nerve:

Romberg's:

Examination of Oral Cavity/ Oropharynx / Nose

Palate : Bulge/ Movements of soft palate, postnasal drip, tonsils, posterior pharyngeal wall, Dental hygiene.

SYSTEMIC EXAMINATION

RS

CNS : Higher functions, Cranial Nerves, Sensory, Motor, Reflexes, Gait, Cerebellar System, Speech

CVS

Abdomen

INVESTIGATIONS:

Blood	-	Hb, TC, DC, ESR
Urine	-	Routine, Microscopy
Pus	-	Culture/ Sensitivity

CT Temporal bones :- Axial / Coronal views

Plain / Contrast

SL NO.	NAME	AGE/SEX	IP NO.	DIAGNOSIS	DOA	DOD	DOS	SURGERY	OSS.ER- Mhan		OSS. ER- INCUS		OSS. ER- MH		FCD		LSCC ER		MCD		CHOLEST		TEG ER		KORN SEP		HJB		FLSS	
									CT	SURG	CT	SURG	CT	SURG	CT	SURG	CT	SURG	CT	SURG	CT	SURG	CT	SURG	CT	SURG	CT	SURG	CT	SURG
1	SELVARAJ	23/M	75503	L CSOM+CP	11/24/2011	12/1/2011	11/25/2011	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2	DHANALAKSHMI	38/F	69164	LCSOM+ AAD	12/1/2011	12/9/2011	12/2/2011	MRM+WM	NO	NO	YES	YES	NO	YES	NO	YES	NO	NO	NO	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO
3	CHITRA	40/F	78234	R CSOM+CP	12/6/2011	12/14/2011	12/7/2011	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	YES	YES	N O	NO	NO	NO	NO	NO	NO	NO
4	MALA	40/F	78665	LCSOM+CP	12/8/2011	12/15/2011	12/9/2011	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5	CHELLAMMAL	40/F	5951	R CSOM+ CP	1/5/2012	1/13/2012	1/6/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
6	SHANMUGAM	30/M	2210	RCSOM+ CP	1/10/2012	1/18/2012	1/11/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7	VEERAN	21/M	2762	BL CSOM+ CP	1/12/2012	1/19/2012	1/13/2012	ICWM+SCTYM	NO	NO	NO	NO	NO	NO	NO	NO	N O	NO	YES	YES	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO
8	PETCHI	32/F	4413	BLCSOM+CP	1/19/2012	1/26/2012	2/5/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
9	SUBRAMANIAN	24/M	6192	L CSOM+CP	1/26/2012	2/5/2012	1/27/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
10	VIJAY	23/M	7529	R CSOM+CP	1/31/2012	2/8/2012	2/1/2012	MRM+WM	NO	NO	YES	YES	NO	NO	NO	YES	YES	NO	YES	YES	YES	YES	NO	NO	NO	NO	NO	NO	YES	YES
11	RAJAMANI	65/M	9210	R CSOM+CP	2/3/2012	2/11/2012	2/4/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
12	RAMACHANDRAN	28/M	10252	BL CSOM+ CP	2/12/2012	2/20/2012	2/13/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
13	VILVAIRAJA	20/M	10991	R CSOM+CP	2/14/2012	2/22/2012	2/15/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	N O	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
14	MOHD MYDEEN	24/M	11056	BLCSOM+CP	2/14/2012	2/22/2012	2/15/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
15	SHAMSHAD BEGUM	24/F	12002	R CSOM+CP	2/19/2012	2/27/2012	2/20/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	N O	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
16	JEYASATHYA	25/F	12201	R CSOM+AAD	2/28/2012	3/8/2012	2/29/2012	MRM+WM	YES	YES	YES	YES	NO	NO	NO	YES	NO	NO	YES	YES	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO
17	VELLAISAMY	36/M	13695	R CSOM+CP	2/28/2012	3/8/2012	2/29/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
18	VINOD	24/M	14335	R CSOM+CP	3/1/2012	3/9/2012	3/2/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
19	SENTHIL KUMAR	32/M	15386	R CSOM+ PSRP	3/4/2012	3/12/2012	3/5/2012	MRM+WM	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	NO	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO
20	JYOTHI	34/F	17939	L CSOM+AAD	3/13/2012	3/21/2012	3/14/2012	MRM+WM	NO	NO	YES	YES	NO	NO	NO	N O	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO
21	KRISHNAVENI	63/F	18921	L CSOM+ AAD	3/18/2012	3/26/2012	3/19/2012	MRM+WM	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO	NO	NO	YES	YES
22	DHANAPANDI	31/M	19005	R CSOM+CP	3/20/2012	3/28/2012	3/21/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	N O	NO	NO	NO	NO	NO	YES	YES
