A STUDY OF EFFICIENCY OF AUTOLOGOUS

PLATELET RICH PLASMA IN MYRINGOPLASTY

Dissertation submitted to
THE TAMIL NADU DR.M.G.R. MEDICAL UNIVERSITY

In partial fulfillment of the regulations
For the award of the degree of
M.S., (Oto-Rhino-Laryngology)
Branch – IV

Department of ENT
Kilpauk medical college,
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THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY
CHENNAI

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CERTIFICATE

This is to certify that the dissertation on **"A STUDY OF EFFICIENCY OF AUTOLOGOUS PLATELET RICH PLASMA IN MYRINGOPLASTY"** presented herein by **Dr.R.V.KUMAR,** is an original work done in the Department of Oto-Rhino-Laryngology, Govt kilpauk Medical College, Chennai-10, and submitted in partial fulfillment of the regulations laid down by The Tamil Nadu Dr. M.G.R.Medical University, Chennai for M.S.,Degree Examination Branch IV– Oto-Rhino-Laryngology, under my guidance and supervision during the academic period 2011-2013.

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DECLARATION

I **Dr.R.V.KUMAR** solemnly declare that the dissertation on **"A STUDY OF EFFICIENCY OF AUTOLOGOUS PLATELET RICH PLASMA IN MYRINGOPLASTY"** was done by me at Government Kilpauk Medical College, Chennai-10 under the guidance and supervision of **Prof**.**Dr.G. SANKARANARAYANAN, M.S.,D.L.O.,D.N.B.,M.N.A.M.S.,** Professor &HOD, Department of ENT, Kilpauk Medical College, Chennai.

The dissertation is submitted to the Tamil Nadu DR.MGR medical university towards the partial fulfillment of the requirements of **MS Branch IV – Otorhinolaryngology** degree examination

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The Institutional Ethical Committee of Govt. Kilpauk Medical College , Chennai reviewed and discussed the application for approval entitled "A Study on efficiency of autologus platelet rich plasma in myringoplasty" submitted by Dr.R.V.Kumar, MS, (ENT),Post Graduate Student, Govt. Kilpauk Medical College, Chennai.

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CONTENTS

A STUDY OF EFFICIENCY OF AUTOLOGOUS PLATELET RICH PLASMA IN MYRINGOPLASTY

INTRODUCTION

Chronic suppurative otitis media is defined as chronic inflammation of the mucoperiosteal lining of the middle ear cleft. It is associated with a persistent or intermittent infected discharge through a non intact tympanic membrane.

It is prevalent in developing countries like India and is more common in lower socio economic groups. The incidence is very high among rural population than in urban population. [7] The overall prevalence rate is 46 and 16 persons per thousand in rural and urban population.

Chronic otitis media (COM) is the term that equates with classic term “chronic suppurative otitis media” which is no longer advocated as there is no pus in all case of chronic otitis media. They are now divided into active COM where there is production of pus and inactive COM where there is no pus but can become active at times. [1]

The diagnosis of chronic otitis media implies that there is permanent abnormality of pars tensa or flaccida which results from previous acute otitis media or negative middle ear pressure or otitis media with effusion. The clinical presentation of chronic otitis media varies with

severity of infection, host response, and the time course over which it manifests. [11]

Chronic otitis media (COM) is classified as follows [1]

Types	Synonyms	Findings
Healed COM	Tympanosclerosis / healed perforation	Thinning or opacification of pars tensa without perforation or retraction.
Inactive (Mucosal) COM	Perforation	Permanent perforation of pars tensa without inflammation of middle ear mucosa.
Inactive(Squamous) COM	Retraction	Retraction of pars flaccida or tensa (in the posterosuperior quadrant) that can become active with retained debris.
Active (Mucosal) COM		Permanent defect in the pars tensa with inflammation of

		middle ear mucosa that can discharge mucopus.
Active (squamous) COM	Cholesteatoma	Retraction of pars flaccida and tensa which has retained squamous epithelial debris and associated with inflammation and production of pus.

PATHOLOGY OF CHRONIC OTITIS MEDIA [(1)]

Various histopathological changes occurring in middle ear and mastoid in case of COM are due to direct result of infection and inflammation and due to host response to the disease process.

In inactive mucosal type of COM or dry perforation there is permanent perforation seen in the tympanic membrane without inflammation of middle ear mucosa. The fibrous tissue in the lamina

propria gets thickened around the perforation. Usually the squamous epithelium migrates medially into mucosal layer to some extent.

In Active mucosal COM there will be perforation with ottorrhea. Chronic inflammation of the mucosa of the middle ear leads to edema,submucosal fibrosis, hypervascularity, inflammatory cell infiltrates. There are areas of mucosal ulceration and granulation tissue formation. The subepithelial layer of the middle ear gets thickened by inflammatory edema. Mucoperiosteum is infiltrated by lymphocytes. Mucoperiosteum will appear polypoid. Progression of these mucosal changes can lead to formation of aural polyps which protrudes through the perforated tympanic membrane. This type of COM can lead to resorption of part or all ossicles called as resorptive osteitis. Long process of incus is commonly affected followed by stapes crura, body of incus and manubrium. Inflammatory mediators like interleukin-1, interleukin-6, tumour necrosis factor, prostaglandins, neurotransmitters and nitric oxide leads to pathological process of disease. Tympanosclerotic patch can occur over the tympanic membrane or in the middle ear. It is actually hyaline degeneration of the mucoperiosteum which is followed by calcification and ossification. It

appears as chalky white plaque over the tympanic membrane and as drops of cooled candle wax in the middle ear and can fix the ossicles.

In inactive squamous COM there is retraction pocket due to static negative middle ear pressure. Retraction pocket is an invagination of the part of ear drum into the middle ear space which might be fixed or mobile. Epidermization is an advanced stage of retraction where middle ear mucosa is replaced by keratinizing squamous epithelium without accumulation of keratin debris.

In active squamous type of COM there is cholesteatoma formation which is characterized by retention of keratin debris. Due to retraction the normal migratory pattern of the squamous epithelium is disrupted. It leads to the accumulation of keratin debris. Chronic infection and inflammation in the sac leads to biochemical changes in the local environment which leads to further growth and migration of the squamous epithelium and increased osteoclastic bone resorption. The local inflammation causes mucosal edema and retention of secretion which can further promote infection and this vicious cycle continues. Both mucoperiosteum and underlying bone are affected in the disease process. There is regular osteitic bone erosion mainly involving the postero-

superior bony canal wall, scutum and ossicles. In addition erosion can involve any walls of the middle ear cleft, even the bony labyrinth. These defects are usually covered with inflammatory vascular granulations and there will be new bone formation.

Chronic otitis media results from long term Eustachian tube dysfunction with a poorly aerated middle ear space, multiple bouts of acute otitis media, persistent middle-ear infection or other chronic inflammatory stimulus. The Eustachian tube appears to be the important one in pathogenesis of all forms of COM.

The normal physiological functions of Eustachian tube are

1. Maintain the middle ear gaseous pressure at the level that approximates atmospheric pressure.

2. Prevents reflux of nasopharyngeal contents into middle ear cleft.

3. Mucociliary clearance of middle ear secretion

Both anatomical and functional obstruction of the Eustachian tube can lead to failure of these functions which can result in otitis media.

In our study we analyze the case of chronic otitis media mucosal type only which is one of the common diseases seen in ENT OPD. Tympanic membrane perforation may result from AOM, chronic otitis media, or trauma (injury or surgery). In some instances, a dry, simple perforation results from a single episode of AOM (i.e., necrotizing otitis media). Perforation of the tympanic membrane, especially involving the tympanic annulus, may allow in growth of the keratinizing epithelium of the ear canal or tympanic membrane, leading to cholesteatoma.

These are the mechanisms by which persistent tympanic membrane perforation can occur

1. Majority of cases are following an attack of acute otitis media following which tympanic membrane has failed to heal.

2. Chronic otitis media with effusion can lead to degeneration of fibrous layer of tympanic membrane with subsequent thinning which predisposes to perforation and prevents spontaneous healing

3. Following large traumatic perforations

4. Following extrusion of tympanostomy tube.

The primary symptom is conductive hearing loss, but it can also present with ottorhea, aural fullness, otalgia, and tinnitus.

By the following two mechanisms tympanic membrane perforation can lead to repeated middle ear infections

1. Bacteria can contaminate the middle ear directly from the external auditory canal through the perforated tympanic membrane
2. The intact tympanic membrane usually has a middle ear gas cushion which helps to prevent the reflux of nasopharyngeal secretion into middle ear which will be lost in perforation

MANAGEMENT:

Before starting any antimicrobial therapy a swab of the discharge should be sent for culture and sensitivity. The commonly

isolated bacteria in COM are pseudomonas aeruginosa, Staphylococcus aureus and the proteus species.[7]

Audiological evaluation is necessary to assess the type and degree of hearing loss. Usually most of the patient will have associated conductive hearing loss. As potentially ototoxic ear drops are often used it is very important to record the hearing before starting the treatment.

Radiological investigations particularly X-ray of both mastoids is useful to compare the cellularity of the mastoids. Computed tomography scans are very useful in demonstrating the bony anatomy and are very important if intracranial complications are suspected.

The aim of treatment in mucosal type of COM is to eliminate infection, to prevent further infection and to restore normal functioning of middle ear[7]. There are various nonsurgical and surgical measures available in achieving these aims.

Nonsurgical measures include aural toileting, use of topical and systemic antibiotics. Topical antibiotics are more effective than systemic antibiotics in treating mucosal disease. Some cases of mucosal

type COM resolve with medical management itself and usually no further intervention is needed if the patient is asymptomatic.

If there is recurrence or persistence of ottorhea despite the medical treatment or if the patient is handicapped by conductive hearing loss surgical treatment should be considered. Ideal surgical procedure that has to be done is tympanoplasty after adequate control of infection and after the middle ear mucosa has become healthy. In this situation the chance of successful outcome is very high. Usually tympanic membrane perforation can be closed by doing a procedure called myringoplasty which can be combined with /without ossicular chain repair (tympanoplasty). In resistant cases which were refractory to medical management, tympanoplasty is usually combined with cortical mastoidectomy. In this procedure the aim is to aerate the middle ear and mastoid, remove chronically inflamed tissue; repair the tympanic membrane and ossicular chain.

