

DISSERTATION ON
**“A COMPARATIVE STUDY OF CARTILAGE AND TEMPORALIS
FASCIA IN BILATERAL SIMULTANEOUS MYRINGOPLASTY”**

Dissertation submitted
in partial fulfillment of the regulations
for the award of degree of

**M.S DEGREE BRANCH – IV
OTORHINOLARYNGOLOGY**

of

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



**UPGRADED INSTITUTE OF OTORHINOLARYNGOLOGY
MADRAS MEDICAL COLLEGE
CHENNAI**

APRIL 2013

CERTIFICATE

This is to certify that the dissertation “ **Comparative Study Of Cartilage Versus Temporalis Fascia In Bilateral Simultaneous Myringoplasty** “ submitted by Dr. LAVANYA B.T appearing for M.S. ENT Branch IV Degree examination in April 2013 is a bonafide record of work done by him under my direct guidance and supervision in partial fulfillment of the regulations of the Tamilnadu Dr. M.G.R. Medical University, Chennai. I forward this to the Tamilnadu Dr. M.G.R University , Chennai, Tamilnadu , India.

DIRECTOR & PROFFESOR,
Upgraded Institute of Otorhinolaryngology,
Rajiv Gandhi Govt
General Hospital,
Madras Medical College ,
Chennai 600 003.

DEAN
Madras Medical College,
Rajiv Gandhi General
Hosp,
Chennai 600 003.

ACKNOWLEDGEMENT

At the out set, I would like to express my deep sense of gratitude to **Prof.V. Kanagasabai, M.D .**, The Dean ,Madras Medical College for allowing me to undertake this study with much avidity.

In keeping to the maxim, All is well that ends well , I was able to carry out my study to the fullest satisfaction. I thank the guidance , encouragement , motivation and constant supervision extended to me by my respected teacher **Dr. Prof. A. Muraleedharan , M.S D.L.O.**, The Director & Professor ,Upgraded Institute of Otorhinolaryngology.

I am thankful to **Dr. Prof. G . Gananathan M.S.,D.L.O.** Professor, UIORL for his guidance through out the work.

I express my sincere thanks to **Dr. Prof . R. Muthukumar M.S D.L.O,** **DNB** , Professor, UIORL for guiding me.

I am greatly indebted to **Dr . Prof.G.Selvarajan M.S., D.L.O** , Professor ,UIORL, for his valuable guidance in conducting this study

I am bound by ties of gratitude to **Dr. Prof. M.K. Rajasekar M.S.,D.L.O** , Professor UIORL for helping me complete my study. Simple words cannot express in depth for this contribution.

I express my sincere thanks to all the Assistant professors for their valuable guidance.

I thank the secretary and chair man of the Institutional Ethical Committee, Government General Hospital and Madras Medical College , Chennai.

I thank the audiology technicians of UIORL for their co operation and help in conducting the study.

I thank Mrs. Jeyanthi , Biostatistician .

I would be failing in my duty if I don't place my sincere thanks to those patients who were subjects of my study.

I thank all my friends for their constant encouragement

I am extremely thankful to my family members for their support.

Above all I thank god almighty for his immense blessings.

CONTENTS

SNO	CONTENTS	PAGE NO
1	INTRODUCTION	1
2	REVIEW OF LITERATURE	3
3	MATERIALS AND METHOD	7
4	RESULTS AND ANALYSIS	43
5	DISCUSSION	64
6	LIMITATIONS OF STUDY	73
7	CONCLUSION	74
8	BIBILIOGRAPHY	77
9	ANNEXURES	83

A	PROFORMA
B	MASTER CHART
C	KEY TO MASTER CHART
D	CONSENT FORM
E	ETHICAL COMMITTEE CERTIFICATE

Myringoplasty is technique where the tympanic membrane defect is reconstructed aimed at creating an air filled middle ear cleft , prevent re infections for the external surroundings and help in reconstructing the hearing².

Since the publication of Miodoński, Zollner and Wullstein different methods and grafting materials have been promoted. Temporalis fascia has stood the test of time as an ideal graft material for tympanic membrane reconstruction. The past few years has seen the emergence of cartilage as an alternate or in fact more effective graft material. Various cartilage grafting techniques have been proposed. Palisade graft , island graft , cartilage shield and butter fly graft. This is attributed to its increased stability , resistance to re perforation and retraction. The rigidity of the cartilage raises doubts with regard to its ability to conduct sound. But thin the cartilage may improve sound conduction. It was suggested that cartilage grafts are stable , reliable and post operative hearing results are as good as or even better than the fascia⁸.

In this study I aim to compare the clinical and audiological outcomes of bilateral simultaneous myringoplasty done using cartilage versus bilateral simultaneous myringoplasty using temporalis fascia as graft materials .

REVIEW OF LITERATURE

ANATOMY OF THE MIDDLE EAR CLEFT

The middle ear along with the Eustachian tube and the mastoid air cell system forms the middle ear cleft.

The lateral limit of the cleft is formed by the tympanic membrane.

TYMPANIC MEMBRANE

Is 9 mm in diameter, angled at 55 degrees to the external auditory canal. The fibrous annulus anchors it to the tympanic sulcus. The sulcus does not extend into the notch of rivinus. From the superior limits of the sulcus the malleolar folds run to the lateral process of malleus. This leaves a part of the tympanic membrane above the malleolar folds within the notch of rivinus called the pars flaccida. The pars tensa forms rest of the tympanic membrane and is concave towards the external auditory canal but each segment is slightly convex from the annulus to the centre of the tympanic membrane which is marked by the umbo. Both the pars tensa and flaccid are made up of and mucosal layer, fibrous layer and epithelial layer. In pars tensa the fibrous layer has radially oriented fibres in the outer layers and circular parabolic and transverse fibres in

the deeper layers. In the pars flaccida the fibrous layer is thin and the fibres are randomly oriented¹.

THE OSSICULAR CHAIN

Made up of Malleus , Incus And Stapes. The malleus is the lateral most ossicle. It has a head , manubrium ,neck anterior and lateral process. The incus is the largest of the three ossicles . It has a body , short process ,long process and lenticular process. The body articulates with the head of malleus . The long process runs parallel and posterior to the manubrium. The lenticular process articulates with the stapes. The anterior ligament of malleus with the posterior incudal ligament creates an axis for ossicular rotation. The stapes has head, anterior and posterior crura and a foot plate. The foot plate articulates with the oval window².

MUSCLES :

The two important muscles aiding in sound conduction are the tensor tympani and the stapedius. The former attaches to the neck and manubrium of malleus and tenses the tympanic membrane while the latter attaches to the posterior crura of the stapes and helps to dampen loud sound¹.

THE TYMPANIC CAVITY

Is a sagittally oriented slit that lies medial to the tympanic membrane¹. Its roof is called tegmen serves to separate it from the middle fossa. The floor has jugular bulb. It is continuous with Eustachian tube anteriorly and with the mastoid air cell system via the aditus ad antrum. It is divided into hypotympanum, mesotympanum and epitympanum. Epitympanum or the attic lies above the malleolar folds. The hypotympanum lies below the level of the inferior part of the tympanic sulcus and is continuous with the mesotympanum above. It is limited by inferiorly by the jugular bulb and may extend inferomedial to the cochlea. Anteriorly the mesotympanum is dominated by the canal for tensor tympani, the tympanic orifice of the Eustachian tube is immediately inferior to this. The carotid canal is located medial to the opening of the Eustachian tube. Posteriorly the key structures are the pyramidal eminence for the stapedial tendon and lateral to it the chordal eminence. Facial recess is a groove between the pyramid, facial nerve and the annulus. The medial wall features the sinus tympani, oval window and round window. The sinus tympani is defined by the ponticulus superiorly, the sibiliculum inferiorly the mastoid segment of the facial nerve laterally and posterior semicircular canal medially. The oval window niche is occupied by the stapes foot plate. The round window is found postero inferior to the promontory. Promontory is the bulge created by the basal turn of cochlea. The facial nerve runs above the oval window in the

medial wall of the tympanic cavity turning inferiorly to run along the posterior wall postero inferior to the pyramid.¹

EUSTACHIAN TUBE :

It's size is 17-18 mm at birth and in adults 35 mm . Thus the tympanic orifice is about 15 mm higher than the tympanic orifice. It can be divided into cartilaginous portion anteromedially (24 mm) and a bony portion (11 mm)³ . The action of the tensor palati and levator veli palatine open it . In a normally to produce air flow 200 -300 mm h₂o pressure difference is needed. Expelling air from the middle ear is easier than getting air into it .A middle ear transudate can form if there is a pressure of -30 mm Hg or lower for 15 minutes. For “locking” the tube a pressure differential of 90 mm Hg or greater is needed . This is the "critical pressure difference".A pressure difference of 100 mm Hg or more cause rupture of the tympanic membrane . The tympanic ostium opens at the anterior wall of the tympanic cavity . The ostium diameter is is 3-5 mm. A body of fat called the ostmann pad of fat abuts the lateral aspect of the tube and aids in maintaining the resting closure of the tube³⁸.

THE MUCOSAL LINING OF THE MIDDLE EAR CLEFT :

The Eustachian tube is lined by pseudo stratified ciliated columnar epithelium with several mucous glands. The tympanic cavity is lined by ciliated

columnar epithelium in its anterior and inferior part which changes into cuboidal in the posterior aspect . Epitympanum and mastoid air cells are lined with flattened non ciliated epithelium. The mucous membrane lines the bony walls extends over the ossicles and their supporting ligaments separating the middle ear into spaces and compartments. Three distinct mucociliary clearance pathways can be identified – epitympanic , promontorial and hypotympanic ,the last being the largest. Each of these pathways coalesces at the tympanic orifice of the Eustachian tube.¹

PNEUMATISATION:

There are five recognized regions of pneumatisation , the middle ear, mastoid , perilabyrinthine ,petrous apex and accessory. The mastoid region is subdivided into antrum,central mastoid and peripheral mastoid. The perilabyrinthine region is divided into supra and infra labyrinthine areas. The apical region and peritubal area comprise the petrous apex region . The accessory areas encompasses the zygomatic,squamous , occipital and styloid area. There are 5 recognized air cell tracts ie the posterosuperior tract, posteromedial tract, subarcuate tract perilabyrinthine tract and peritubal tract.⁴

ROLE OF MIDDLE EAR CLEFT IN ACOUSTICS

Sound results when particles of a medium are set into vibration. A sound wave has two basic properties :

INTENSITY - a subjective correlate of loudness

FREQUENCY - a subjective correlate of pitch.

The acoustic signals are transmitted from air of the external environment to fluid filled inner ear. The transmission of sound power at an air fluid interface depends on the relative impedance of air and fluid. The external and middle ear act to better match the sound conducting properties of air and cochlear fluid by increasing the sound pressures that reach the inner ear .¹

The external ear has a significant influence on the sound that reach the middle ear. This acoustic function is called **external ear gain** . It funnels the sound from the external environment into the ear. Sound localization is achieved by two major mechanics : **inter aural time difference and inter aural amplitude difference**. The inter aural time difference is important for low frequency sound localization , whereas the amplitude difference is important for higher frequency sound localization. The difference in amplitude is increased further by the **head shadow effect**. This head shadow effect helps to improve signal to noise ratio in binaural hearing.³

The middle ear couples sound signals from ear canal and sends it to the cochlea via the tympanic membrane and ossicles. The middle ear acts to increase sound pressure at the foot plate relative to that at the tympanic membrane. Thus by acting as an effective transformer it changes the high displacement low pressure vibrations of air into displacements of vibrations high pressure thus driving the cochlear fluid.

OSSICULAR COUPLING

THE AREA RATIO

The entire surface of the tympanic membrane gathers force and then transfers it to the stapes foot plate. Since pressure is force per unit area, and the human tympanic membrane is 20 times larger than the foot plate there is a gain of 20 times or 26 db.

THE OSSICULAR LEVER

This is provided by the different lengths of the rotating incus and malleus arms around the axis of rotation of ossicles. The axis of rotation is an imaginary line joining the anterior malleolar ligament to the incudal ligament that anchor the short process of incus. The ratio of the length of the ossicular arms is 1.3 thus only an approximately 2 db gain in sound pressure.

THUS IDEALLY THERE HAS TO BE AGAIN OF 28DB.

The actual measured gain is less than 28db because

- a) The entire tympanic membrane does not move as a rigid body. For frequencies above 1000 hz it breaks into multiple smaller vibrating segments that vibrate with different phase thus decreasing the efficacy of tympanic membrane as a coupler of sound.