23	MANONMANI	24/F	19651	L CSOM+CP	25-3-12`	4/4/2012	3/26/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
24	MURUGANANTHI	18/F	18945	RCSOM+ CP	3/27/2012	4/5/2012	3/28/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
25	SUDHARSHAN	46/M	20546	BLCSOM+CP	3/29/2012	4/7/2012	3/30/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
26	THANGARAJ	27/M	21263	RCSOM+ CP	4/1/2012	4/9/2012	4/2/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
27	SENTHIL KUMAR	31/M	36925	LCSOM+CP	5/31/2012	6/1/2012	6/8/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
28	VAITHEESWARI	24/F	37740	LCSOM+CP	6/3/2012	6/12/2012	6/4/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
29	SURIYAPRABAVATHI	14/F	38350	R CSOM+AAD	6/7/2012	6/15/2012	6/8/2012	MRM+WM	NO	NO	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO
30	UMAR FAROOQ	16/M	39589	BLCSOM+PSRP	6/10/2012	6/18/2012	6/11/2012	L MRM+WM	NO	NO	YES	YES	YES	YES	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
31	MEENAKSHI	30/F	4223	LCSOM+CP	6/11/2012	6/19/2012	6/12/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO
32	THIRUPATHI	18/M	42542	RCSOM+ CP	6/17/2012	6/27/2012	6/18/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO	NO
33	RAJENDRAN	57/M	43271	RCSOM+AUR POLYP	6/19/2012	6/28/2012	6/20/2012	MRM+WM	YES	YES	YES	YES	YES	YES	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
34	SOUNDARRAJAN	19/M	19471	RCSOM+AAD	6/21/2012	6/29/2012	6/22/2012	MRM+WM	YES	NO	YES	YES	NO	NO	YES	YES	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO
35	KAVIYARASU	23/M	44391	RCSOM+CP	6/23/2012	2-7-112	6/25/2012	CM+T 1 TYM	NO	NO	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO
36	CHINNAPONNU	34/F	45135	BLCSOM+CP	6/26/2012	7/4/2012	6/27/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
37	SARADHA	40/F	45712	BLCSOM+CP	6/28/2012	7/6/2012	6/29/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	YES	YES
38	MADHAVAN	25/M	46214	BLCSOM+CP	6/30/2012	7/10/2012	7/2/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO
39	SUGANYA	18/F	49190	LCSOM+AAD	7/13/2012	7/22/2012	7/14/2012	MRM+WM	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
40	MAHENDRAN	23/M	50299	BLCSOM+CP	7/17/2012	7/25/2012	7/18/2012	RCM+T 1TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO
41	JANNATHIN FIRDOUSE	40/F	53027	L CSOM+CP	7/29/2012	8/8/2012	7/30/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
42	MALA	40/F	55454	RCSOM+AAD	8/7/2012	8/15/2012	8/8/2012	MRM+WM	NO	NO	YES	YES	NO	YES	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
43	SHALINI	12/F	49631	L CSOM + CEREBELLAR A	8/12/2012	8/21/2012	8/13/2012	MRM+WM	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES	NO	NO	NO	NO	NO	NO
44	KARUPAYEE	29/F	57638	L CSOM+CP	8/16/2012	8/25/2012	8/17/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
45	THANGAPANDI	18/M	58795	R CSOM+AAD	8/21/2012	8/29/2012	8/22/2012	MRM+WM	NO	NO	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO	NO	NO	YES	YES
46	DURAIVAIRAVAN	37/M	59777	RCSOM	8/26/2012	9/5/2012	8/27/2012	MRM+WM	NO	NO	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
47	MAHALAKSHMI	55/F	54973	RCSOM+ R LMN FACIAL	8/28/2012	9/6/2012	8/29/2012	MRM+ FACIAL NERVE DECOMPRESION	YES	YES	YES	YES	NO	NO	YES	YES	NO	NO	NO	NO	YES	YES	YES	NO	NO	NO	NO	NO	NO	NO
48	MANIKANDAPRABHU	20/M	53681	BLCSOM+CP	8/2/2012	8/11/2012	8/3/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	YES	YES	NO	NO	NO	NO
49	GANESAN	26/M	53728	LCSOM+AAD	7/31/2012	8/9/2012	8/1/2012	MRM+TYPE3 TYMP + WM	NO	NO	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
50	RATHIFA	31/F	54225	LCSOM+CP	8/2/2012	8/11/2012	8/3/2012	CM+T 1 TYM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