HISTORY OF MASTOID SURGERY [2].

Mastoid Surgery developed as a treatment for suppurative ear disease. Infections of the ear were recorded as early as 380 BC in the Hippocratic era. In 16th century, Fabricius Hildanus reported a case of spontaneous drainage from a post auricular abscess for which he advocated early incision and drainage. Riolan in 1649 described a procedure similar to mastoidectomy, and John Luis Petit was the first person to perform the surgical trephination of the mastoid in 1774. Petit described exposing the mastoid cortex, performing a trephination, and then enlarging the surgically created fistula. Schwartze repopularized the operation in 1873. Since then, technologic advancements such as the operating microscope, the high-speed drill, and specialized microsurgical instruments have led to significant advances in the treatment of mastoid disease. Regions of the skull base previously thought to be inaccessible such as the petrous apex, the course of the facial nerve, the endolymphatic sac, and the cerebellopontine angle were now within reach.

MYRINGOPLASTY

Various graft materials are available for closing the tympanic membrane perforation. Most commonly used grafting material is temporalis fascia graft. Other materials that can be used are vein, areolar tissue over temporalis fascia, tragal perichondrium, periosteum over mastoid process, meatal skin from bony external auditory meatus, split skin, fat, cartilage, xenografts like bovine pericardium and treated acellular dermal homograft's etc can be used[(11)].

There are various approaches used for myringoplasty like endaural approach, post auricular approach and transcanal approach.

Endaural approach is usually indicated for small and medium sized perforations of the tympanic membrane with good hearing and dry ear. If the anterior edge of the perforation is concealed by the anterior meatal wall then this approach can be used.

Post auricular approach is usually indicated for large perforation extending widely into the anterior edge of the tympanic membrane. This approach was done in majority of our cases.

Transcanal approach is used for smaller perforations in the posterior quadrant, especially when the size of the ear canal is large. The procedure is done using the microscope or endoscope. This approach eliminates the need for mastoid dressing, postaural pain, hematoma and infection. There are two popular grafting techniques underlay and overlay technique. In our study we did underlay myringoplasty.

Failures do occur following this procedure due to displacement of graft and improper closure leading to residual perforation. To improve the graft take up rate various biomaterials or biological tissues like autologous serum, autologous platelet rich plasma, epidermal growth factor, alloderm, merogel, embryonic stem cell, royal jelly, seprafilm, chitosan patch, silk patch are used during myringoplasty with varying results.

PLATELET RICH PLASMA (PRP):

Recently biological material obtained from the patient is used with varying success rates. In our study we have planned to use platelet rich plasma because it is an autologous platelet rich concentrate which is available from patient own blood. By concentrating the platelets

we can increase the growth factors. Application of this platelet rich plasma during myringoplasty can prevent the graft displacement and can also promote the faster healing of the perforation thereby improving and hastening the outcome.[3]

Platelet rich plasma was first used in cardiothoracic surgery. M.ferari used platelet rich plasma in 1987 after an open heart surgery. Now it is widely used in various fields like dentistry, orthopedics, otorhinolaryngology, maxillofacial surgery, dermatology, plastic and cosmetic surgery, urology, wound healing etc.

The role of tissue oxygenation in wound healing was established and extensively investigated during 1980's. Tissue oxygenation helps in increasing phagocytic and bactericidal activity of the host cell as well as helps in synthesis of collagen and other proteins. Moreover there is strong link between tissue oxygenation and growth factors which has been well established [17]. Platelets isolated from the blood forms a rich autologous source of growth factors. When these platelets are concentrated and applied to the surgical site, more predictable outcome can be expected. Platelet rich plasma is such an autologous platelet concentrate. A blood clot is the important factor in soft tissue

healing in all natural wounds. Platelet rich plasma is a similar strategy where platelet concentrate which is an enriched natural blood clot is produced which initiate a more rapid and complete healing process. A natural blood clot usually contains 95% RBC's, 5% platelets, and less than one percent of white blood cells and numerous amount of fibrin strands. A platelet rich plasma blood clot contains 95% of platelet, 4% of RBC's and 1% of WBC's. [17]

Earlier recombinant growth factors were used commonly for soft tissue and bone healing. The use of PRP in place of these recombinant growth factors has several advantages. The growth factors obtained from platelets are autologous; upon degranulation they have specific action on the tissues and also interact with other growth factors in the body which results in gene activation and specific protein production. So the properties of PRP are based on the production and release of multiple growth factors and differentiation factors that are released upon platelet activation. These factors play an important role in cellular process like chemotaxis, mitogenesis, differentiation and metabolism.

The following growth factors are released from platelets upon degranulation

1. Platelet derived growth factors (PDGF)
    - They are released by platelets, macrophages, monocytes, endothelial cells and smooth muscle cells.
    - Stimulates DNA and protein synthesis.

2. Transforming growth factor beta (TGF-b)
    - Released platelets, T-Lymphocytes, neutrophils, macrophages and monocytes.
    - Stimulates angiogenesis and endothelial chemotaxis.

3. Platelet derived angiogenesis factor (PDAF)
    - Released by platelets, endothelial cells, chondrocytes and macrophages.
    - Mitogenic effect on endothelial cells
    - Increases vessel permeability and angiogenesis.

4. Insulin like growth factor-1 (IGF-1)
    - Released by platelets, osteoblasts and macrophages.
    - Enhances rate and quality of wound healing.

5. Platelet factor -4 (PF-4)
    - Released by platelets
    - Chemo attractant for fibroblasts and neutorphils

6. Interleukin 8
7. Epidermal growth factor
8. Fibroblast growth factor
9. Connective tissue growth factor
10. Insulin-like growth factor 2
11. Vascular endothelial growth factor
12. Keratinocyte growth factor

The above mentioned growth factors are small proteic fragments belonging to cytokine group. Cytokines usually join to the membrane receptors which results in activation or inhibition of cellular functions. A type of regeneration which is specific for the tissue is produced. They

intervene in intercellular communication, needed function of the moment, type of cells surrounding them and their location at that moment. Fibroblasts get activated by the influence of these platelets. The platelet derived growth factor stimulates cell proliferation, fibroblast chemotaxis and collagen synthesis. The transforming growth factor controls cell proliferation, it has intrinsic inflammatory activity and increases extracellular matrix formation and tissue repair. The epidermal growth factor promotes keratinocyte production, fibroblast chemotaxis, it stimulates angiogenesis and a provisional matrix formation. In short the growth factors promote regeneration of new functional tissue that is similar to the original one.

Now it is well understood that platelets have many functions beyond simple hemostasis. Whitman et al cites PRP an "autologous alternative to fibrin glue" [17]. Fibrin glue is obtained from the blood bank donations and it has been used for many years as haemostatic agent and surgical adhesive. The difference in composition between PRP and Fibrin Glue is presence of a very high concentration of platelets and patient's own fibrinogen in PRP.

PREPARATION OF PRP:

PRP can be prepared by two techniques.

1. General-purpose cell separators
2. Platelet-concentrating cell separators

1. **General-purpose cell separators:**

They require large amount of blood (450 ml) and requires good hospital setup. Blood is drawn into the collection bag which contains citrate phosphate-dextrose anticoagulant and is first centrifuged at 5,600 rpm to separate RBCs from platelet-poor plasma (PPP) and PRP. Next the centrifugation speed is reduced to 2,400 rpm and final separation of about 30 ml of PRP is obtained from the RBCs. The remaining PPP and RBCs can be returned to the patient's body or can be discarded.

2. **Platelet-concentrating cell separators:**

They require small quantity of blood and can be prepared by in clinic itself. The preparation and the processing of PRP is similar in most of the platelet-concentrating systems but the anticoagulant used and

the speed and duration of centrifugation might differ with different systems.

1. Venous blood is taken into a tube containing an anticoagulant which avoids platelet activation and degranulation.

2. The first centrifugation is a "soft spin", which separates blood into three layers, namely bottom-most layer containing RBC (55% of total volume), top most acellular layer called Platelet Poor Plasma- PPP (40% of total volume), and an intermediate Platelet Rich Plasma layer (5% of total volume) called the "Buffy coat".

3. Using a syringe PPP, PRP and some RBCs into another tube without an anticoagulant.

4. This tube now undergoes a second centrifugation; it is longer and faster than the first one, so called "hard spin". This allows the PRP to settle at the bottom of the tube with a very few RBCs. The acellular plasma (80% of the volume) is found at the top.

5. PPP is removed with a syringe and discarded and the remaining PRP is shaken well.

6. This PRP is mixed with bovine thrombin & calcium chloride during the time of application which results in gelling of this platelet concentrate.

SIDE EFFECTS OF PRP:

Since it is an autologous preparation, PRP is inherently safe and therefore it is free from transmissible diseases such as HIV, Hepatitis etc. During the preparation of PRP calcium chloride and bovine thrombin are used. It has been found that the use of this bovine thrombin can lead to the development of antibodies to the factors V, XI and thrombin which results in the risk of life threatening coagulopathies. Bovine thrombin preparation contains factor V, which can result in the stimulation of immune system when challenged with a new protein.

PLATELET RICH FIBRIN (PRF):

PRF was first developed by Choukroun et al in France. It is usually called as second generation platelet rich plasma. It has several advantages over traditionally PRP. The chief advantages are

- The ease of preparation and

- The absence of biochemical handling of the blood, which makes this preparation purely autologous.

PREPARATION OF PRF:

The preparation of PRF is very simple procedure. Since we do not use bovine thrombin for the preparation; PRF is free from the associated risks.

- The required quantity of blood is taken into 10ml test tubes
- No anticoagulant was added.
- It was centrifuged immediately.
- Blood is centrifuged using a tabletop centrifuge, which is easily available in most of the labs.
- It is centrifuged for 12 min at 2,700 rpm.