- b) The simple transformer mechanism does not account for the force and pressure needed to stretch the tympanic membrane and ossicular ligaments and accelerate the mass of the middle ear components. Part of the force generated by sound pressure in the external auditory canal is used for this purpose and is thus lost before it reaches the cochlea.
- c) The ossicular system is not a rigid body. A slippage of ossicular system occurs around 1000 to 2000 hz which reduces the motion of stapes relative to that of the manubrium. This slippage is due to translational movement in the rotational axis of the ossicles or flexion in the ossicular system.¹

ACOUSTIC COUPLING

The effective stimulus to the cochlea is the difference in the levels of sound pressure at the oval and round window. The middle ear maximizes this pressure difference. The tympano ossicular system preferentially increases the sound pressure at the oval window. The middle ear has a protective function by providing a cushion of air outside the round window to permit the window to move freely when the inner ear is stimulated. When the stapes foot plate moves in, the round window moves out. It is this coupling of the round and oval windows by the incompressible cochlear fluids that leads to the difference in

sound pressure at the round and oval window causing stimulation of the inner ear⁸. Normally ears the magnitude of the window pressure difference is small (ie) 60db less than ossicular coupling. But in normal ears and following a successful tympanoplasty when the oval window sound pressure is larger due to significant coupling of the ossicles the acoustic coupling offered by the difference in phase of sound pressure at the two windows has a little impact on hearing. It has a role to play only in cases of a compromised tympano ossicular system.⁵

ROLE OF MUSCLES AND OSSICLES

The contraction of the stapedius muscle in response to sound is known as acoustic reflex. This reflex is thought to help in speech discrimination and in protecting inner ear from acoustic trauma of loud continuous sound. Contractions of tensor tympani muscle is associated with opening of the Eustachian tube where the inward movement of the tympanic membrane that results from the contraction produces an increase in pressure in the middle ear and this opens tube. The incudo malleal joint and incudo stapedial joint add flexibility to the ossicular system, which allow the middle ear to with stand large variations in static pressure difference across the tympanic membrane without producing the damage to the ear. The ossicular joints also provide

independent control of the tympanic membrane and stapes motion by the middle ear muscle³

CHRONIC OTITIS MEDIA :

It is defined as chronic irreversible inflammation of the middle ear cleft. The factors that allow acute infections with in the middle ear cleft to develop in to chronic are still unclear.

CHRONIC OTITIS MEDIA(COM):

1. **HEALED COM :** Tympanosclerosis , Healed perforation
2. **MUCOSAL COM - INACTIVE STAGE :** Permanent perforation of the pars tensa. The mucosa not inflamed.
3. **INACTIVE SQUAMOUS COM :** Retractions of the pars tensa (postero-superior) and pars flaccida which has the potential to become inflamed with retained debris.
4. **ACTIVE MUCOSAL COM :** Permanent defects in pars tensa with an inflamed middle ear mucosa which may produce muco pus that may discharge.

5. ACTIVE SQUAMOUS COM : Retraction of the pars flaccid or tensa that has retained squamous debris and is associated with inflammation and production of pus often the adjacent mucosa.

PATHOLOGY OF INACTIVE MUCOSAL COM:

There is a Permanent Perforation of the pars tensa but the middle ear mucosa is not inflamed. The perforation may be central or sub total . The lamina propria around the perforation may be thickened due to fibroblast proliferation. The squamous epithelium in grows towards the inner mucosal layer forming a permanent perforation.

PATHOLOGY OF ACTIVE MUCOSAL COM :

There is chronic inflammation of the middle ear cleft associated with varying degrees of edema , sub mucosal fibrosis , hyper vascularity and inflammatory infiltrate. This may lead to various outcomes like Granulation Tissue , Persistent Muco Purulent Ear Discharge , Aural Polyp. It is also associated with Resorptive Osteitis of the ossicular chain. Some ears demonstrate Cholesterol Granuloma also.

PATHOLOGY OF HEALED MUCOSAL COM:

There may be loss of lamina propria of the tympanic membrane due to atrophy or failure to reform during healing of the tympanic membrane forming a

Dimeric tympanic membrane. There may be hyalinization and calcification of the collagen fibres forming Tympanosclerosis. There may be fibrosis and cyst formation that may obliterate portions of the middle ear cleft. The cystic spaces become lined by mucosal epithelium that has been overrun by proliferating connective tissue leading to Fibro Osseous Sclerosis.³

MYRINGOPLASTY

Myringoplasty is the term used for repair of the tympanic membrane perforations. This is a part of tympanoplasty with ossicular reconstruction or only a repair of the perforation without any work in the tympanic cavity.⁹

HISTORICAL ASPECTS :

1. Banzer (1640) - repair of tympanic membrane with pig's bladder
2. Toynbee (1853) - rubber disc used to repair perforation
3. Roosa (1876) - use of cauterizing agents
4. Blake (1887) - introduced the paper patch test
5. Wullstein & Zollner (1952) - use of split skin graft
6. Zollner (1956) - use of fascia lata
7. Salen & Jenson (1963) - use of cartilage

GRAFT MATERIAL USED:

1. Temporalis fascia
2. Cartilage
3. Perichondrium
4. Periosteum
5. Vein graft
6. Fat
7. Fascia lata
8. Ear canal skin
9. Homograft Duramater
10. Treated acellular dermal homografts

The above mentioned types of tissues are of two categories :

...soft transplant

...hard transplant

Perichondrium and temporalis fascia are soft transplants

Hard transplants are cartilage

The soft transplants are similar the original tympanic membrane in histology and function. But the problem is that these transplants have difficulty in their adaptation and in getting fixed in the area of transplantation. Fixing becomes tedious and time consuming.

The hard transplants are stiff and coarse , working with them is easier ,they have a better adaptation to their position .⁵

INFLUENCING OUTCOMES OF MYRINGOPLASTY :

The final anatomic objective in the myringoplasty is a dry middle ear through an intact tympanic membrane. In the literature, several studies have discussed conditions of the middle ear in the chronic ear disease that in some way may affect the final result in the myringoplasty.

1. The mucosal status of middle ear
2. The stage of COM
3. Perforation size
4. The contra lateral ear
5. Eustachian tube function
6. Mastoid pneumatisation
7. Type of graft material used
8. Type of approach
9. Influence of smoking and systemic illness
10. Revision

MIDDLE EAR RISK INDEX :

RISK FACTOR**RISK VALUE****1.Otorrhea (Belluci) –**

Dry	0
Occasionally wet	1
Persistently wet	2
Wet with cleft	3

2.Perforation

None	0
Present	1

3 Cholesteotoma

None	0
Present	2

4. Ossicular Status (AUSTIN –KARTUSH)

0–M+S+I+	0
----------	---

A-M+S+	1
B-M+S-	2
C-M-S+	3
D-M-S-	4
E-Ossicular head fixation	2
F- Stapes fixation	3

5. Middle Ear Granulation Or Effusion

Yes	0
No	2

6. Previous Surgery

None	0
Staged	1
Revision	2

7. Smoker

Yes	0
No	2

The prognosis is graded as follows :

0 = best prognosis

2 = mild risk

5 = moderate risk

7 = severe risk

12 = worst prognosis

Currently in middle ear surgery cartilage are used to repair perforated eardrum. The tissues are available close to the surgical field and their biological characteristics like fibers amount, fewer number of cells, less consumption of nutrients , oxygen make it an ideal graft material in the initial stage of the process of healing

Non-smokers , a healthy opposite ear, a relatively smaller perforation and an surgeon experience significantly have a positive prognostic influence in a successful myringoplasty .The age of the patient, the length of time the ear had been dry had no influence on the success rate².

ROLE OF THE GRAFT MATERIAL USED

In cases of tubal dysfunction, bilateral disease, adhesions and total perforations. In these cases, the prognosis of hearing is poor. In these patients cartilage has a better prognosis. This is because of its higher mechanical stability. Cartilage has a slow metabolism, resists infection and is stiff, thus making it a reliable graft material.⁴

During the early period of healing the implant immobility is important. Every minimal graft movement during the first days can prove destructive and delays the healing. Cartilaginous grafts have a less tendency to be affected by pressure changes happening in the middle and external ear. To eliminate these movements correct graft size and perfect adaptation is needed. The cartilage edges are firmly fixed in sulcus tympanicus. The entire tympanic membrane replacement needs more extensive work for preparing the bed for the graft. But the stiffness makes working with cartilage easier than with fascia or perichondrium.²

ROLE OF MIDDLE EAR VENTILATION IN SUCCESS OF MYRINGOPLASTY

The Eustachian tube (ET) has a vital role in maintaining aeration of the middle ear normally. Middle ear disease is related to Eustachian Tube problems, and restoration of middle ear function is closely related to Eustachian Tube in chronically diseased ears. Better results are seen in normal

Eustachian Tube function Eustachian Tube problems are associated with higher failure .Thus predicting postoperative outcomes in results hearing improvement and recurrence, and choosing the correct operative methods,can be done if the tubal function can be assessed pre op .In cases of tubal dysfunction better results are seen with cartilage than fascia .

In addition to exchange via the Eustachian Tube middle ear trans mucosal exchange plays a vital role in ventilation and regulating pressure. A diseased mucosa can acts like a barrier to normal exchange of gases and also to leads the Eustachian Tube block directly. In these patients in comparison to patients having normal middle ear mucosa the hearing results are poor. The impairment of mucosal exchange by the inflammatory changes in the middle ear mucosa disturb the passive gas exchange that occurs trans mucosally as the alter the partial pressure gradient between the mucosal capillaries and the middle ear cavity .³⁸

The middle ear mucosa can be graded into 6 types by MIRKO TOS :

- * thin normal looking mucosa
- * thick but dry mucosa
- * thick but moist mucosa ,clinically the ear is relatively dry

- * thickened and edematous with distinct mucous film on the surface – secretory type
- * chronically infected mucosa with edema, granulation ,an irregular surface and severe discharge
- * infected mucosa which is edematous has pulsating secretions but no granulation.⁷

The middle ear mucosal swelling is a poor prognostic sign, as it indicates interference with gas exchange both via the mucosal route and the Eustachian Tube .The normal functioning of the Eustachian Tube leads to better hearing, restores aeration of middle ear , and reduces post-operative complications .Due to its rigidity, cartilage is resistant to retraction and resorption, which offers advantages in cases of abnormalities of the Eustachian Tube or Middle Ear Mucosa.⁶

CARTILAGE MYRINGOPLASTY

INTRODUCTION :

Using cartilage as an alternate source of graft material is gaining world wide acceptance of late specially in cases of high risk perforations like perforations draining at the time of surgery, perforations larger than 50 % size. or bilateral perforations , all of which have been associated with increased

failure rates using traditional techniques. In these cases ,cartilage has proven extremely valuable tympanic membrane reconstruction.

HARVESTING A CARTILAGE

SITES :

The cartilage is typically harvested from two areas :

Tragus

Cymba concha

Other sites include : Eminence of the concha

Eminence of the triangular fossa

Eminence of the scaphoid fossa

The tragal cartilage is flat and sleek and permits complete tympanic membrane reconstruction. The cartilage is used as a graft of full thickness of 1mm.

The cartilage from the cymba area of the conchal bowl is similar to the tragal cartilage in thickness , when compared to the other areas which are thick and irregular. But its curved nature makes creation of an island flap difficult³⁶.

TYPES OF CARTILAGE TYMPANOPLASTY:

Group A: Cartilage tympanoplasty using palisades, strips, and slices. The eardrum is reconstructed by several, various, full-thickness pieces of cartilage with attached perichondrium on the ear canal side.

Group B: Cartilage tympanoplasty with foils, thin plates, and thick plates, not covered with the perichondrium.

Group C: Tympanoplasty with cartilage-perichondrium Composite Island grafts. The perichondrium flap suspends or fixates the cartilage.

Group D: Tympanoplasty with special total pars tensa cartilage-perichondrium composite grafts. All three methods are used to close a total perforation, but differ from each.

Group E: Cartilage-perichondrium Composite Island grafts tympanoplasty for anterior, inferior, and subtotal perforations.

Group F: Special cartilage tympanoplasty methods: The cartilage disc is placed under the perforation: the perichondrium onto the denuded eardrum remnant.

TECHNIQUES:

BUTTER FLY GRAFT :

This technique is described for small perforation . The tragal cartilage graft with intact perichondrium on both sides is harvested . Using a surgical blade, circumferential incision of 2 mm is made creating a groove similar in appearance butterfly wings . The perforation rim is freshened, the cartilage is fixed onto the perforation like a tympanostomy tube.