KEY TO MASTER CHART

DOA- date of admission

DOS- date of surgery

DOD- date of discharge

OSS ER- ossicular erosion

M Hand- malleus handle

MH- malleus head

FCD- facial canal dehiscence

LSCC ER- lateral semicircular canal erosion

MCD- mastoid cortex dehiscence

CHOLEST- cholesteatoma

TEG ER- tegmen erosion

KORN SEP- korner's septum

HJB- high jugular bulb

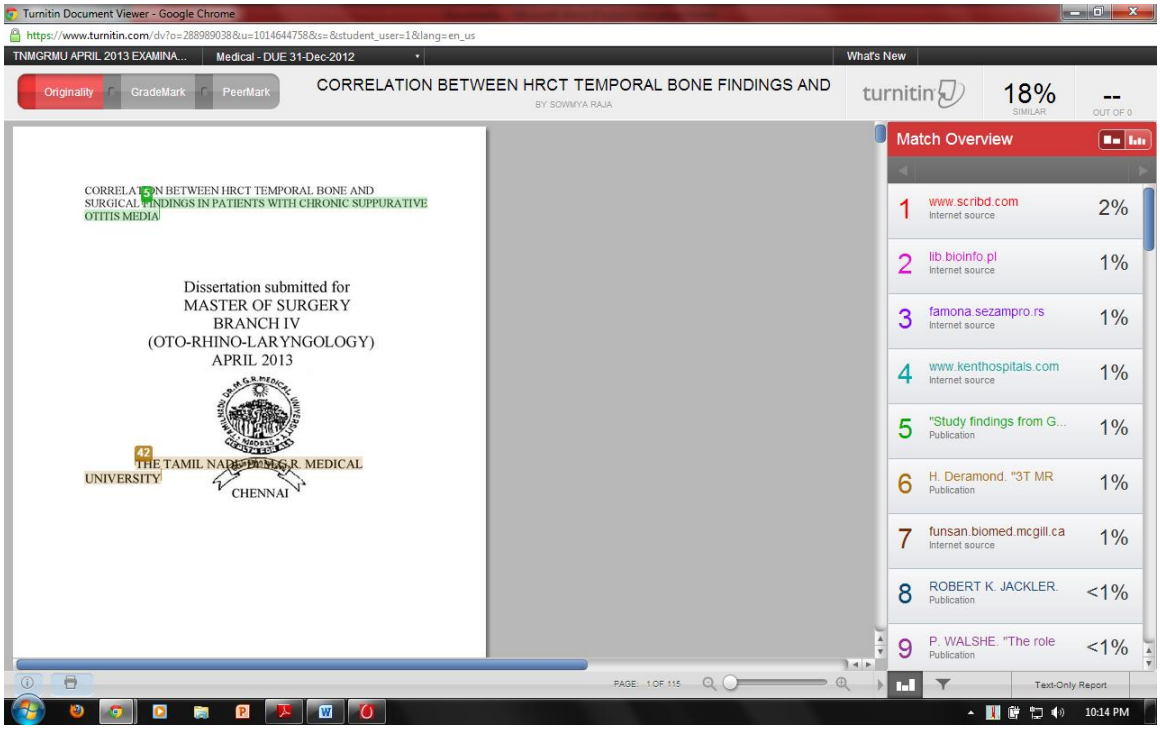
FLSS- forward lying sigmoid sinus

SURG- surgery

CM+ T 1 TYM- Cortical mastoidectomy+ type 1 tympanoplasty

MRM+ WM- modified radical mastoidectomy + wide meatoplasty

T 3 TYM- type 3 tympanoplasty


Turnitin Document Viewer - Google Chrome
https://www.turnitin.com/dv?o=288989038&u=1014644758&s=&student_user=1&lang=en_us
TNMGRMU APRIL 2013 EXAMINA...
Medical - DUE 31-Dec-2012
What's New
Originality
GradeMark
PeerMark
CORRELATION BETWEEN HRCT TEMPORAL BONE FINDINGS AND
BY SOWMYA RAJA
turnitin
18%
SIMILAR
--
OUT OF 0
CORRELATION BETWEEN HRCT TEMPORAL BONE AND SURGICAL FINDINGS IN PATIENTS WITH CHRONIC SUPPURATIVE OTITIS MEDIA
Dissertation submitted for
MASTER OF SURGERY
BRANCH IV
(OTO-RHINO-LARYNGOLOGY)
APRIL 2013
THE TAMIL NADU DR.M.G.R. MEDICAL UNIVERSITY
CHENNAI
Match Overview
1 www.scribd.com Internet source 2%
2 lib.bioinfo.pl Internet source 1%
3 famona.sezampro.rs Internet source 1%
4 www.kenthospitals.com Internet source 1%