The resultant product consists of the following three layers:

- Topmost layer consisting of acellular Platelet poor plasma.
- PRF clot is in the middle
- RBCs at the bottom

Because of the absence of the anticoagulant, blood begins to coagulate very soon when it comes in contact with the glass surface. So for successful preparation of PRF, quick blood collection and centrifuging it immediately before the clotting cascade is initiated is necessary. PRF can be applied to surgical site. In our study we have used this second generation platelet rich concentrate. The growth factor content (PDGF and TGF-β) was comparable in both PRF and PRP. PRF has many advantages over usually prepared PRP. It eliminates adding anticoagulant and neutralizing it. The addition of bovine-derived thrombin which promotes the conversion of fibrinogen to fibrin in PRP is also eliminated. All these steps considerably reduce biochemical handling of blood and reduce the risk associated with the bovine derived thrombin. The conversion of fibrinogen into fibrin occurs slowly with the available small quantities of physiological thrombin present in the blood sample itself. Thus there is a normal physiologic architecture which is very favorable to the healing which is obtained due to this slow polymerization process.

For repairing the tympanic membrane there is always a search for new biomaterials or biological tissues which has a better outcome, lower cost, safety, structure similar to tympanic membrane.

Though temporalis fascia and tragal perichondrium are commonly used graft material, there are lot of differences in outcome which depends upon experience of surgeon and patients own tissue repair response.

ANATOMY OF MIDDLE EAR CLEFT

The middle ear is an air-filled cavity formed by extension of the foregut into the analage of temporal bone. The expanding first pharyngeal pouch forms multiple cul-de-sacs that join to form a common airspace partitioned by the ossicular chain and its associated ligaments and mucosal folds. The resorption of mesenchymal tissue further expands the size of middle ear and mastoid into niches, various compartments, and bony tracts of air cells. These additional areas vary considerably among different individuals and between ears, also influenced by heredity, airflow via the Eustachian tube, and the disease in the early years of life.

Middle ear cleft includes Tympanic cavity proper, mastoid air cell system and the Eustachian tube.

There are 3 parts in the tympanic cavity namely

- Epitympanum – Portion of the middle ear which is above the level of neck of malleus.
- Mesotympanum – Portion of the middle ear that lies between the two horizontal lines drawn at the level of upper and lower edges of pars tensa of the tympanic membrane
- Hypotympanum – Portion of the ear that lies below the level of bony ear canal.

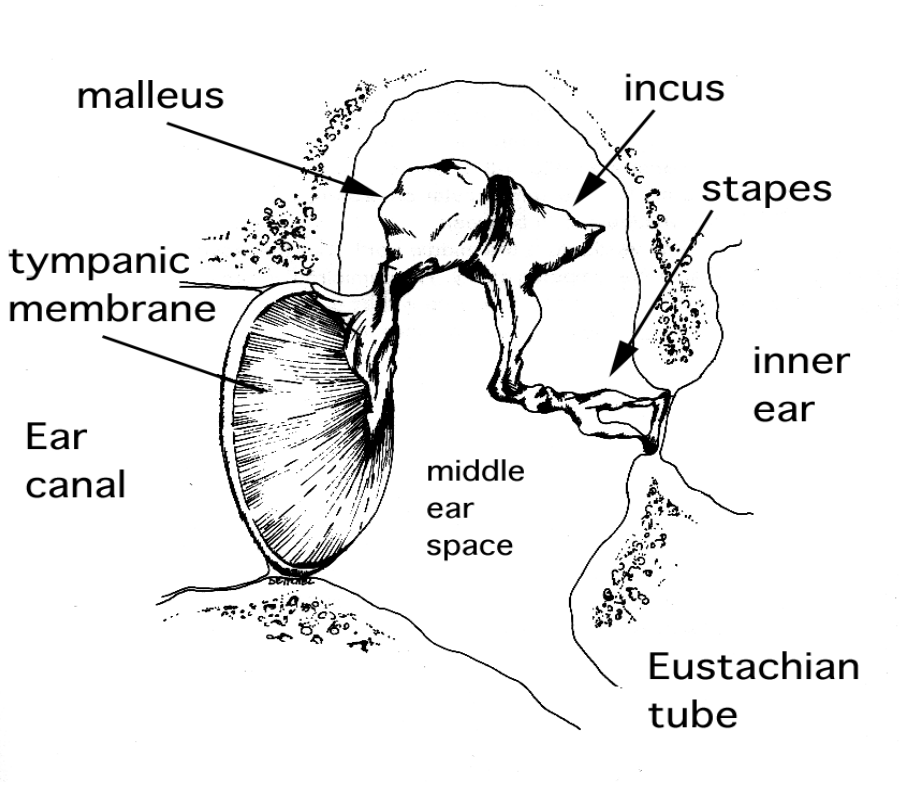


Fig.1. Tympanic cavity

Roof of the tympanic cavity is formed by petrous part of temporal bone. It is called as Tegmen tympani.

Floor of the tympanic cavity is a formed by a bone which separates it from the Jugular Bulb.

Lateral wall is partly bony and partly membranous. Most of it is formed by Tympanic membrane. The lateral epitympanic wall is wedge shaped bone and its lower bony wall is called the SCUTUM (Shield of Liedy).

The anterior wall mainly consists of three parts

- Superiorly the opening for canal of Tensor tympani muscle
- In the middle part there is an opening for auditory tube
- Inferiorly there is a thin plate of bone which separates the middle ear from the internal carotid artery. This plate is traversed by the superior and inferior Carotico- tympanic nerves and the tympanic branches of internal carotid artery.

The bony canal between the two tensor tympani and Eustachian tube continues posteriorly on the medial wall like a curved lamina which is called Proccessus cochleariformis. The posterior end of this process forms a pulley around which this tensor tympani muscle turns 90 degrees to get attached to the upper part of handle of malleus.

In the medial wall the most prominent structure that is visualized is Promontry which is actually the basal turn of cochlea. It is grooved by Tympanic plexus. Fenestra Vestibuli or Oval window is an oval shaped opening in the posterosuperior aspect of medial wall. This opening leads into the vestibule of the inner ear and it is closed by foot plate of stapes. Fenestra Cochleae or Round window is an opening in the bottom of the depression posteroinferior to the promontory. It opens into Scala tympani of the cochlea and it is closed by a thin membrane called secondary tympanic membrane. Facial nerve runs backward just above the oval window, towards the lower margin of additus. The canal then descends behind the posterior wall to end in Stylomastoid foramen.

In the Posterior wall of the Tympanic cavity there is an opening in the superior part which is called as aditus, through which

epitympanic recess communicates with mastoid antrum. Fossa incudis is a depression which lodges the short process of incus. There is a conical projection in the posterior wall called as pyramid with an opening in its apex. This opening transmits tendon of stapedius muscle which gets attached to the posterior surface of neck of stapes. Lateral to the pyramid and near the posterior edge of the tympanic membrane, there is posterior canaliculus for chorda tympani through which nerve enters the middle ear cavity. The space which is bounded laterally by vertical part of facial nerve and medially by promontory is called sinus tympani which can be the site of hidden cholesteatoma. Facial recess is the space which is bounded medially by the vertical part of facial nerve and laterally by tympanic annulus.

ARTERIAL SUPPLY

- Anterior tympanic branch of maxillary artery enters through the petrotymapnic fissure.
- Posterior tympanic branch from stylomastoid branch of posterior auricular artery enters through the stylomastoid foramen.

- Superior tympanic branch from the middle meningeal artery which enters through the tympanic canaliculus.
- Tympanic branch from the artery of pterygoid canal enters through the canal for auditory tube.
- Caroticotympanic branch from internal carotid artery
- Petrosal branch from middle meningeal artery enters through the hiatus for greater petrosal nerve

VENOUS DRAINAGE:

Veins from the middle ear drain into

- Superior petrosal sinus.
- Pterygoid plexus of veins.

LYMPHATIC DRAINAGE:

Lymphatics drain to

- Preauricular nodes.
- Retropharyngeal nodes

NERVE SUPPLY:

Nerve supply is derived from the tympanic plexus which is present over the promontory. The plexus is formed by

- Tympanic branch of glossopharyngeal nerve which is otherwise called as Jacobson's nerve. It supplies mucous membrane of middle ear, Eustachian tube, mastoid antrum, and air cells.
- Superior and inferior caroticotympanic nerves from the sympathetic plexus around internal carotid artery. These fibers are vasomotor to the mucous membrane.

MIDDLE EAR MUCOSA:

The middle ear mucosa is pseudo stratified ciliated columnar epithelium near the Eustachian tube and becomes cuboidal near the facial nerve. The epithelium is flat, pavement type in the attic region. Goblet cells present in the mucous membrane secrete mucus. Goblet cells are in higher concentration near the Eustachian tube. The mucous membrane lining the tympanic cavity forms various mucosal folds which divides it into numerous compartments.

Both the ossicular chain and associated mucosal folds partition the middle ear. Separation of mesotympanic and epitympanic regions is by the tensor fold, the interosseous fold and the medial incudal fold, leaving the isthmus tympani anticus and isthmus tympani posticus as the only remaining openings. Other mucosal folds are obturatoria stapedis, plica stapedis, superior incudal fold, anterior malleal fold, superior malleal fold, incisura tensoris, anterior malleal ligament, superior malleal ligament and posterior incudal ligament.

There are various pouches and spaces which are formed as the result of these mucosal folds.

PRUSSAK'S SPACE:

It is bounded

- Laterally by pars flaccida
- Medially by neck of malleus
- Inferiorly by lateral process of malleus
- Superiorly by lateral malleolar fold

POSTERIOR POUCH OF VON TROELTSCH:

It lies in between the tympanic membrane and the posterior malleolar fold. It opens inferiorly.

ANTERIOR POUCH OF VON TROELTSCH:

It lies in between the tympanic membrane and the anterior malleolar fold.

OSSICLES:

There are 3 ossicles in the middle ear which conducts the sound from external ear to inner ear. They are Malleus, Incus and Stapes.