ISLAND FLAP :

A cut is made through skin and cartilage on the medial aspect and a 2 mm cartilage strip is left behind for cosmetic purpose. Dissect the cartilage with the perichondrial attachment from the overlying skin and soft tissue . The perichondrium on the medial side is preserved.. Using round knife cartilage is removed to produce an eccentrically located cartilage disc measuring 7 to 9 mm in diameter . A flap of perichondrium is made posteriorly and this eventually drape over the posterior canal wall .A vertical strut is removed from the center for accommodating the malleus handle. The entire graft is placed underlay and the malleus fits in the groove .The cartilage is placed towards the promontory with the perichondrium laterally adjacent to the remnant tympanic membrane .⁷

PALISADE GRAFT :

In the palisade technique the cartilage is cut into several slices and finally pieced together to reconstruct the tympanic membrane . A large area of the conchal eminence can be exposed by elevating the subcutaneous tissue and post aural muscles from the conchal perichondrium. The cyma cartilage is the prominent bulge at the superior aspect of the concha. A circumferential cut the size of the anticipated graft is made through the perichondrium and cartilage . Remove the perichondrium from the post aural side . The convex side of the cartilage is turned towards the tympanic cavity and should not be covered by perichondrium. The palisades are cut into 0.5 mm strips. They are placed close to each other and the space in between will be filled with tissue fluid. The perichondrium on the outer side sticks to the remnant tympanic membrane.⁷

CARTILAGE SHIELD:

Make a vascular strip incision in the ear canal. Harvest the areolar tissue overlying the temporalis fascia. Harvest a round piece of conchal cartilage and remove the perichondrium on both sides . Remove a wedge of cartilage is to accommodate the malleus handle . The graft is placed medial to the malleus remnants of the TM. Place the areolar temporalis graft in between the remnant tympanic membrane and cartilage .⁸

MOSAIC TYMPANOPLASTY :

This technique was popularized by DORNHOFFER. Instead of placing rectangular strips of cartilage in a side to side manner an attempt is made to cut one major piece of cartilage in semilunar fashion which is placed directly against the malleus on top of the prosthesis. This helps to reconstruct the major portion of the posterior part of the tympanic membrane and serves as a foundation for rest of the cartilage pieces. The second semilunar piece is placed between this piece and the canal wall to reconstruct the scutum. Any spaces that results between this cartilage and canal wall is filled with slivers of cartilage. The reconstruction is then covered with perichondrium drapping it over the posterior canal wall.³

ADVANTAGES OF CARTILAGE GRAFT

1. Tolerated well
2. Contributes minimally to an inflammatory tissue reaction
3. Very low metabolic rate
4. Cartilage grafts are nourished by diffusion thus have along time survival
5. Cartilage maintains its rigidity quality and is resorption and retraction resistant even in during Eustachian tube dysfunction.
6. Easy to work due to its pliable nature.⁴

ROLE OF PERICHONDRUM

Many authors believe that perichondrium has a role in survival of cartilage while some disapprove it. Microscopic analysis of cartilages with out perichondrium showed viable chondrocytes within their lacunae with normally apparent matrix .There was no evidence of degeneration, necrosis or calcification .The content of the elastic fibres remained the same. Cartilage graft viability could be referred to the avascular nature of the cartilage with its low metabolic rate that enables the graft to reestablish its nutritional pattern readily with surrounding tissues. There fore the degenerative changes observed in some previous studies could be attributed to the technique of harvesting and handling than the lack of perichondrium. The increase pliability of the cartilage graft would be due to the escape of the mucopolysacharide from the matrix of the cartilage into the surrounding tissue fluid. On the other hand cartilage grafts with preserved perichondrium showed an increase in proliferative activity of the chondroblast adjacent to the perichondrium in terms of fusiform cells surrounded by immature matrix. Thus helping in maintaining the thickness of the graft. This may be again attributed to the inherent property of the chondroblasts when exposed to stress rather than the contribution of the perichondrium⁵

But it is widely believed that perichondrium acts as a protective shell preventing direct exposure of the graft to the notorious effect of local mediator of wound healing. Preserving perichondrium is seldom practiced in modern day cartilage tympanoplasty. There has been no proper reports of late cartilage necrosis due to lack of perichondrium except for late deterioration of hearing. The viability of cartilage depends upon direct diffusion of tissue fluid into the fibrous matrix thus nourishing the chondrocytes and chondroblasts. The cartilage that has been modified by physical force such as pressure or crushing can survive and function as a total pars tensa graft.³⁷

FATE OF CARTILAGE :

As time passes some softening occurs . Cartilage matrix remains intact . The lacunae are empty with degeneration of chondrocytes and the cartilage gets well incorporated with in the tympanic membrane.³³

ROLE CARTILAGE IN HEARING OUTCOME :

It has been stated that cartilage may affect the acoustics of the Tympanic membrane due to its increased mass and stiffness. With decreased thickness, the transfer qualities improve. Small cartilage grafts have a less influence on vibration pattern. As the bending stiffness of the entire TM increases with the size of the implanted cartilage, large grafts influence the entire frequency range¹³. Thus smaller thickness of transplant is needed. The cartilage should be cut as thinly as possible ideally 0.5 mm. Cutting into thin plates or palisades decreases the first resonance frequency and increases amplitude, causing improved sound transmission. the 0.5-mm cartilage plate seems preferable compared with the palisade technique. Cartilage island techniques showed superior vibration characteristics than palisade techniques.¹⁵

For medium and large TM perforations, the optimal thickness is 0.1 to 0.2 mm. For small perforations, cartilage less than 1.0 mm provide a good bargain between mechanical stability and low acoustic transfer loss.¹

Cartilage can offer a better prognosis for permanent closure in comparison with temporalis fascia and perichondrium in tubal dysfunction. Factors influencing the sound transmission characteristics of the cartilage like mass, density, and thickness of the graft, determine the acoustic quality.

Surgical processing of the cartilage might further affect the acoustic properties of the transplant.²

It is suggested that the cartilage significantly effects motion pattern of TM 4 kHz, however, but this is those not associated with changes in sound-induced stapes velocity. Neither the cartilage graft position (either with contact of the bony tympanic rim or not) or thicknesses of cartilage of 1.0 mm or less influence sound-induced stapes velocity. Thus small cartilage grafts of 1.0 mm thickness or less do not have much effect middle-ear function whether they are in contact with the bony annulus or not .

The site of maximum displacement was not changed at low frequencies 0.5 and 1 kHz. At high frequency measurements , a no motion or reduced motion area could be seen. Cartilage plates on the posterior-superior part of Tympanic membrane decreased the TM motion at 0.5 and 1 kHz .¹⁵

The middle ear impedance is altered by cartilage ie at 1 kHz with the 1.0 mm thickness not in contact with bone, and 4 kHz with both 0.5mm and 1.0 mm thick grafts without bone contact. At 4 kHz, the 1.0 mm thick graft having a bony contact decreases the mean impedance. The occasional decreases seen in the impedance are because of increased motion of other areas of the TM that are not covered by the cartilage graft.⁹

Reduction in umbo velocity is associated with reduction in stapes velocity. However, this is not proportional . Interruption the continuity of the ossicular chain causes increase in TM and umbo velocities while the stapes velocity is decreased .The vibration of the reconstructed TM and its relation to stapes velocity is complicated . Local changes in displacement , even when the cartilage is located at the area of maximal displacement , have minimal effect on the stapes velocity . The acoustics of the reconstructed TM are determined by stiffness of the cartilage when it is suspended from the osseous rim. A cartilage island surrounded by a regular TM influence the vibrations due to the mass of the cartilage, as the stiffness of the membrane is determined by the surrounding TM remnant. When cartilage plates were positioned so that they were either in contact with the bony tympanic rim and manubrium or not only minor changes are noted in tympanic membrane motion or stapes velocity at 500 hz and 1 khz.

Thus , alterations are seen in the pattern of TM displacement after placing cartilage on the medial side of TM at all the frequencies, but they are associated with changes in stapes velocity. Small cartilage grafts in the posterior-superior TM quadrant offer protection from graft retraction and

not greatly affect middle-ear function irrespective of the thickness of the cartilage and its contact with the bony tympanic rim and manubrium.

MATERIALS AND METHODS

STUDY PLACE : Rajiv Gandhi Govt General Hospital
Chennai 600 003.

STUDY DESIGN : Prospective

STUDY PERIOD : September 2010 to December 2012

SAMPLE SIZE : 30

AIM :

To compare the outcome of bilateral simultaneous myringoplasty done using temporalis fascia versus cartilage and to compare the results in term of graft uptake , hearing improvement and the various factors influencing the same.

INCLUSION CRITERIA

1. Age : above 12 years
2. Sex : both male and female are equally included
3. Chronic suppurative otitis media tubo tympanic disease
4. Bilaterally diseased ears
5. Dry ear for at least 6 weeks
6. Pure tone audiometry evidence of conductive hearing loss
7. Treated / controlled nose and para nasal sinus disease.

EXCLUSION CRITERIA :

1. Age : below 12 years
2. Chronic suppurative otitis media attico antral disease
3. Unilateral CSOM
4. Actively discharging ears
5. Pure tone audiogram evidence of mixed or sensori neural hearing loss
6. Other external or middle ear disease
7. Active nose and par nasal sinus disease
8. Ear disease requiring any other procedure apart from myringoplasty

INVESTIGATIONS :

1. Otoscopic examination
2. Pure tone audiometry
3. X ray mastoids
4. CT nose and paranasal sinuses
5. Diagnostic nasal endoscopy
6. Examination on table

METHODOLOGY :

This prospective study was conducted in 30 patients in our Institute from September 2010 to December 2012.

The patients with the above criteria were included in the study. The pre operative details were collected .The surgery was performed under local anesthesia with prescribed weight titrated pre medication . 0 degree Hopkin's rod lens endoscope was used .Transcanal myringoplasty technique was followed in all patients. 2 % xylocaine with 1 : 1,00,000 adrenalin was used to infiltrate 4 quadrants of the external auditory canal. All patients were asked to do a valsalva to look for air bubbles coming out of the perforation thus confirming the patency of the Eustachian tube.

Temporalis fascia was used in the left ear .It harvested by a separate supra aural incision . Tragal cartilage was used in the right ear. The cartilage of approximate thickness of 1 mm was harvested with perichondrium attached to one side .An ISLAND GRAFT was then constructed with a disc of cartilage located on a longer flap of perichondrium draped over the posterior canal wall . A central strip of cartilage was removed to accommodate the handle of malleus.

The margins of the perforation was freshened and the under surface of the tympanic membrane remnant was also made raw. Rosen's incision was made and the tympano meatal . The annulus was elevated from the sulcus , middle ear entered. The handle of malleus was skeletonised from the tip to the lateral process . Per operative assessment of the middle ear mucosa was done , the ossicular integrity was assessed by establishing the round window reflex , and the Eustachian tubal patency was rechecked by doing an Valsalva after washing the tympanic end of the Eustachian orifice.

In the right ear the tragal cartilage island graft was placed with the malleus sitting in the slit created for it , the cartilage facing the promontory and the perichondrium laterally draping over the posterior canal wall. In the left ear the temporalis fascia graft was dried and placed medial to the handle of malleus . Gel foam was not used in the middle ear to support either of the graft materials used .The tympanomeatal flap was repositioned and ointment soaked gelfoam was placed along the approximating margins in both the ears .Both the ear canal was packed with medicated gauze wick .

All patients were treated as in patients. All of them were treated with iv antibiotics (Inj cefataxime 1 gm iv BD) , Analgesic (tab.diclofenac BD) and antihistamine (tab.levocetizine BD) for a period of 7 days . Ear pack and suture removal was done on the 7 th post operative day. All patients discharged

on the post operative day 7. On discharge all patients were prescribed with an oral antibiotic (tab amoxicillin in combination with clavulonic acid) for 5 days and antihistamine (tab levocetrisne)) for a month. No patients were put on any topical medications on discharge.

All patients were reviewed on the 14 th post op day and the on the 3 rd week , 6 th week and 12 th week. During each visit otoscopic evaluation was done and the audiological evaluation was done on the 6 th and 12 th week.

The patients were followed up in the outpatient clinic at 1 week ,one month , three months. They under went otoscopic examination during each visit . Those patients who developed upper respiratory tract infection during the post operative follow up were treated with an additional course of oral antibiotics. Aural suctioning was not done as a routine except for those patients who developed post operative ear discharge . In those patients the ear discharge was sent for gram staining and pus culture and sensitivity , aural suctioning was done and they were treated with topical ear drops (antibiotic + steroid) and oral antibiotics for 5 days based on culture and sensitivity levels .All those patients with associated medical co morbidities had their general conditions monitored during every visit. Patients had their hearing assessment at the 6 th and 12 th week.