5 "Study findings from G... Publication 1%
6 H. Deramond. "3T MR Publication 1%
7 funsan.biomed.mcgill.ca Internet source 1%
8 ROBERT K. JACKLER. Publication <1%
9 P. WALSHE. "The role Publication <1%
PAGE: 1 OF 115
Text-Only Report
10:14 PM

turnitin

Your digital receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

Paper ID	288989038
Paper title	CORRELATION BETWEEN HRCT TEMPORAL BONE FINDINGS AND SURGICAL FINDINGS IN PATIENTS WITH CHRONIC SUPPURATIVE OTITIS MEDIA
Assignment title	Medical
Author	Sowmya raja
E-mail	doc.sow83@gmail.com
Submission time	17-Dec-2012 07:33PM
Total words	13443

First 100 words of your submission

CORRELATION BETWEEN HRCT TEMPORAL BONE AND SURGICAL FINDINGS IN PATIENTS WITH CHRONIC SUPPURATIVE OTITIS MEDIA Dissertation submitted for MASTER OF SURGERY BRANCH IV (OTO-RHINO-LARYNGOLOGY) APRIL 2013 THE TAMIL NADU Dr.M.G.R. MEDICAL UNIVERSITY CHENNAI CERTIFICATE This is to certify that this dissertation entitled " CORRELATION BETWEEN HRCT TEMPORAL BONE FINDINGS AND SURGICAL FINDINGS IN PATIENTS WITH CHRONIC SUPPURATIVE OTITIS MEDIA" presented herewith by Dr. SOWMYA RAJA to the faculty of otorhinolaryngology in the Tamilnadu Dr. MGR Medical University , Chennai, in partial fulfillment of the requirements for the award degree of the Master of Surgery Branch IV (Otorhinolaryngology) April...