Malleus

It is the lateral and largest of the ossicles. It is about 8 to 9 mm long. It has the following parts

1. Head – It is rounded and lies in the attic. It articulates posteriorly with the body of incus. It provides attachment to the superior and lateral malleolar ligaments.

2. Neck – Lies against the pars flaccida and is related medially to Chorda tympani.
3. Anterior process – It is connected to the petro tympanic fissure by the anterior malleolar ligament.
4. Lateral process – It projects from upper end of the handle and provides attachment to the malleolar folds.
5. Handle – Extends downwards, backwards and medially and it is attached to upper half of the tympanic membrane.

Incus

It has following parts

1. Body – Large with its articular surface directing forwards.
2. Short process – It is directed backwards and is fixed to fossa incudis just below the aditus.
3. Long process – Projects downwards into the cavity just behind and parallel with the handle of malleus. Its tip bears a lentiform process which is directed medially to get articulated with stapes head.

Stapes

This is the medial most and smallest of the 3 ossicles. It has following parts

1. Head – It is a small concave facet which articulates with the lentiform nodule.
2. Neck – It is the narrowest part which provides insertion posteriorly to the thin tendon of stapes.
3. Crura – They are 2 in number, the anterior and posterior one. The anterior crura is shorter and less curved. The limb diverges from neck and gets attached to the foot plate.
4. Foot plate – It is oval in shape and fits into fenestra vestibuli.

TYMPANIC MEMBRANE

The tympanic membrane forms the medial limit of the External auditory canal and most of the lateral wall of the middle ear space. It is a three-layered, concave-shaped thin membrane connected centrally to the manubrium of handle of malleus and peripherally to the

tympanic sulcus. The tip of the malleus is attachment produces a depression known as the umbo.

Fibrous layer of the tympanic membrane is divided into two dense layers an outer layer and a deeper layer, which provide the structural support for thin EAC skin laterally and middle ear mucosa medially. The outer radial fibrous layer inserts on the manubrium of the malleus, and deeper circular fibrous layer is arranged circumferentially close to the circumference of the tympanic membrane. Both layers become integrated in the periphery to form a fibro cartilaginous ring, the annular ligament which anchors the tympanic membrane to a bony sulcus in the tympanic ring. This tympanic sulcus terminates superiorly at anterior and posterior spines, to which the most superior edge of the fibrous layer is attached to form posterior and anterior mallear folds that insert on the lateral process of the malleus. The small area of tympanic membrane located superior to the anterior and posterior mallear folds lacks a fibrous layer and is attached superiorly to the bony rim of the notch of Rivinus. The thinner superior segment of tympanic membrane is known as pars

flaccida or Shrapnel's membrane, and the thicker inferior area is known as pars tensa.

The round window, long process of the incus, incudostapedial joint, and chorda tympani are identifiable through the intact tympanic membrane to varying extent, depending on its translucency, extent of its retraction, and the mucosal status within the middle ear.

EUSTACHIAN TUBE:

The Eustachian tube serves as the conduit through which atmospheric air is exchanged between the middle ear and upper aero digestive tract. It is angled about 45 degrees from the middle ear to the nasopharyngeal opening. The proximal one third of the tube is formed by petrous bone. The distal two third segment is formed by fibro cartilaginous tube. The fibro cartilaginous portion is an open tube that is shaped like an inverted "J" in its cross section. A fibrous membrane closes the tube laterally. The tensor veli palatini muscle gets inserted on to this membrane retracting it during muscular contraction to enlarge the

lumen during swallowing and yawning. The bony-cartilaginous junction is the narrowest part of the Eustachian tube. The internal carotid artery is in close relation with the medial wall of the Eustachian tube near its tympanic opening, where sometimes the overlying bone may be very thin or even dehiscent.

AIMS OF STUDY

To study the efficiency of use of autologous platelet rich plasma in closure of tympanic membrane perforation during myringoplasty by

- Preventing the graft displacement.
- Promoting quicker healing.
- Improving the overall outcome.

MATERIALS AND METHODS

STUDY DESIGN

Cohort study / Prospective Observational study of myringoplasty done in our institution during the study period.

STUDY CENTRE& POPULATION

Study was conducted in patients who undergone myringoplasty at Government Kilpauk Medical College hospital and Government Royapettah hospital during the study period.

STUDY PERIOD

November 2011 to December 2012.

FINANCIAL SUPPORT

Self.

INCLUSION CRITERIA

- Chronic otitis media inactive mucosal disease (central perforation with dry ear) without discharge for at least 6 to 8 weeks

EXCLUSION CRITERIA

- Children below 12 years of age.
- Active ear disease.

- Atopic ear conditions.
- Diabetes mellitus.
- Other systemic illness like autoimmune disease, active neoplastic disease.
- Patient on immunosuppressant drugs.

The above patients were excluded from the study.

CONTROL GROUP

Patient in whom platelet rich plasma is not used for myringoplasty during the same study period are taken as control group.

PATIENT HISTORY

History taking is very important as this gives valuable income regarding age at onset, drainage, Eustachian tube function, and previous surgery etc.

Patient with chronic otitis media mucosal disease were randomly selected from the OPD of our institution. They were first subjected to examination under microscope. Otoscopic examination with the aid of microscope is the gold standard for diagnosis of COM [(1)]. Microscopic examination is the most important aspect of the initial evaluation. It should be accomplished with the patient in the supine position. This allows an assessment of ear canal size in the surgical position, bend of the neck, shoulder elevation, anticipated comfort of the surgeon in a seated surgical position, and patient tolerance for examination. The contra lateral ear is carefully examined first and serves as a point of reference. The status of the middle ear mucosa in the surgical ear will dictate topical preoperative treatment.[(10)] This also facilitates aural toileting which can be done by suction, irrigation, mopping or instrumental removal. Under microscopic magnification all areas can be fully visualized

and perforation edges can be can be clearly seen. Ossicular chain status can be assessed. Findings like presence of granulation, in growth of squamous epithelium from edges of perforation, tympanosclerosis and adhesions can be seen. Though anatomically pars tensa is divided into four quadrants, pathologies like perforations are usually anterior, posterior or inferior. Hence division into thirds rather than quarters is preferred.

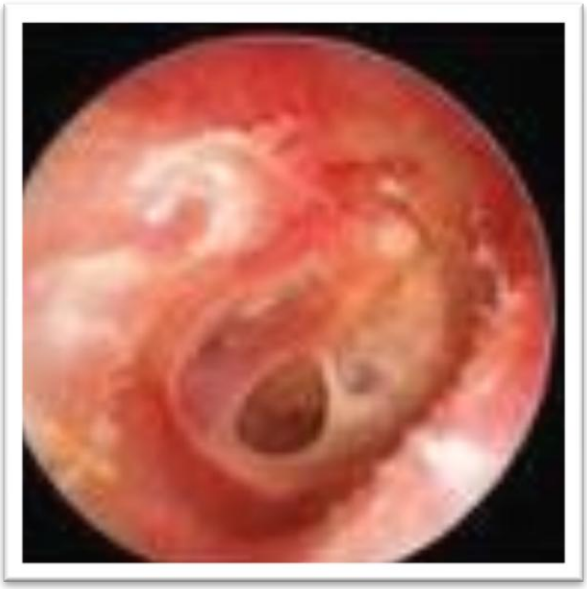


Fig.2.Small central perforation

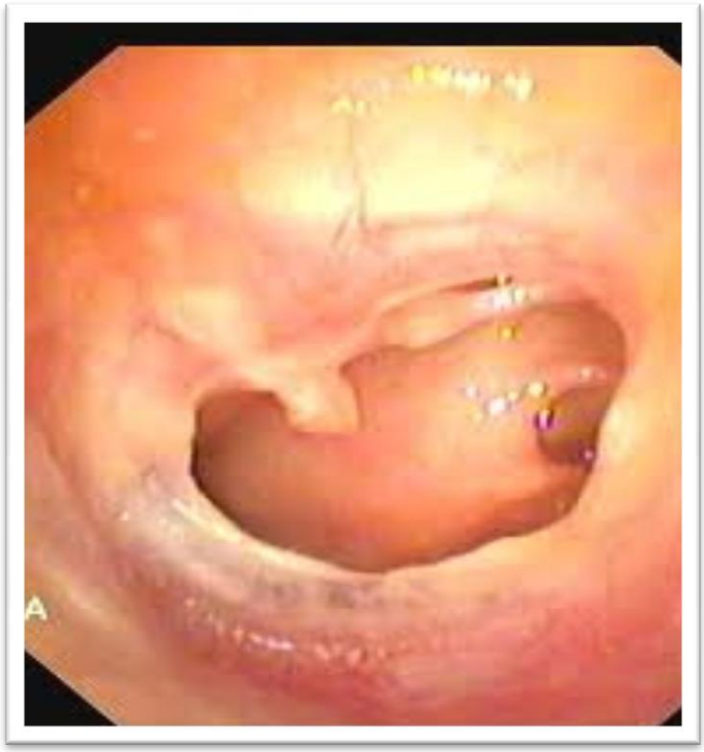


Fig.3.Subtotal perforation

Pus was sent for culture and sensitivity. The bacteriological culture is of potential value in starting specific antibiotics. All the patients with active ear disease were treated upto one month with specific antibiotics.

Diagnostic nasal endoscope was done for all patients. Those who had nasal obstruction and features of chronic sinusitis were subjected to computerized tomography of paranasal sinus. Patients with symptomatic

septal deviation and chronic sinusitis initially underwent Functional endoscopic sinus surgery with septal correction.

Pure tone audiogram is done in all patients which is helpful in assessing degree and type of hearing loss. Usually patients will have conductive hearing loss in this type of illness. It also helped us in deciding the ear to be operated first in case of bilateral disease. In case of bilateral disease usually more symptomatic and worse ear is operated first. It is important to assess whether there is any associated senosrineural hearing loss.

After achieving dry ear for six to eight weeks patient is subjected to X-ray of both mastoids – Law's view or lateral oblique view. X-ray showed sclerotic mastoid or clouding or air cells or cellular mastoid. Depending upon the X-ray finding the surgical procedure was planned. Patients with sclerosed mastoids and clouding of air cells underwent cortical mastoidectomy with myringoplasty with or without ossicular reconstruction. Patients with cellular mastoid underwent myringoplasty alone with or without ossicular reconstruction.