The results of the study are evaluated as follows

1. Closure of the tympanic membrane perforation
2. Hearing assessment by the improvement in closure of air bone gap
3. Factors affecting post op outcomes in terms of graft take up and improvements in hearing

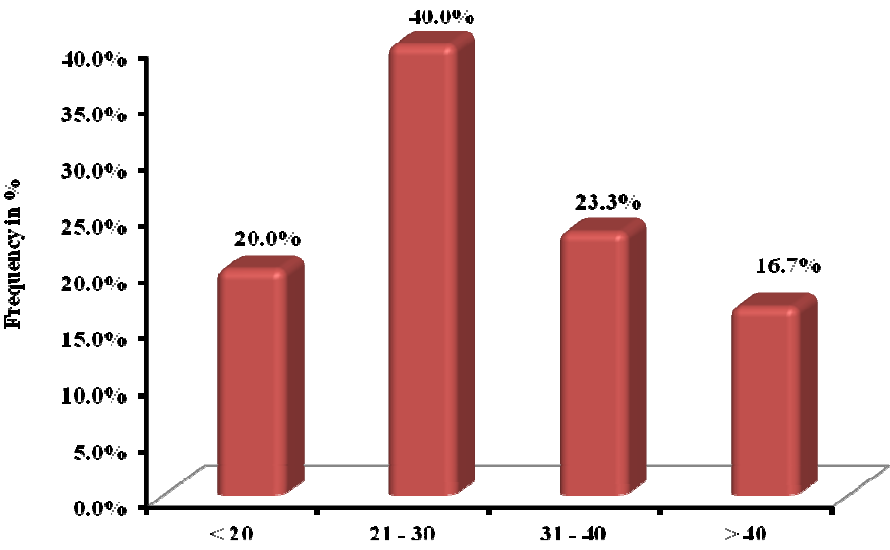
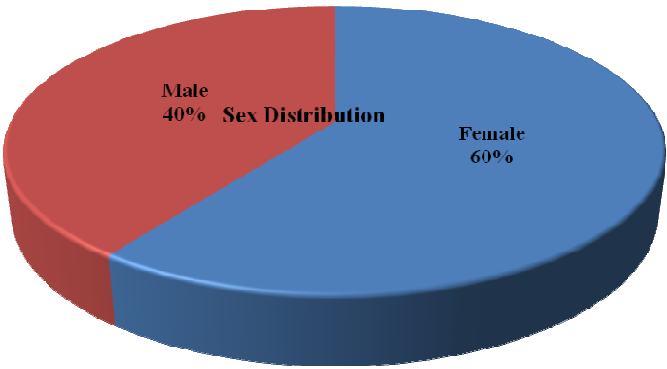
RESULTS AND OBSERVATION

The mean, median, mode and standard deviation were calculated for all continuous variables. Distribution of the variables was assessed by kolmogrov-smirnov tests. For continuous variables not normally distributed median and the mid-quartile range were calculated. Pearson's chi square was applied. Fischer's Exact was applied wherever required. Chi square for trends was applied for ordinal data. A p value less than 0.05 was taken as significant. SPSS version16.0 was used for analysis.

Among them 12 were males and 18 females.

Female	18
--------	----

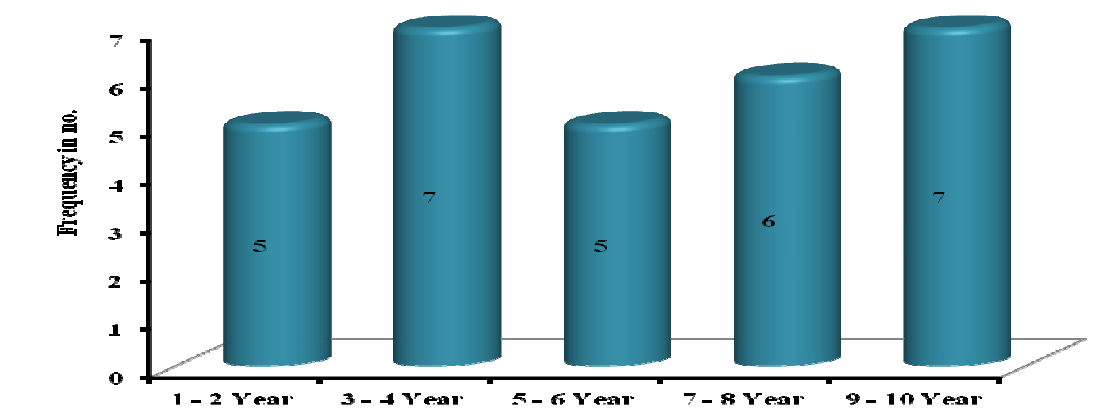
Male	12
Total	30



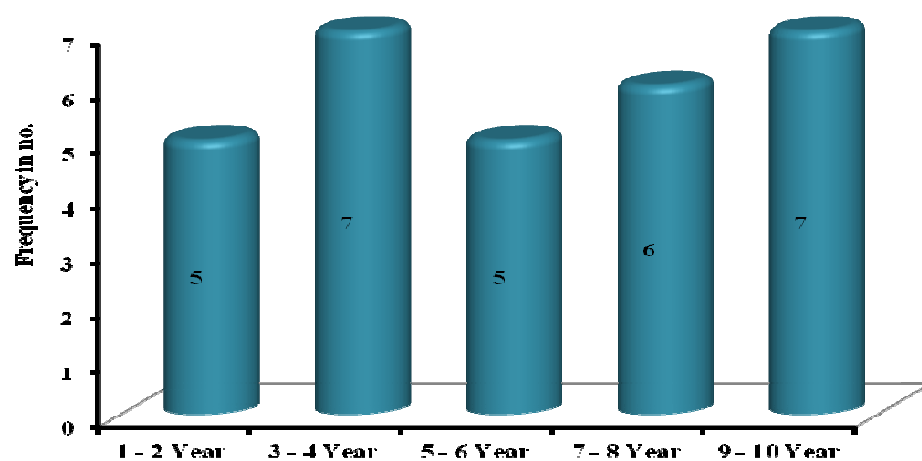
Age	No	%
< 20	6	20.0%
21 – 30	12	40.0%
31 – 40	7	23.3%
> 40	5	16.7%
Total	30	

The median age was in the age group 21 to 30 years

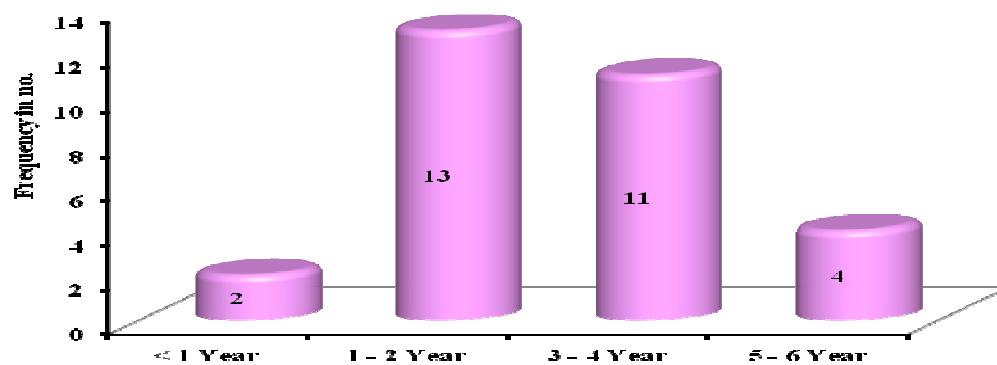
IN THE RIGHT EAR – DURATION OF DISCHARGE



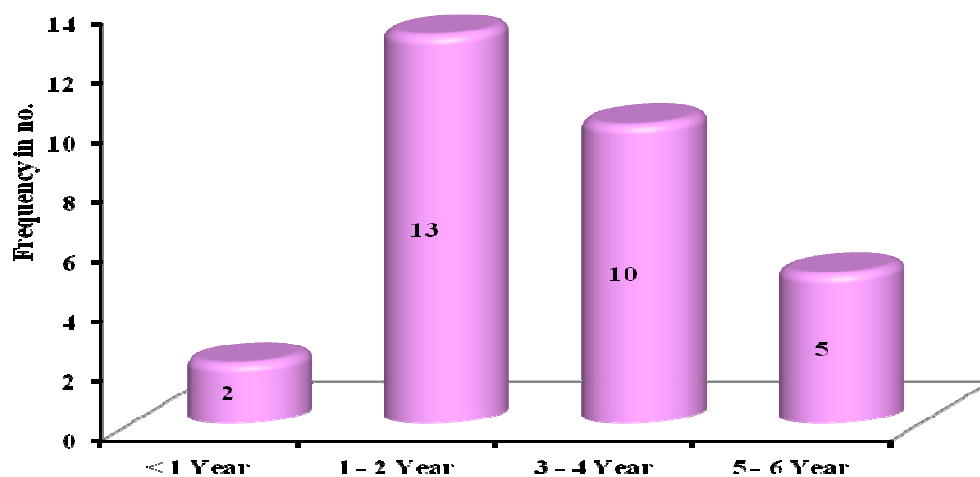
IN LEFT EAR – DURATION OF DISCHARGE



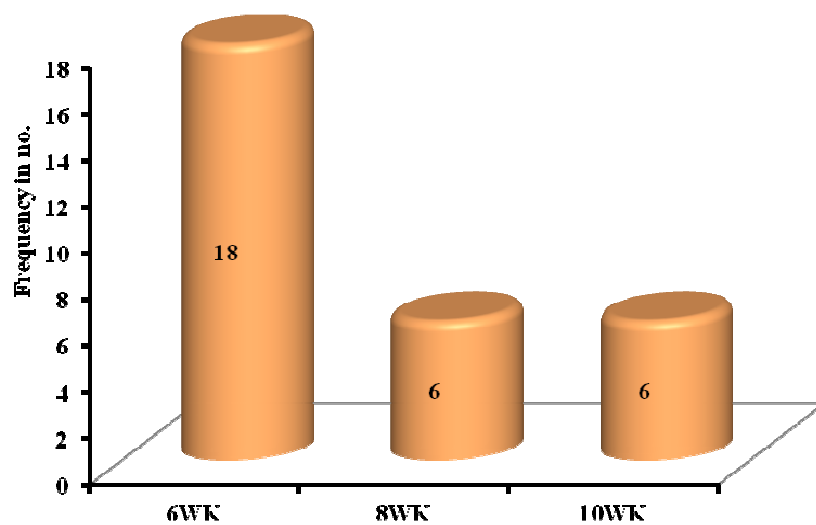
DURATION OF HARD OF HEARING RIGHT EAR



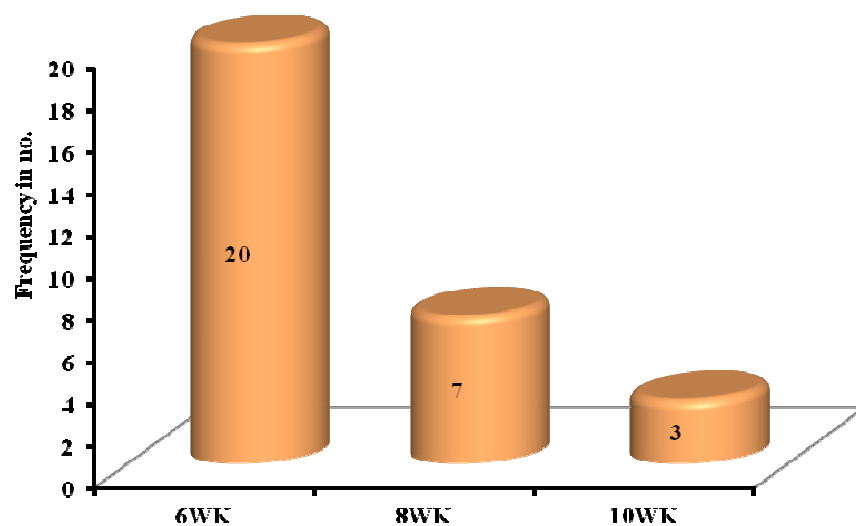
IN LEFT EAR – DURATION OF HARD OF HEARING