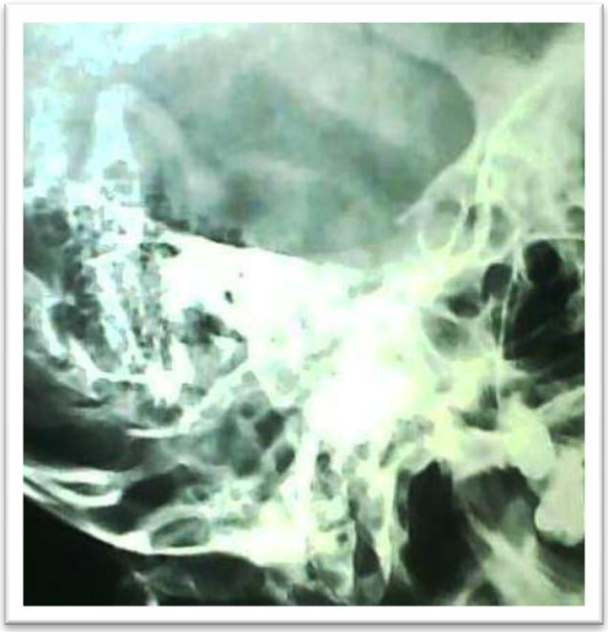


Fig.4.cellular mastoids

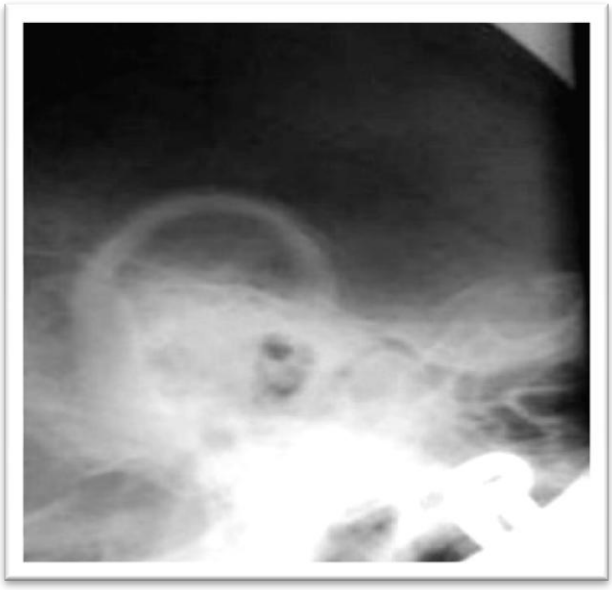


Fig.5.sclerosed mastoids

All the cases in whom cortical mastoidectomy with myringoplasty was done was performed under general anaesthesia. The two principal incisions used for access to the mastoid cortex are the post auricular incision of Wilde and the endaural incision of Lempert. [10] The post auricular incision provides better overall exposure and allows complete access to the mastoid tip. In adults, the incision is placed 8 to10 mm posterior to the post auricular sulcus where it is hidden by the pinna. This incision can be placed more posterior for wider exposure. It should not be placed directly in the post auricular crease, however, because this creates a deep, difficult to clean post auricular furrow. In children younger than 2 years, the inferior portion of this incision must be placed more posterior than in adults. This is because the tympanic ring in children is underdeveloped, mastoid pneumatization is incomplete, and the stylomastoid foramen is quite shallow.

Therefore, the facial nerve is vulnerable to injury. The surgeon should also keep in mind that congenital anomalies of the temporal bone can result in highly variable facial nerve position.

The post auricular incision is first outlined with a marking pen.

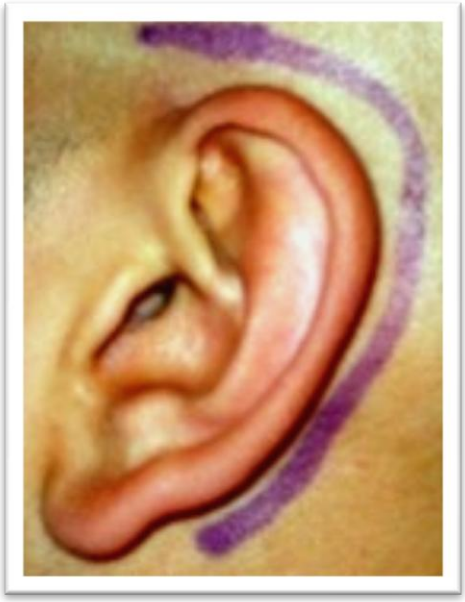


Fig.6.William Wilde’s postaural incision

Infiltration is given with a mixture of local anesthetic and epinephrine. The skin and subcutaneous tissues are incised sharply down to the periosteum overlying the mastoid cortex. The ear flap is elevated anteriorly to identify the posterior edge of the external ear canal.

TEMPORALIS FASCIA HARVESTING:

In 1959, kley first described using muscle fascia for closing tympanic membrane perforation. The temporalis fascia can be taken from the operative field in both transmeatal and post auricular approach. Incision was extended superiorly and temporalis fascia graft is harvested. The fascia 1 cm above the supramastoid crest is usually preferred because it is thin and suitable for grafting the tympanic membrane. Fat adhered to the fascia is removed. Smooth muscle side of fascia should be turned inside the middle ear while placing the graft. Before placing the fascia it should be allowed to dry so that it can get adapted better.

Fig.7.Temporalis fascia graft

The incision is then extended into the subcutaneous tissue. Soft tissue and post auricular muscles are divided. A T-shaped incision is made through the soft tissues and periosteum overlying bone. The superior limb is placed along the inferior temporal line (inferior margin of the temporalis muscle) starting at a point just superior to the anterior-superior ear canal. This incision extends posterior as far as is needed for adequate exposure. An inferior limb to the T- is fashioned from the mastoid tip to the superior limb just described.

Periosteal elevators are then used to elevate the periosteum of the mastoid cortex toward the posterior margin of the ear canal. Superior to the ear canal, the periosteum should be elevated anteriorly along the zygomatic root. Inferior to the ear canal, the surgeon should elevate periosteum to the anterior margin of the superior aspect of the mastoid tip. Periosteum and meatal skin are elevated. The meatal skin is now incised about 5 to 6 mm from the edge of the tympanic membrane. Edges of the perforation are freshened and tympanomeatal flap is elevated. Ossicular chain status is noted. The mastoid is opened through its cortical surface with a drill.

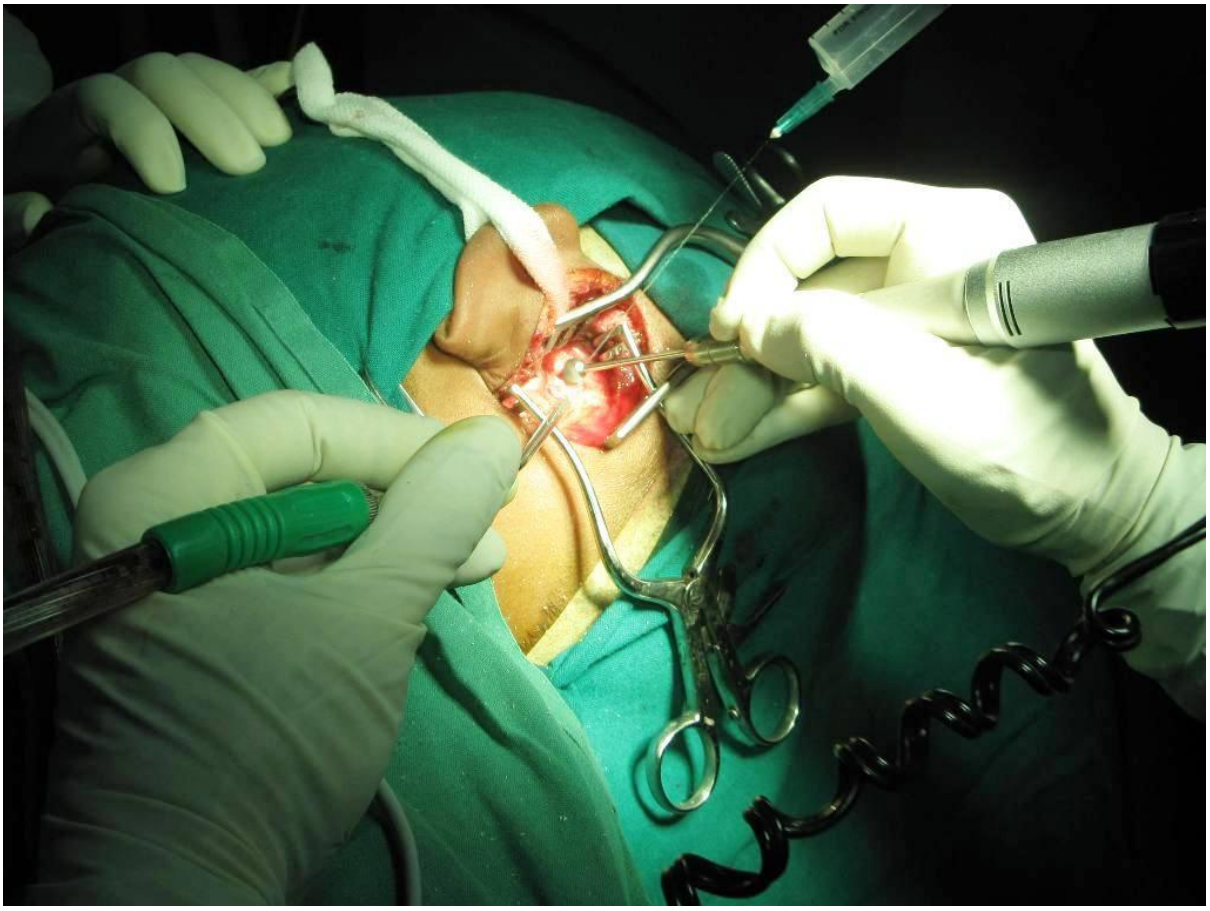


Fig.8.showing cortical mastoidectomy is being performed

The temporal line, spine of Henle, cribrose area, and posterior ear canal are used as the initial landmarks for drilling. Mastoid antrum is usually located at a distance of 1 to 1.5 cm from the surface of the mastoid cortex. After opening the antrum, additus is widened and drainage

established. It is followed by myringoplasty by underlay technique with or without ossiculoplasty.