HOW LONG HAS THE RIGHT EAR BEEN DRY BEFORE SURGERY



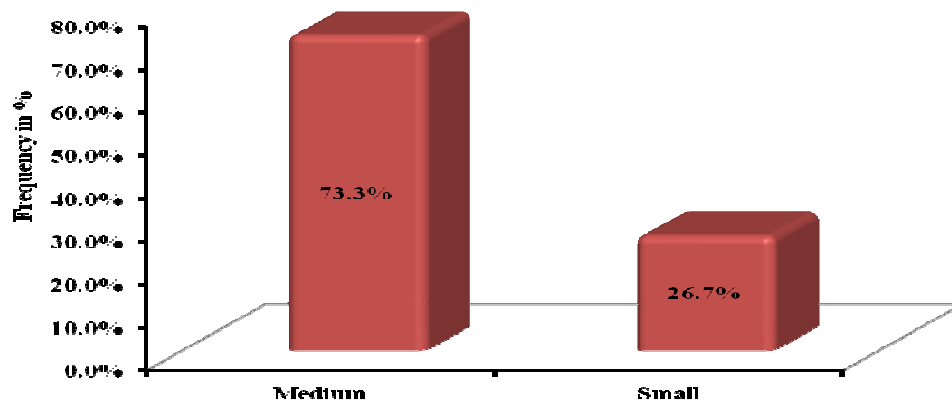
HOW LONG HAS THE LEFT EAR BEEN DRY BEFORE SURGERY



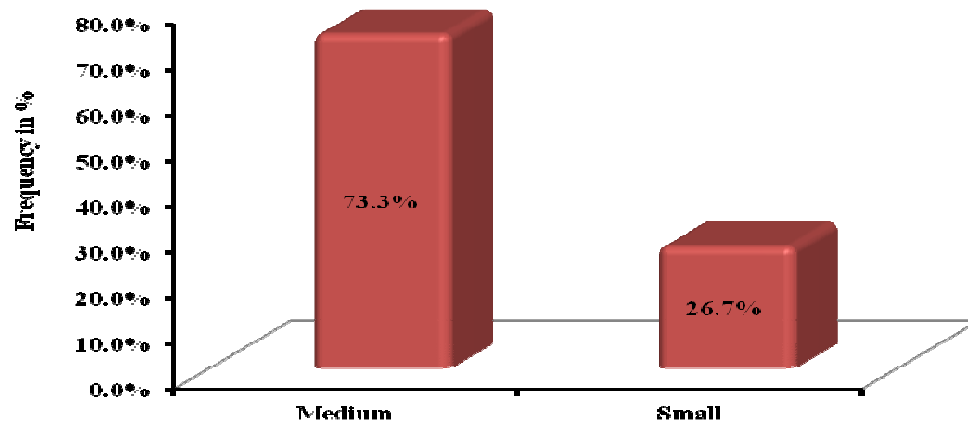
PERFORATION SIZE

Small perforations are those which involve only one quadrant. Medium sized perforations are those which involve 2 or 3 quadrant.

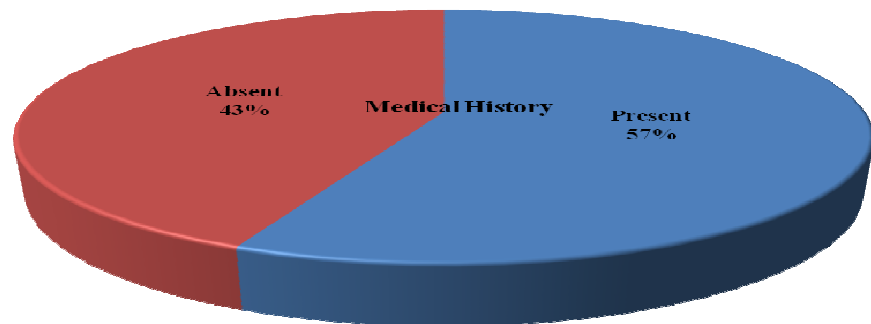
PERFORATION SIZE RIGHT EAR



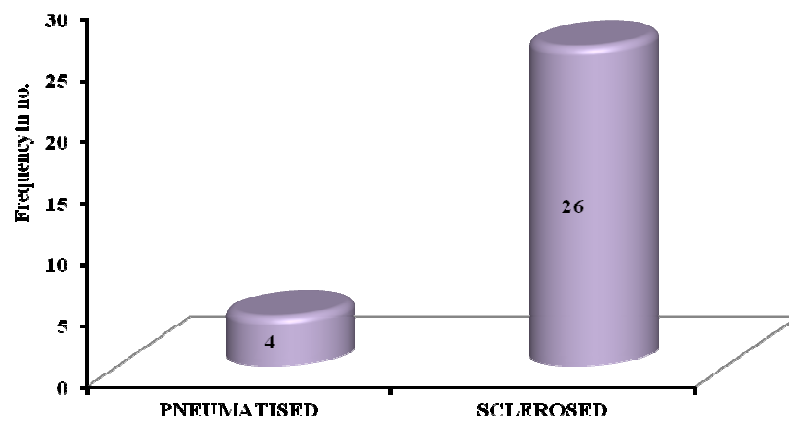
PERFORATION SIZE LEFT EAR



PRIOR HISTORY OF TREATMENT TO NOSE AND PNS DISEASE



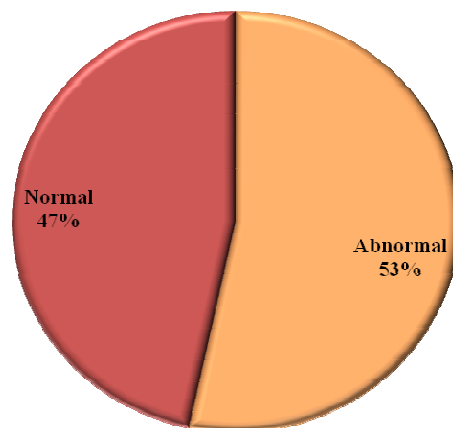
MASTOID PNEUMATISATION



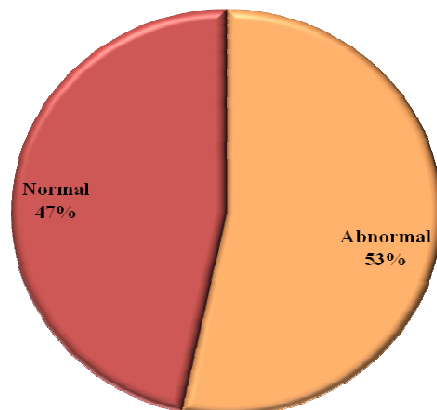
MIDDLE EAR MUCOSAL STATUS

The middle ear mucosal status was termed as normal if it was a dry pink mucosa and abnormal in the presence of discharge , congested mucosa or polypoidal mucosa.

MIDDLE EAR MUCOSAL STATUS RIGHT EAR



MIDDLE EAR MUCOSAL STATUS LEFT EAR



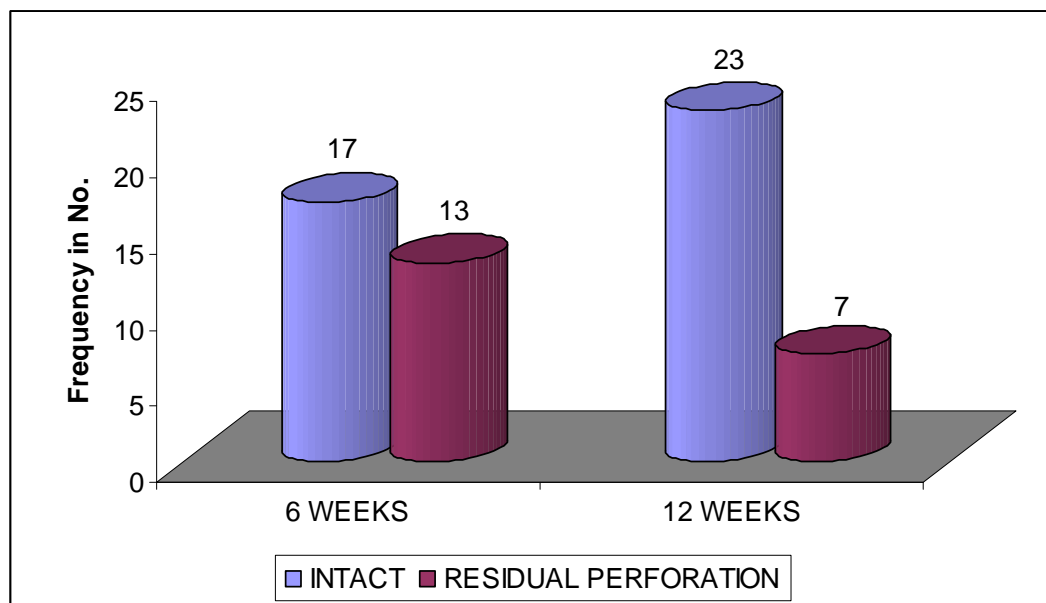
GRAFT UPTAKE RATES AND FACTORS AFFECTING GRAFT STATUS

ALL PATIENTS UNDERWENT ENDOSCOPIC TRANSCANAL UNDERLAY MYRINGOPLASTY USING TRAGAL CARTILAGE ISLAND GRAFT IN THE RIGHT EAR UNDER LOCAL ANASTHESIA

GRAFT STATUS – Right	6WEEKS	12 WEEKS
INTACT	17	23
RESIDUAL PERFORATION	13	7
Total	30	30

The number of intact Tympanic Membrane at the end of 12 WEEKS: 23

The number of Residual Perforation at the end of 12 WEEKS : 7

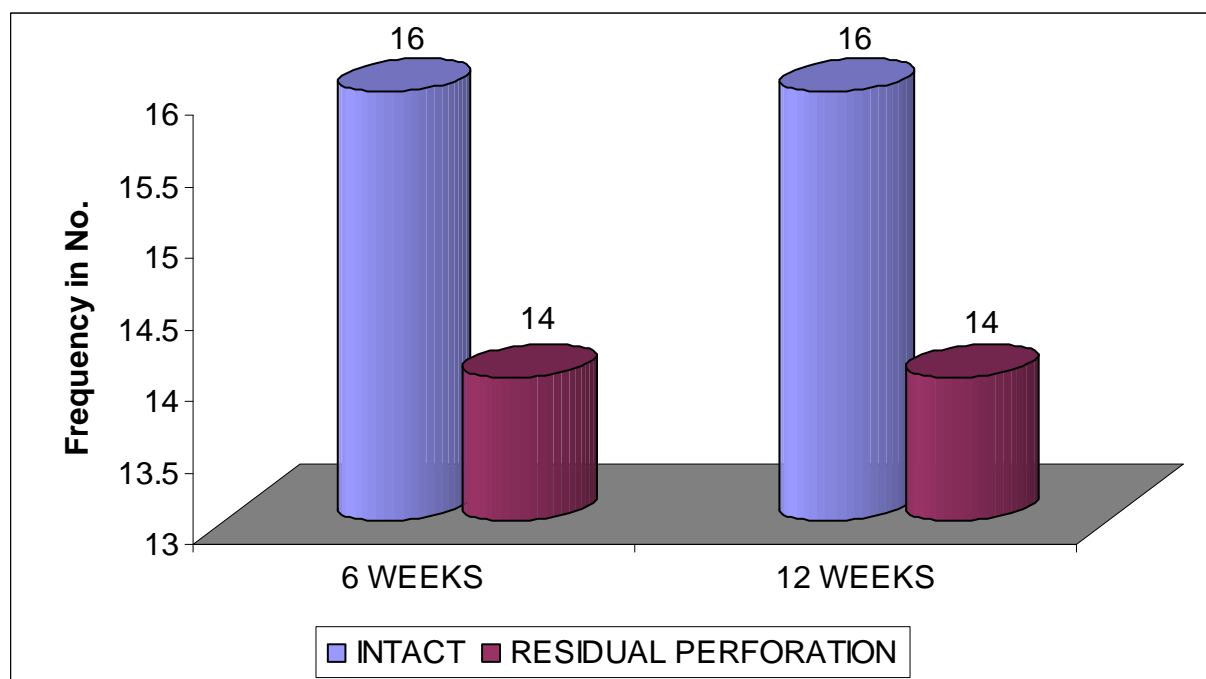


ALL PATIENTS UNDERWENT ENDOSCOPIC TRANSCANAL UNDERLAY MYRINGOPLASTY USING TEMPORALIS FASCIA IN THE LEFT EAR

GRAFT STATUS – Left	6 WEEKS	12 WEEKS
INTACT	16	16
RESIDUAL PERFORATION	14	14
Total	30	30

The number of Intact Tympanic Membrane at the end of 6 WEEKS: 16

The number of Residual Perforation at the 12 WEEKS: 14



THE GRAFT TAKE UP WAS BETTER WITH CARTILAGE GRAFT THAN COMPARED TO TEMPORALIS FASCIA.