UNDERLAY MYRINGOPLASTY TECHNIQUE:

- Skin incision made in post auricular fold or behind the fold.
- Soft tissues and postaural muscles are cut and periosteum is elevated as described earlier.
- Tympanomeatal flap is elevated after incision around edge of perforation has been made.

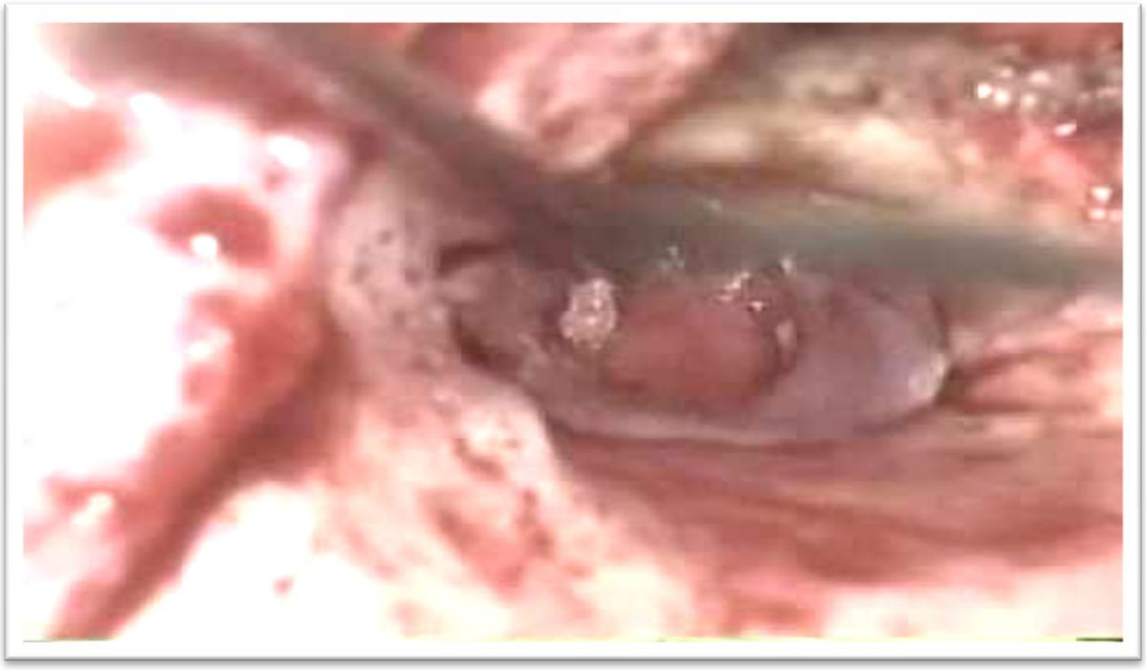


Fig.9.Tympanomeatal flap elevation

- Ossicular chain status is examined.
- After clearing the disease in the middle ear, the fascia is laid in the tympanic membrane from the middle ear side, overlapping the perforation on all edges.
- Tympanomeatal flap is repositioned.

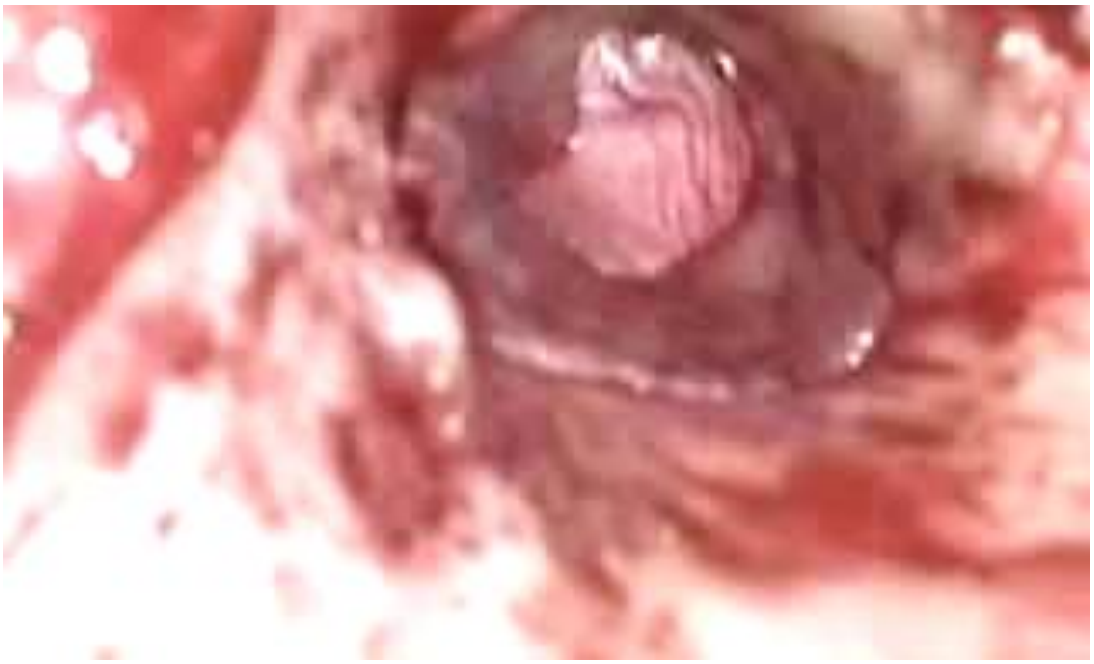


Fig.10.Underlay myringoplasty done

- Second generation Platelet rich concentrate, the platelet rich fibrin was prepared and it is applied to the edges of perforation and ear canal packed with gel foam

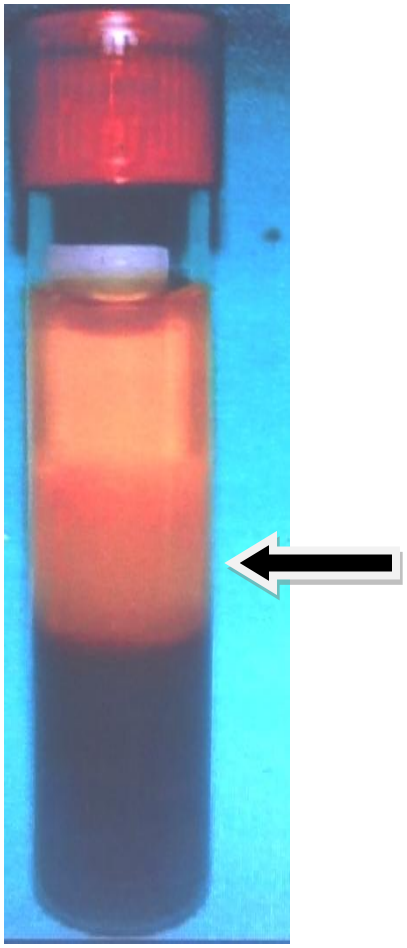


Fig.11.platelet rich fibrin preparation.

The superficial platelet poor plasma layer is removed and the middle layer which is a Buffy coat containing platelet clot is taken out.

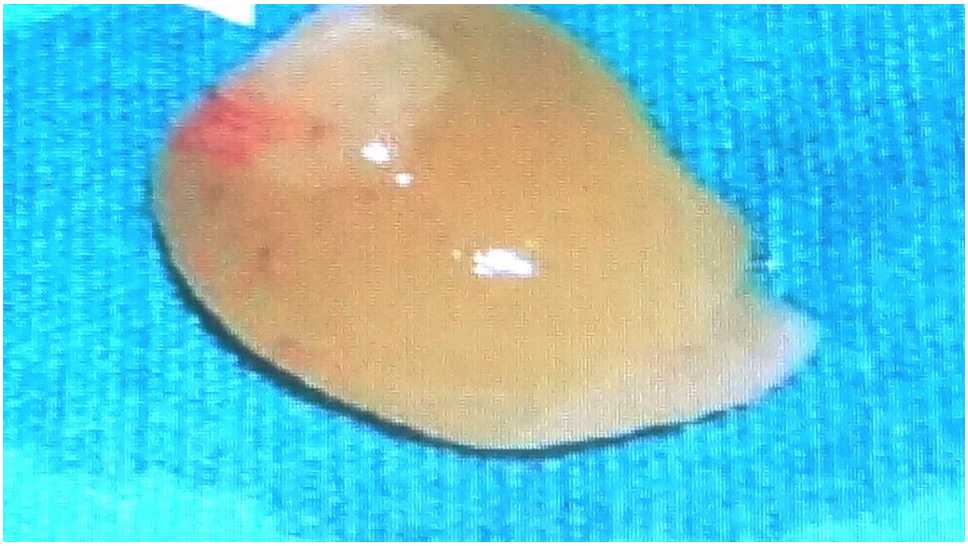


Fig.12.Middle PRF layer

ENDOSCOPIC APPROACH:

Endoscopic myringoplasty was done in few of our patients with wide canal and small perforation. Endoscopes often see where the microscope cannot. The surgeon's view through the operating microscope depends on a clear line of sight. A 30-degree rigid telescope,

however, can look around a corner to visualize the facial recess, sinus tympani, or epitympanum.

All the patients were under antibiotic cover in the postoperative period. Sutures were removed on 7th postoperative day and patients were given oral antibiotics and antihistamines. Patients were on a regular follow up every 15 days for 3 months.

REVIEW OF LITERATURE

The UK national study of hearing has examined the relationship between chronic otitis media and age, sex and socioeconomic status [1].

According to their study the prevalence of COM is equal in males and females. The incidence is double in 41 to 80 years age group as compared to 18 to 40 years age group.

The disease is more common in low socioeconomic status. The manual workers are twice commonly affected than the nonmanual workers.