GRAFT STATUS IN RELATION TO EUSTACHIAN TUBE FUNCTION

Graft status right	6 WEEKS		12 WEEKS	
	Eustachian tube function		Eustachian tube function	
	Block	Normal	Block	Normal
INTACT	9	8	11	12
RESIDUAL PERFORATION	7	6	5	2
Total	16	14	16	14

P – Value : 0.273 > 0.05 – Not Significant

EUSTACHIAN TUBE FUNCTION DOES NOT AFFECT CARTILAGE GRAFT UPTAKE

Graft Status Left	6 WEEKS		12 WEEKS	
	Eustachian tube function		Eustachian tube function	
	Block	Normal	Block	Normal
INTACT	6	10	5	11
RP	10	4	11	3
Total	16	14	16	14

P – Value : 0.009 < 0.05 – Significant

EUSTACHIAN TUBE FUNCTION AFFECT UPTAKE OF TEMPORALIS FASCIA GRAFT

Graft Status Right	6 WEEKS		12 WEEKS	
	Medical History		Medical History	
	Present	Absent	Present	Absent
INTACT	11	6	13	10
RESIDUAL PERFORATION	6	7	4	3
Total	17	13	17	13

P – Value : 0.975 > 0.05 – Not Significant

Graft status Left	6 WEEKS		12 WEEKS	
	Medical History		Medical History	
	Present	Absent	Present	Absent
INTACT	4	12	4	12
RESIDUAL PERFORATION	13	1	13	1
Total	17	13	17	13

P – Value : 0.000 < 0.05 – Significant

GRAFT STATUS IN RELATION TO MIDDLE EAR MUCOSAL STATUS

Graft Status Right	6 WEEKS		12 WEEKS	
	Middle Ear Mucosa		Middle Ear Mucosa	
	Abnormal	Normal	Abnormal	Normal
INTACT	9	8	11	12
RESIDUAL PERFORATION	7	6	5	2
Total	16	14	16	14

P – Value : 0.273 > 0.05 – Not Significant

MIDDLE EAR MUCOSAL STATUS DOES NOT AFFECT UPTAKE OF CARTILAGE GRAFT

Graft Status Left	6 WEEKS		12 WEEKS	
	Middle Ear Mucosa		Middle Ear Mucosa	
	Abnormal	Normal	Abnormal	Normal
INTACT	6	10	5	11
RESIDUAL PERFORATION	10	4	11	3
Total	16	14	16	14

P – Value : 0.009 < 0.05 – Significant

MIDDLE EAR MUCOSAL STATUS AFFECTS UPTAKE OF TEMPORALIS FASCIA GRAFT

GRAFT STATUS IN RELATION TO MASTOID PNEUMATISATION

Graft Status Right	6 WEEKS		12 WEEKS	
	Mastoid Pneumatisation		Mastoid Pneumatisation	
	PNEUMATISED	SCLEROSED	PNEUMATISED	SCLEROSED
INTACT	1	16	3	20
RESIDUAL PERFORATION	3	10	1	6
Total	4	26	4	26

P – Value : 0.933 > 0.05 – Not Significant

Graft Status Left	6 WEEK		12 WEEKS	
	Mastoid Pneumatisation		Mastoid Pneumatisation	
	PNEUMATISED	SCLEROSED	PNEUMATISED	SCLEROSED
INTACT	3	13	3	13
RESIDUAL PERFORATION	1	13	1	13
Total	4	26	4	26

P – Value : 0.351 > 0.05 – Not Significant

MASTOID PNEUMATISATION DOES AFFECT UPTAKE OF
CARTILAGE OR TEMPORALIS FASCIA GRAFT

GRAFT STATUS IN RELATION TO PERFORATION SIZE

Graft Status Right	6 WEEKS		12 WEEKS	
	Perforation size		Perforation size	
	Medium	Small	Medium	Small
INTACT	13	4	17	6
RESIDUAL PERFORATION	9	4	5	2
Total	22	8	22	8

P – Value : 0.896 > 0.05 – Not Significant

Graft Status Left	6 WEEKS		12 WEEKS	
	Perforation size		Perforation size	
	Medium	Small	Medium	Small
INTACT	11	5	11	5
RESIDUAL PERFORATION	11	3	11	3
Total	22	8	22	8S

P – Value : 0.544 > 0.05 – Not Significant

PERFORATION SIZE DOES NOT AFFECT GRAFT UPTAKE

GRAFT STATUS IN RELATION TO DURATION OF EAR DISCHARGE

Graft Status Right	Duration of discharge	
	Mean	Sd
INTACT	5.87	2.78
RESIDUAL PERFORATION	6.29	3.09

P-value : $0.735 > 0.05$ – Anova –Not Significant

Graft Status Left	Duration of discharge	
	Mean	Sd
INTACT	5.81	2.9
RESIDUAL PERFORATION	6.14	2.98

P-value : $0.767 > 0.05$ – Anova –Not Significant

DURATION OF DISCHARGE DOES NOT AFFECT GRAFT TAKE UP

GRAFT STATUS IN RELATION TO DURATION OF DRY EAR

Graft Status Right	Duration of dry ear	
	Mean	Sd
INTACT	7.3	1.66
RESIDUAL PERFORATION	6.86	1.57

P-Value : 0.540 > 0.05 Not Significant

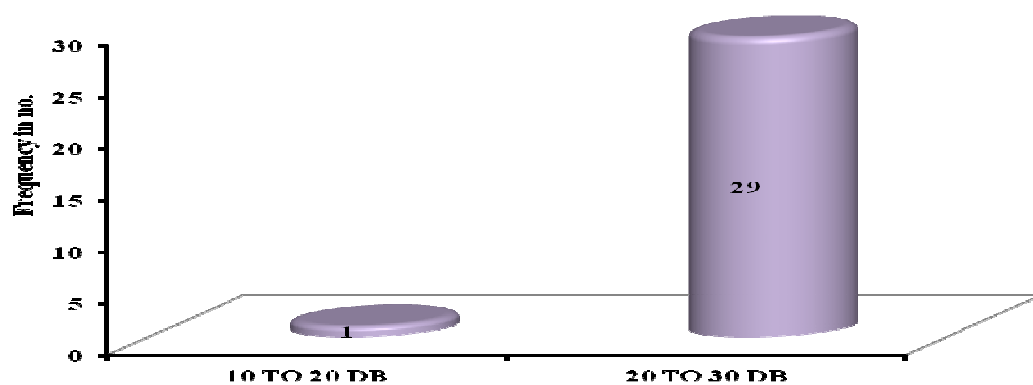
Graft Status Left	Duration of dry ear	
	Mean	Sd
INTACT	6.6	0.96
RESIDUAL PERFORATION	7.14	1.7

P-Value : 0.285 > 0.05 Not Significant

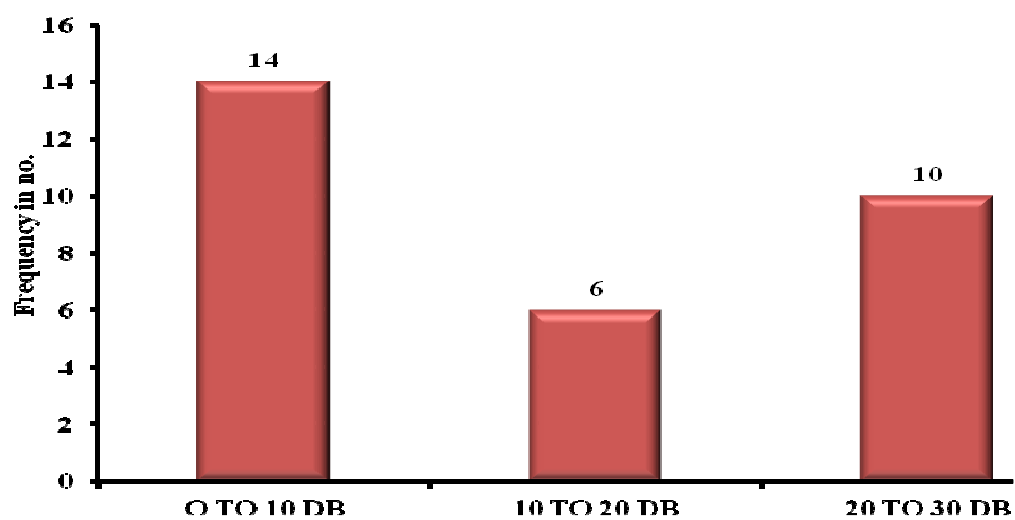
DURATION OF DRY EAR DOES NOT AFFECT GRAFT TAKE UP

AUDIOLOGICAL OUTCOMES

PRE OP AIR BONE GAP RIGHT EAR	No
10 TO 20 DB(GOOD)	1
20 TO 30 DB(FAIR)	29
Total	30

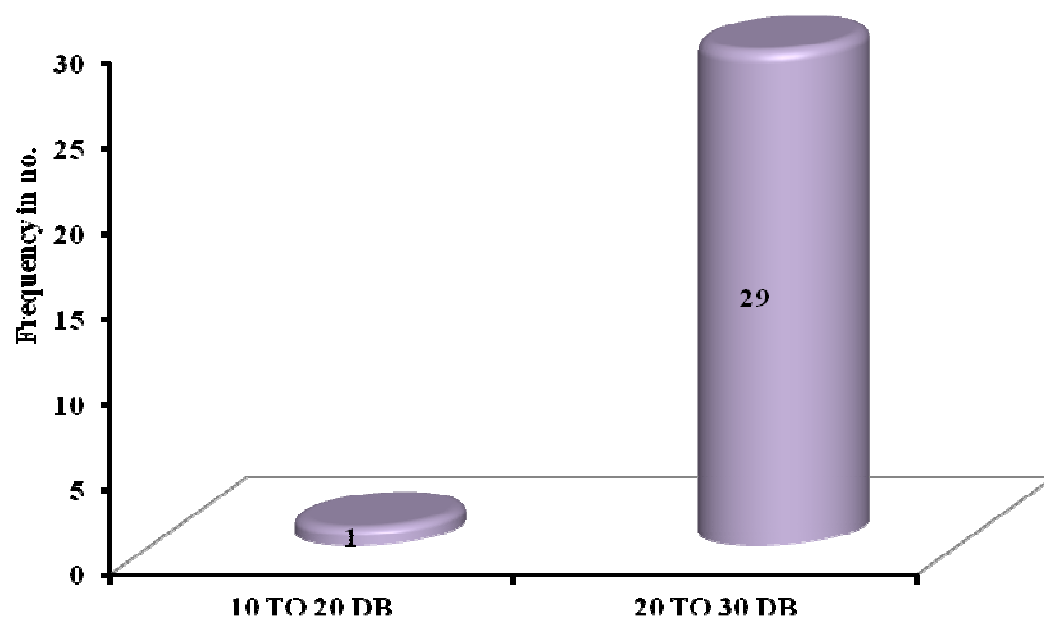


POST OP AIR BONE GAP RIGHT EAR AT END OF 12 WEEKS	No
0 TO 10 DB(EXCELLENT)	14
10 TO 20 DB(GOOD)	6
20 TO 30 DB(FAIR)	10
Total	30

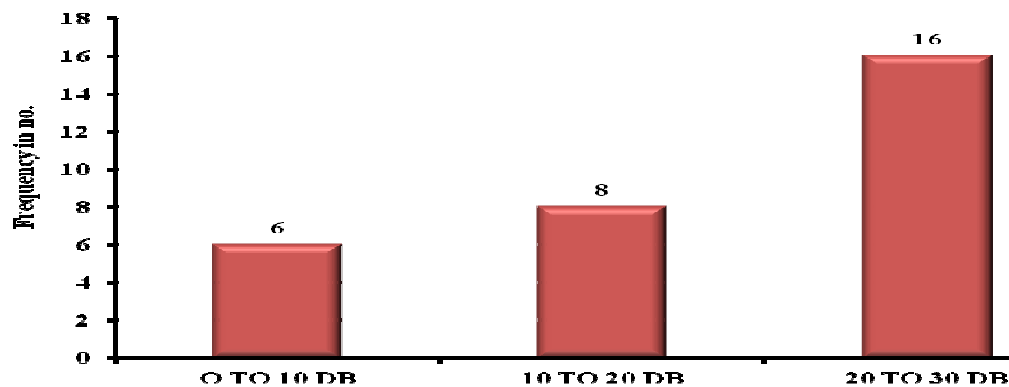


P-value : 0.036<0.05 - SIGNIFICANT

PRE OP AIR BONE GAP LEFT EAR	No
10 TO 20 DB(GOOD)	1
20 TO 30 DB(FAIR)	29
Total	30



POST OP AIR BONE GAP LEFT EAR AT END OF 12 WEEKS	No
0 TO 10 DB (EXCELLENT)	6
10 TO 20 DB (GOOD)	8
20 TO 30 DB (FAIR)	16
Total	30



P VALUE :0.0.801> 0.05 –NOT SIGNIFICANT

THERE IS A SIGNIFICANT DIFFERENCE IN THE POST OPERATIVE CLOSURE OF AIR BONE GAP WHILE USING CARTILAGE AS A GRAFT THAN COMPARED TO TEMPORALIS FASCIA

DISCUSSION :

From the introduction of Tympanoplasty by Wullstein and Zoellner different types of graft materials have been used to reconstruct the tympanic membrane. Temporalis fascia is most commonly used material . But now there is a growing interest in using cartilage as an alternative.

Performing a bilateral simultaneous myringoplasty has been traditional associated with fears of failure with regard to graft uptake and hearing outcome but several studies have disproved this .

A study on Bilateral Myringoplasty in Chronic Otitis Media by Per Caye-Thomasen shows “ a closure of 94%. Hearing significantly improved , and the air-bone gap was reduced. The air-bone gap was closure was within 10 dB in 92% and within 20 dB in 100% of the ears. Surprisingly good hearing was found during postoperative despite bilateral ear canal gauze packing.”²⁰

2005 Sep Katsura H, Sakagami M, Tsuji K, Muto T, Okunaka M, Mishiro Y, Fukazawa K evaluated the results of bilateral same-day surgery for bilateral perforated chronic otitis media .It shows “The postoperative air-bone gap was less than 10 dB on both sides in 29% and less than 20 dB in 88%. The postoperative hearing level was less than 20 dB in both ears in 24%, less than 30 dB in 41%, and less than 40 dB in 59%. The rate of bilateral closure of the ear drum was 91 %.”²⁶

In my study, the statistical analysis of 30 patients with bilateral chronic suppurative otitis media who underwent simultaneous closure of their perforations using cartilage in the right ear and temporalis fascia in the left ear are compared in terms of graft take up rates and hearing improvement. The rates of residual perforation for cartilage was 7 among 30 cases and the rate of residual perforation for temporalis fascia was 14 among 30 cases. This difference is statistically significant shows cartilage as a better graft material than compared to fascia.

The uptake of cartilage graft was independent of the status of the Eustachian tube or the middle ear mucosa. The uptake of graft either cartilage or fascia was independent of the duration of ear discharge, duration of the ear being dry and the size of the perforation.

A 1,000-patient series of cartilage tympanoplasty by Dornhoffer in November 2003 showed that the Cartilage achieved good anatomical and audiological results. Reconstruction with cartilage yields better anatomical and functional results in comparison to primary tympanoplasties using traditional techniques in high risk perforations.²⁵

It is a widely accepted factor that the success rates in using temporalis fascia as a graft material in unilateral myringoplasties provides a success rate of 90 % and above, my study found only a 50 % success rate. Thus while dealing

with bilateral disease the success rates seems to be are very much lower ,concluding that for a bilateral perforation which is classified under the category of a high risk perforation by Dornhoffer temporalis fascia may not be the material of choice.

An article published in the J Laryngol Otol. 2012 Jan comparing Functional results of temporalis fascia versus cartilage tympanoplasty in patients with bilateral chronic otitis media shows “the graft success rate was 65.9 per cent for the fascia group and 92.3 per cent for the cartilage group. Post-operatively, the mean \pm standard deviation air conduction threshold was 28.54 ± 14.20 dB for the fascia group and 22.97 ± 8.37 dB for the cartilage group, while the mean \pm standard deviation bone conduction threshold was 11.71 ± 8.50 dB for the fascia group and 7.15 ± 5.56 dB for the cartilage group. Patients with bilateral chronic otitis media, cartilage tympanoplasty seems to provide better hearing results and graft success”.²³

During the 6 th post operative week the number of residual perforation rates were similar among cartilage graft and temporalis fascia graft. But at the end of the 12 th week the residual perforation rates among the cartilage graft was drastically reduced than compared to the temporalis fascia graft. The cartilage had overcome the influences of various factors contributing to the outcome of myringoplasty, sucessfully integrating itself in the neotympanic

membrane than compared to temporalis fascia. Thus it had withstood the test of time

The reason for the failure of cartilage among 7 cases were also assessed. 3 patients out of the 7 cases were Diabetic with improper control of their glycemic status. 2 cases were known to be having history of Bronchial asthma. 4 cases developed URI in the 2nd post operative week. 3 cases developed post operative infection and ear discharge. Pus culture taken from the discharge was positive pseudomonas in 2 cases and MRSA in 1 case.

According to Altuna et al “the anatomical and functional outcomes of 122 cases of cartilage island graft assessed over a period of 5 years showed successful closure rates of 92% of the cases with functional results showing an improvement in the air-bone gap average with statistical significance”.¹⁰

A comparison of cartilage palisades and fascia in type 1 tympanoplasty in children by Ozbek et al in 2008 shows “significantly higher graft acceptance rate (100%) than with the fascia technique (70.2%). Comparison of audiological results between the groups did not reveal any statistically significant difference ($p > 0.05$)”.¹⁶

According to Mauri M, et al “an evaluation of inlay butterfly cartilage tympanoplasty show the graft take up was 85.3% in the inlay cartilage

tympanoplasty and 83.3% in over lay cartilage .No audiometric difference was observed between groups .”²

According to Kulak Burun et al “ with island technique for reconstruction of tympanic membrane perforation , perforation closure rates for cartilage and fascia group were 91.3% and 88.2%, respectively. The audiological outcomes revealed that the overall gains of 12.3 dB for the cartilage-perichondrium group and 12.7 dB for the fascia group ($p>0.05$). “ ¹¹

According to Ben Gamra et al “successful closure of the tympanic membrane perforation in 97% of the cartilage group as compared to 94% of the fascia group. The average ACG was 21 ± 11 dB in cartilage group and 20 ± 22 dB in fascia group. There was great reliability on cartilage to close tympanic membrane perforations and , using cartilage as a first choice chronic otitis media was recommended.”²⁸

On the contrary in 2011 August a randomized study comparing fascia and cartilage grafts in myringoplasty by Yung M, Vivekanandan S, Smith P “shows the graft take rates of fascia and cartilage grafts at 2 years were 84.2% and 80%, respectively. The postoperative air-bone gaps and hearing gains at 2 years were 16.97 dB and 13.63 dB, respectively, in the fascia group and 20.63 dB and 12.60 dB, respectively, in the cartilage group. There was no significant

difference in the graft take rates or postoperative hearing between the two groups”.³¹

A comparative study of Tympanoplasty with island cartilage or temporalis fascia by Bozdemir K, et al shows “postoperatively the PTAs and air-bone gap closure were better with temporalis fascia compared to cartilage grafting .On frequency-specific comparisons, the pure tone thresholds at the frequencies of 0.5, 1 and 2 kHz recovered better with temporalis fascia .Although the pure tone recovery was better at 4 kHz with temporalis fascia, the difference between the groups were not significantly different ($p > 0.05$). Temporalis fascia grafting seems better in this study than conchal cartilage”.²¹

Despite the various reviews in literature with regard to the advantages of cartilage as a graft material still it has not gained that much popularity as that of temporalis fascia and is being used only as a second option . It has become the material of choice only for high risk cases and not a routine alternative to temporalis fascia but ,the cartilage is a satisfactory grafting material as it is accessible, adaptable , negative middle ear pressures resistant, stable, elastic, well tolerated by the middle ear, resorption resistant. Therefore its use is recommended in less severe middle ear disorders, in which the functional outcome is more essential.³⁴

In our study the audiological outcomes showed significant improvement in Air Bone Gap with Cartilage graft than compared to Temporalis Fascia (P-value : $0.036 < 0.05$ – SIGNIFICANT)

Doubts still exists in the minds of many surgeons with regards to the acoustic benefits of the cartilage . Majority of the studies quoted in literature suggested the audiological benefits of cartilage graft to be in par with temporalis fascia . This is the outcome of my study also .

1997 Aug Dornhoffer studied cartilage graft with perichondrium in type I tympanoplasty. He states “Tympanic Membrane closure was achieved in all 22 patients undergoing cartilage reconstruction. These hearing gains were statistically significant ($P < 0.001$ in each case), but there was no statistically significant difference in hearing results between the cartilage and fascia .”²⁹

Matthew J. et al on Jan 2009 states “ no statistically significant differences in speech reception threshold improvement or air–bone gap closures between cartilage and fascia.”³⁶

In 2005 a study on hearing results after primary cartilage tympanoplasty with island technique by Kirazli T et al shows “there were no statistically significant differences in the postoperative frequency-specific gains in air-bone gap between the cartilage and fascia .”³⁵

2011 August comparison of Cartilage island flap and Temporalis fascia in type I tympanoplasty by Onal K, et al shows “ the graft take rate was 89.6% for the fascia group and 93.2% for the cartilage group. Significant recovery was found in the postoperative pure-tone averages and air-bone gaps compared to preoperative thresholds.” ³³

The follow up period in majority of the studies including mine has been only 1 or 2 years .Thus a long term follow up is needed to exactly comment upon the acoustic benefits of cartilage graft over temporalis fascia .

LIMITATIONS OF THE STUDY :

- 1 . Smaller sample size
2. This sample population does no represent true population
- 3 This study includes surgical procedures done by various surgeons
- 4 . Follow up period is short .

CONCLUSION

1 . This study found that bilateral simultaneous myringoplasty can offer results equal in terms of healing and hearing like that of unilateral myringoplasty and at the same time help to conserve money and resources.

2. The graft take up rates were superior with cartilage than compared to temporalis fascia.

3 . Though several studies prove 90 % and above success rates while using temporalis fascia for closure of tympanic membrane perforation in unilateral disease my study found only a 50 % success rate. Thus according to my study while dealing with bilateral disease the success rates are very much lower ,so for a bilateral perforation which is quoted as a high risk perforation by Dornhoffer temporalis fascia may not be the material of choice.

4. Rates of residual perforation were drastically reduced at the end of 12 weeks in the ear using cartilage as graft material ,were by the cartilage was found have successfully overcome the various factors influencing the outcome of a successful myringoplasty , to become integrated in the neotympanic membrane and thus withstanding the test of time.

5 . The uptake of cartilage is not influenced by the status of the middle ear or status of the Eustachian tube .

6 . Perforation size , Duration of discharge, Mastoid pneumatisation, and Duration of dry ear does not affect the uptake of either cartilage or fascia.

7. In all patients who had a history of nose and paranasal sinus disease and in those patients who were operated for the same showed successful results with the use of cartilage.

8 . Proper post op care is of utmost importance . Post operative infections and their effective control play a vital role in the outcome .

9. Cartilage provide better closure of air bone gap than temporalis fascia. But a long term follow up is awaited to exactly comment on the acoustic benefits.

10. Cartilage as a graft material has not gained that much popularity as that of temporalis fascia and is being used only as a second option . It is yet to gain popularity as alternative to temporalis fascia in routine myringoplasties and not only for high risk cases. The cartilage is accessible, adaptable , negative middle ear pressure resistant , stable, elastic, well tolerated by the middle ear, resorption resistant . Therefore its use is recommended in less severe middle ear disorders, in which the functional outcome is more essential.

10 .Thus to conclude in simultaneous closure of a bilateral disease cartilage offers to be a better graft material both in terms of healing and hearing outcomes.

BIBLIOGRAPHY

1. Glascock – Shambough surgery of the ear 6 th edition
2. Cummings otorhinolaryngology and head and neck surgery 4 th edition.
3. Scott – Brown ‘s ototrhinolaryngology , head and neck surgery . 7 th edition
4. Ballenger’s otorhinolaryngoglogy Head and Neck Surgery ; 16 th edition
: James B. Snow Jr , John Jacob Ballenger

5. Harold Ludman , Tony Wright , Diseases of the ear 5 th edition
6. Otologic surgery 3 rd edition , Derald .E. Brackmann ; p 119 – 160
7. Mirko Tos manual of middle ear surgery ; Vol 1.
8. Middle Ear and Mastoid surgery : Rex S. Heberman II
9. Surgery of ear and temporal bone : Joseph B Nadol Jr, Micheal J. Mckenna ; 2 nd edition 2005
10. Altuna X, Navarro JJ, Martínez Z, Lobato R, Algaba J Island cartilage myringoplasty. Anatomical and functional results in 122 cases Acta Otorrinolaringologica Espanola 2010, 61(2):100-105
11. Kulak Burun Bogaz Ihtis Derg. 2006;16(6):255-60. Comparison between tympanoplasties with cartilage-perichondrium composite graft and temporal fascia graft in terms of hearing levels and healing
12. Sapçı T, Almaç S, Usta C, Karavuş A, Mercangöz E, Evcimik MF. 2004 May-Jun;132(5-6):148-51. Mucociliary transport in Eustachian tubes in chronic suppurative otitis media
13. Jesić S, Nesić V. HNO. 2011 Oct;59(10):953-63. Eustachian tube and middle ear mechanics.
14. Otolaryngol Pol. 2003;57(6):889-92. The evaluation of cartilage and perichondrium grafts for the reconstruction of the tympanic membrane. Slaska-Kaspera A, Gierak T, Majzel K, Klimczak-Gołab .