The population prevalence of inactive COM in 18 to 40 years age group is 2.5 and active COM is 0.9. In 41 to 60 years age group inactive COM is 2.1 and active COM is 2.1 and in 61 to 80 years age group inactive COM is 2.7 and active COM is 2.1. This study concludes that the disease is common in 41 to 80 years age group.

The population prevalence of inactive COM in manual workers is 2.8 and active COM is 2.2, whereas in nonmanual workers it is 1.9 and 0.8 respectively.

In 1982 a prospective study about the bacteriology in chronic otitis media was conducted by Sweeney G Picozzi GL, Browning GG [(1)].

According to their study 64 percent of culture had only aerobes, 32 percent both aerobes and anaerobes and 5 percent had no growth. They also observed that in those patients with aerobes, most of them had several isolates with a mean of 2.5 different aerobes.

The common aerobic bacteria isolated from patients with active COM were proteus species which is seen in most of the cases followed by staphylococcus aureus and pseudomonas. Proteus species was seen in almost 95% of ear isolates with aerobic infection.

So they concluded that microbiology culture usually yield multiple organisms and it depends on patient population, climate, whether antibiotic has been used or not.

- Michael Gleason/ Scott Brown's, otorhinolaryngology head and neck surgery – 7th edition - page 3408 – 3410.

A study conducted by Bluestone et al in 1989 to study the relationship between Eustachian tube and middle ear disease [19].

He found that Eustachian tube dysfunction is the main cause for middle ear disease. He stated that diseases in the sinuses like chronic sinusitis and other upper respiratory tract infection is the common cause for Eustachian tube dysfunction. According to his study adenoids are less common cause for Eustachian tube dysfunction as compared to sinus disease.

The lining mucous membrane of middle ear continues with that of Eustachian tube. The membrane is also same in sinuses, nose and throat. Any infection in these areas will cause mucosal swelling which in turn can lead to Eustachian tube mucosal swelling.

So in case of persistent otorrhea if there is associated sinus disease it is necessary to treat the sinus disease first to achieve a positive outcome.

A pilot study is being conducted by Maria Lucia Navarrete Alvaro on efficiency of biostimulation with autologous plasma rich in platelet growth factors in myringoplasty. It's an ongoing prospective, longitudinal, observational study at university of Barcelona, Spain [(3)].

They performed Type I Tympanoplasty using a PRP graft from the own patient, obtained at the Blood and Tissue Bank. They did on lay myringoplasty which is technically simpler method with lower morbidity for the patient and a perforation seal guarantee.

Three patients with chronic otitis media inactive stage have been selected for the study and procedure was done. The results were valued based on the tympanic membrane closure index.

According to their study the tympanic membrane closure index was good and preliminary results of these patients were satisfactory. In all three cases, the perforation closed completely.

A study was conducted by Mehmet Habesoglu M.D.; Cagatay Oysu M.D. et al to investigate the effect of Choukroun's Platelet rich fibrin on the acute tympanic membrane perforation due to trauma [4].

It is a prospective controlled study which was conducted in 2011. Thirty two patients with acute tympanic membrane perforation were selected and they were randomly divided into two groups. The study group had 14 patients and control group had 18 patients.

Platelet rich fibrin was used to repair the tympanic membrane perforation in the study group. In control group no manipulation was done. Mean area of perforation was 10.93±3.58 mm^2 in the study group and 10.05±4,02 mm2 in the control group in the first examination. At the end of 1st month the mean area of the perforation was 1.35±2.53 mm^2 in the study group and 4.44±3.34 mm2 in the control group ($P<0.01$). Total closure rate of the tympanic rates was 64.3 % for the study group, and 22.2% for the control group ($P<0.05$) at the end of 1^{st} month.

At the end of 2nd month, number of patients with a perforation was one for the study group, 4 for the control group (P>0.05). At the end of the second month, 7.1% of patients in the study group had unclosure of the tympanic membrane, 22.2% patients in group-2 had unclosure of their tympanic membrane (P>0.05).

Their study concluded that platelet rich fibrin is easy to prepare biomaterial and autologous platelet concentrate which has enriched growth factors accelerates the healing of tympanic membrane.

An experimental study was conducted by Erkilet E in 2008 to study the effect of local application of platelet rich plasma in healing of tympanic membrane perforations. The healing time and histopathological outcome was studied. This study was conducted in rats [13].

Forty four rats were selected and both side tympanic membranes were given standard 3 mm cuts. Platelet rich plasma was applied to right tympanic membrane and they were taken as cases. Left tympanic membrane was allowed to heal spontaneously and taken as controls.

The mean tympanic membrane healing time in tympanic membranes receiving platelet rich plasma is 10.2 +/- 2.1 days, where as in control group it is 13.0 +/- 2.9 days. This study was statistically significant as they had a P value of <0.001.

They concluded that platelet rich plasma accelerates the tympanic membrane healing and it may be effective as an autologous material in healing of tympanic membrane perforation in human subjects also.

RESULTS

Our study population had 50 patients out of which 25 were cases and remaining 25 were controls

Table 1

Age distribution of COM patients in the study population

Age	Total no of patients	Percentage
13 – 20 yrs	8	16
21 – 25 yrs	10	20
26 – 30 yrs	11	22
31 – 35 yrs	5	10
36 – 40 yrs	7	14
40 – 45 yrs	5	10
46 – 50 yrs	2	4
>50 yrs	2	4
Total	50	100

In our study majority of cases belonged to young adults between 21 to 30 years of age.

Figure 13 - showing the age distribution in study population

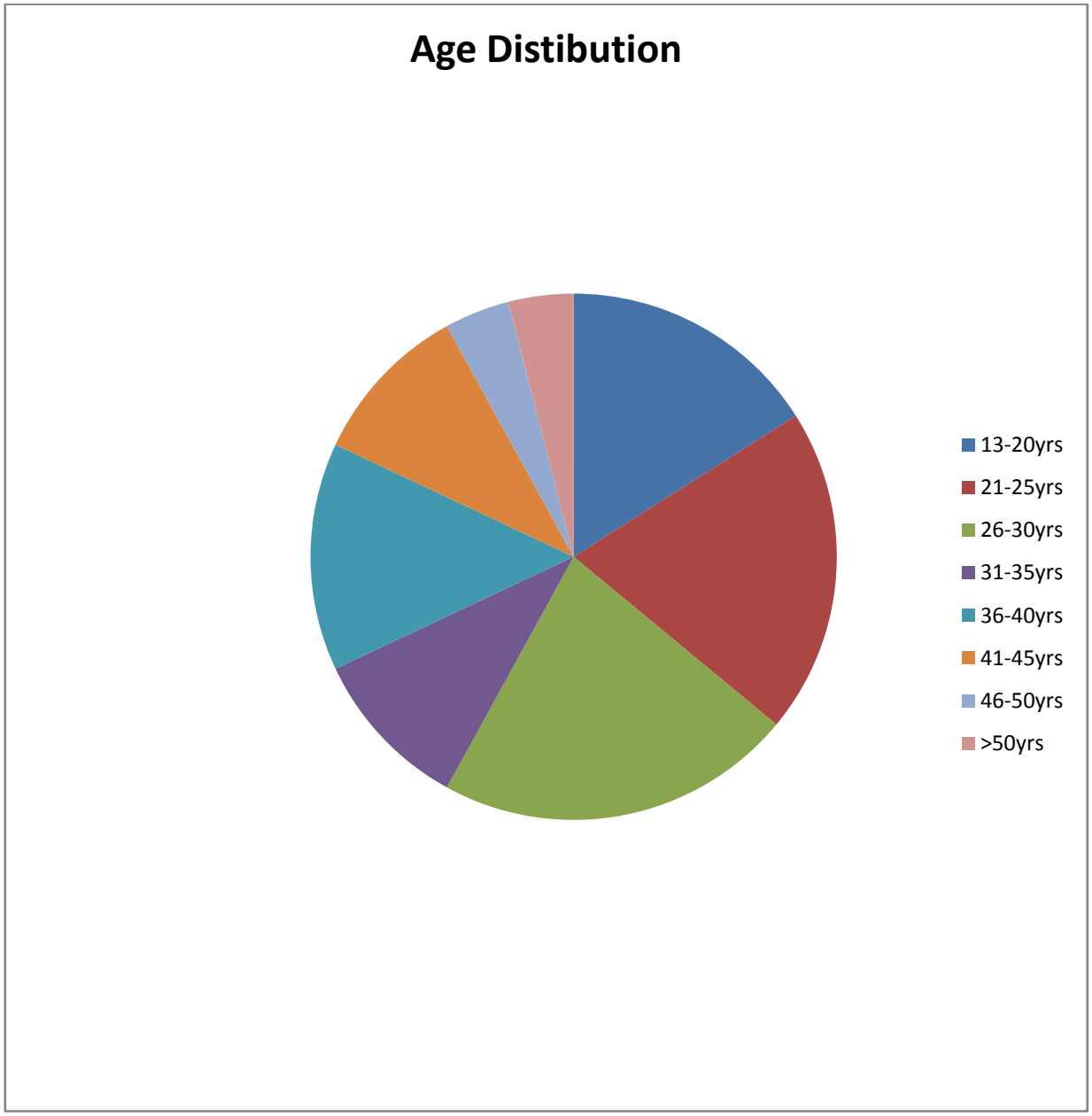


Table 2

Economic status of the patients in the study group

Economic status	Upper class	Middle class	Lower class	Total
No of case	1	13	36	50
Percentage	2	26	72	100

Table 2 shows the economic status of the study group.