15. Optimal Graft Thickness for Different Sizes of Tympanic Membrane Perforation in Cartilage Myringoplasty: A Finite Element Analysis Chia-Fone Lee, MD; Jyh-Horng Chen, PhD; Yuan-Fang Chou, PhD; Lee-Ping Hsu, MD; Peir-Rong Chen, MD; Tien-Chen Liu, PhD *Laryngoscope* 117: April 2007
16. *Otol Neurotol.* 2008 Aug;29(5):679-83. A comparison of cartilage palisades and fascia in type 1 tympanoplasty in children: anatomic and functional results. Ozbek C, Ciftçi O, Tuna EE, Yazkan O.
17. *Indian J Otolaryngol Head Neck Surg.* 2006 Apr;58(2):165-7. comparative study of tympanoplasty in wet perforation v/s totally dry perforation in tubotympanic disease. Vijayendra H, Rangam CK, Sangeeta R.
18. Acoustic Properties of Different Cartilage Reconstruction Techniques of the Tympanic Membrane Dirk Mürbe MD, Thomas Zahnert MD, Matthias Bornitz MS, Karl-Bernd Hüttenbrink MD *The Laryngoscope* Volume 112, Issue 10, pages 1769–1776, October 2002
19. Comparison of different tympanic membrane reconstruction techniques in type I tympanoplasty Inci Alkan Demirpehlivan Kazim Onal Secil Arslanoglu Murat Songu Ejder Ciger Nazan Can *Eur Arch Otorhinolaryngol* (2011) 268:471–474.

20. Bilateral Myringoplasty in Chronic Otitis Media Per Caye-Thomasen MD, DMSc, Torfinnur Rubek Nielsen MD², Mirko Tos MD, DMSc The Laryngoscope Volume 117, Issue 5, pages 903–906, May 2007
21. J Otolaryngol Head Neck Surg. 2012 Feb;141(1):14-9. Effect of type I tympanoplasty on the resonant frequency of the middle ear: comparison between chondro tympanoplasty and temporalis fascia grafting. Iacovou E, Vlastarako PV, Panagiotakopoulou A, Chrysostomou M, Kandiloros D, Adamopoulos G, Ferekidis E
22. Otolaryngol Head Neck Surg. 1987 Jan;96(1):80-2. Eustachian tube function and healing after myringoplasty Holmquist J, Lindeman P.
23. J Laryngol Otol. 2012 Jan;126(1):22-5. Functional results of temporalis fascia versus cartilage tympanoplasty in patients with bilateral chronic otitis media. Onal K, Arslanoglu S, Songu M, Demiray U, Demirpehlivan IA.
24. Cartilage graft in type I tympanoplasty: audiological and otological outcome O. Ben Gamra, C. Mbarek¹, K. Khammassi, N. Methlouthi, H. Ouni, I. Hariga, S. Zribi, J. Koubâa and A. El Khedim European Archives of Oto-Rhino-Laryngology and Head & Neck Surgery March 2007

25. Laryngoscope. 2003 Nov;113(11):1844-56. Cartilage tympanoplasty: indications, techniques, and outcomes in a 1,000-patient series Dornhoffer J.
26. Otolaryngol Head Neck Surg. 2005 Jun;132(6):933-7. Hearing results after primary cartilage tympanoplasty with island technique. Kirazli T, Bilgen C, Midilli R, Ogüt F.
27. Laryngoscope. 2001 Aug;111(8):1479-85. Evaluation of inlay butterfly cartilage tympanoplasty: a randomized clinical trial. Mauri M, Lubianca Neto JF, Fuchs SC.
28. Hearing Results After Primary Cartilage Tympanoplasty Matthew J. Gerber MD¹, John C. Mason MD, Paul R. Lambert MD , The Laryngoscope Volume 110, Issue 12, pages 1994–1999, December 2000.
29. Laryngoscope. 1997 Aug;107(8):1094-9. Hearing results with cartilage tympanoplasty ; Dornhoffer JL.
30. Motion of the Tympanic Membrane after Cartilage Tympanoplasty Determined by Stroboscopic Holography Antti A. Aarnisalo, MD, PhD, Jeffrey T. Cheng, PhD, Michael E. Ravicz, MSc, Cosme Furlong, PhD, Saumil N. Merchant, MD, and John J. Rosowski, PhD.

31. Ann Otol Rhinol Laryngol. 2011 Aug;120(8):535-41. Randomized study comparing fascia and cartilage grafts in myringoplasty. Yung M, Vivekanandan S, Smith P.
32. Audiol Neurotol. 2012 Sep 21;18(1):9-16. Long-Term Histologic Changes and Effects of Perichondrium Preservation of Auricular Cartilage Grafted in Rabbit Tympanic Bullae.
33. J Otolaryngol Head Neck Surg. 2011 Aug;40(4):295-9. Perichondrium/Cartilag island flap and temporalis muscle fascia in type I tympanoplasty. Onal K, Arslanoglu S, Oncel S, Songu M, Kopar A, Demiray U.
34. Otol Neurotol. 2005 Sep;26(5):842-5. Reevaluation of bilateral same-day surgery for bilateral perforated chronic otitis media. Katsura H, Sakagami M, Tsuji K, Muto T, Okunaka M, Mishiro Y, Fukazawa K.
35. J Laryngol Otol. 2005 Aug;119(8):611-3. Results of inlay cartilage myringoplasty in terms of closure of central tympanic membrane perforations : Effat KG.
36. J .otol neuro otol : Is Cartilage tympanoplasty more effective than fascia tympanoplasty ? A systemic review; Shwan H Mohamad , Imran Khan , and S.S Musheer Hussain.
37. Otolaryngology clinics of North America : Cholesteotoma : Cartilage Tympanoplasty : 1161 : John L . Dornhoffer.

38.The Middle ear – role of ventilation in Disease and Surgery . H.Takahashi

PROFORMA

UPGRADED INSTITUTE OF OTORHINOLARYNGOLOGY

RAJIV GANDHI GOVERNMENT GENERAL HOSPITAL

BILATERAL SIMULTANEOUS MYRINGOPLASTY – CARTILAGE VS FASCIA

DETAILS OF STUDY -

Consent for study :

Name :

Age : Sex:

History :

1.DISCHARGE : right left

Duration : :

Nature : :

Dry for how long before Sx :

2.IMPAIRMENT IN HEARING:

Yes or no -

Duration -

3. H/O OF NOSE AND PNS DISEASE:

4.CO MORBID ILLNESS :

EXAMINATION: Right Left

Perforation size :

Small

Medium

MIDDLE EAR MUCOSAL STATUS :

Normal

Thickened but dry

Edematous

Polypoidal

Granular

TUNING FORK TEST

Rinne :

Weber :

ABC :

PURE TONE AUDIOGRAM :

Pure tone average –

Air bone gap-

XRAY MASTOIDS :

CT PNS :

DNE :

NOSE & THROAT EXAMINATION :

SURGERY**Right****Left****PER OP FINDING:**

Perforation size –

Small

Medium

Middle ear mucosal status :

Normal

Thickened but dry

Edematous

Polypoidal

Granular

Ossicular status -

Eustachian tube status -

Normal

Blocked

POST OP OBSERVATION :**GRAFT STATUS -****Right****Left**

1 week

4 weeks

6 weeks

12 weeks

POST OPERATIVE AUDIOGRAM-

Closure of AIR BONE gap

6 weeks

12 weeks

KEY TO MASTER CHART

DOD – R : DURATION OF DISCHARGE RIGHT EAR IN YEARS

DOD – L : DURATION OF DISCHARGE LEFT EAR IN YEARS

HOH – R : HARD OF HEARING RIGHT EAR IN YEARS

HOH – L : HARD OF HEARING IN LEFT EAR IN YEARS

DRY – R : DRY FOR HOW LONG PRIOR TO SURGERY IN RIGHT EAR
IN WEEKS.

DRY – L : DRY FOR HOW LONG PRIOR TO SURGERY IN LEFT EAR IN
WEEKS.

GR- R : GRAFT USED IN RIGHT EAR

GR-L : GRAFT USED IN LEFT EAR

C - CARTILAGE

F – TEMPORALIS FASCIA

MED HIS : PAST MEDICAL HISTORY

PS – R : PERFORATION SIZE IN RIGHT EAR

PS – L : PERFORATION SIZE IN LEFT EAR

M – MEDIUM SIZE PERFORATION

S – SMALL SIZE PERFORATION

TC – TRANSCANAL APPROACH TO SURGERY

XRAY M – XRAY MASTOIDS BOTH EARS

P – PNEUMATISED

S- SCLEROSED

GRA 6 R - GRAFT STATUS IN RIGHT EAR AFTER 6 WEEKS

GRA 6 L -GRAFT STATUS IN LEFT EAR AFTER 6 WEEKS

GRA 12 R - GRAFT STATUS IN RIGHT EAR AFTER 12 WEEKS

GRA 12 L -GRAFT STATUS IN LEFT EAR AFTER 12 WEEKS

RP -RESIDUAL PERFORATION

I - INTACT

PTA –R : PRE OP PURE TONE AVERAGE IN RIGHT EAR IN DECIBELS

PRE PTA – L : PRE OP PURE TONE AVERAGE IN LEFT EAR IN
DECIBELS

PRE ABG R : PRE OP AIR BONE GAP IN RIGHT EAR

PRE ABG L : PRE OP AIR BONE GAP IN LEFT EAR

PTA 6 R –POST OP PURE TONE AVERAGE IN RIGHT EAR 6 WEEKS IN
DECIBEL

PTA 6 L-POST OP PURE TONE AVERAGE IN LEFT EAR 6 WEEKS N
DECIBEL

PTA 12 R-POST OP PURE TONE AVERAGE IN RIGHT EAR 12 WEEKS IN
DECIBEL

PTA 12 L- POST OP PURE TONE AVERAGE IN LEFT EAR 12 WEEKS IN
DECIBEL

POST ABG R -POST OP AIR BONE GAP RIGHT EAR IN 12 WEEKS

POST ABG L - POST OP AIR BONE GAP LEFT EAR IN 12 WEEKS

E – 0 TO 10 DB - EXCELLENT

G – 10 TO 20 DB - GOOD

F – 20 TO 30 DB - FAIR

ET F –R : EUSTACHIAN TUBE FUNCTION RIGHT EAR

ET – L : EUSTACHIAN TUBE FUNCTION LEFT EAR

N – NORMAL

B – BLOCKED

MID MUC R : STATUS OF MIDDLE EAR MUCOSA RIGHT EAR

MID MUC L : STATUS OF MIDLE EAR MUCOSA LEFT EAR

N – NORMAL

A - ABNORMAL

[illegible]

CONSENT FORM

I HEREBY GIVEE CONSENT TO
PARTICIPATE IN THE STUDY CONDUCTED BY DR. B.T. LAVANYA ,
POST GRADUATE IN UPGRADED INSTITUTE OF
OTORHINOLARYNGOLOGY , MADRAS MEDICAL COLLEGE & RAJIV
GANDHI GOVT.GENERAL HOSPITAL , CHENNAI AND TO USE MY
PERSONAL CLINICAL DATA AND RESULTS OF INVESTIGATION FOR
PURPOSE OF ANALYSIS AND TO STUDY THE NATURE OF DISEASE. I
ALSO CONSENT FOR FURTHUR INVESTIGATIONS.

Signature/thumb print of patient :

Date :

Place:

Address:

Signature of the investigator :

Signature of the guide :

TNMGRMU APRIL 2013 EXAMINATI...Medical - DUE 31-Dec-2012

What's New

Originality

GradeMark

PeerMark

Dissertation

BY LAVANYA 22102102 M.S. ENT

turnitin

18%
SIMILAR

--
OUT OF 0

DISSERTATION ON
"A COMPARATIVE STUDY OF CARTILAGE AND TEMPORALIS
FASCIA IN BILATERAL SIMULTANEOUS MYRINGOPLASTY"

Dissertation submitted
in partial fulfillment of the regulations
for the award of degree of

M.S DEGREE BRANCH - IV
OTORHINOLARYNGOLOGY

of

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

UPGRADED INSTITUTE OF OTORHINOLARYNGOLOGY
MADRAS MEDICAL COLLEGE
CHENNAI

APRIL 2013

No Service Currently Active

Done

PAGE: 1 OF 91

Internet | Protected Mode: On

105%