Figure 14 Graphical representation of economic status

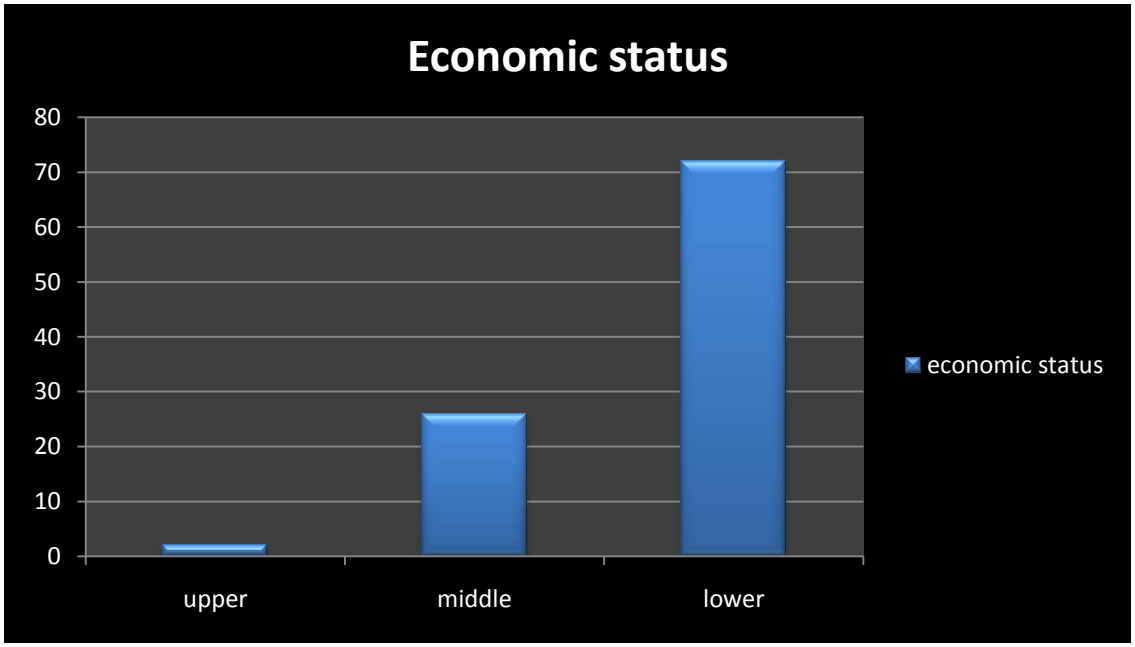


Table 3

Sex wise distribution of the study group

Sex	No of patients	Percentage
Male	20	40
Female	30	60
Total	50	100

Figure 15 showing Gender distribution

Table 4

Unilateral vs. bilateral disease

	Unilateral ear disease	Bilateral ear disease
cases	19	6
controls	23	2
Total	42	8
Percent	84	16

Table 4 shows the disease pattern in cases and controls.

Figure 16 shows the disease pattern in cases and control group

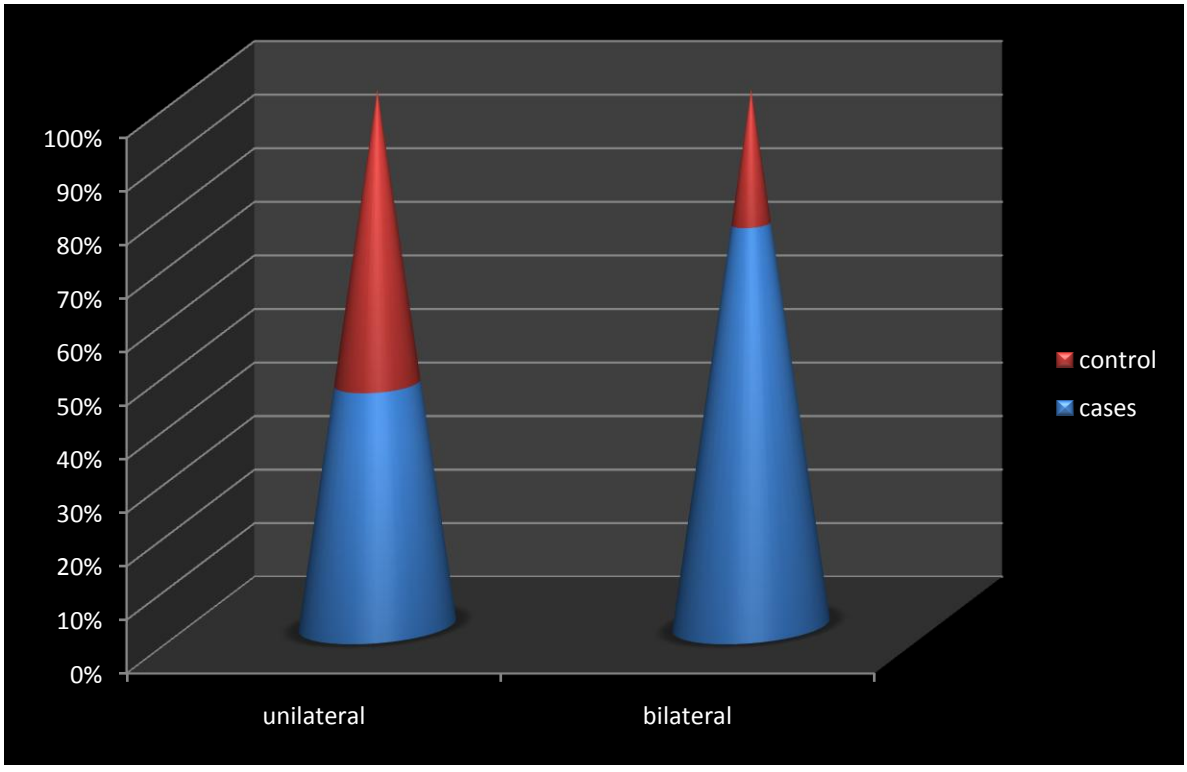


Table 5

Size of perforation in cases

Type of perforation	No of patients	percentage
Small	2	8
Medium	7	28
Large	6	24
Subtotal	10	40

Table 6

Size of perforation in controls

Type of perforation	No of patients	percentage
Small	3	12
Medium	2	8
Large	11	44
Subtotal	9	36

The above tables indicate the various types of central perforation in the study group.

Figure 17 showing size of the perforation in cases and control

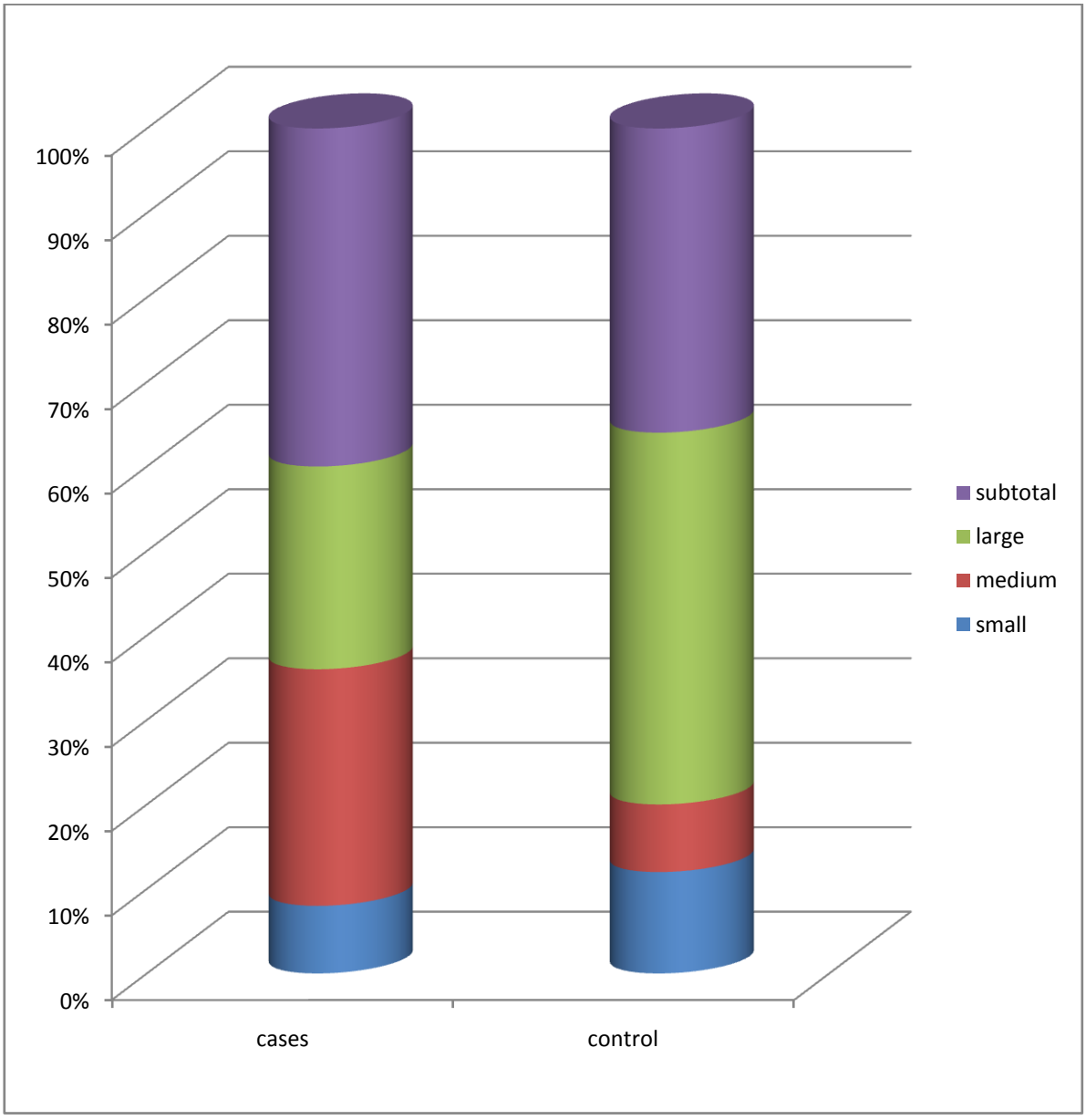


Table 7

Showing degree of hearing loss

Degree	In Unilateral disease	In Bilateral disease
Mild	29	Both ears – 5 Right ear – 1 Left ear – 2
Moderate	11	Both ears – 0 Right ear – 2 Left ear – 1
Severe	2	Nil

Table 7 shows the degree of hearing loss baased on pure tone audiogram finding.

Figure 18 showing degree of hearing loss

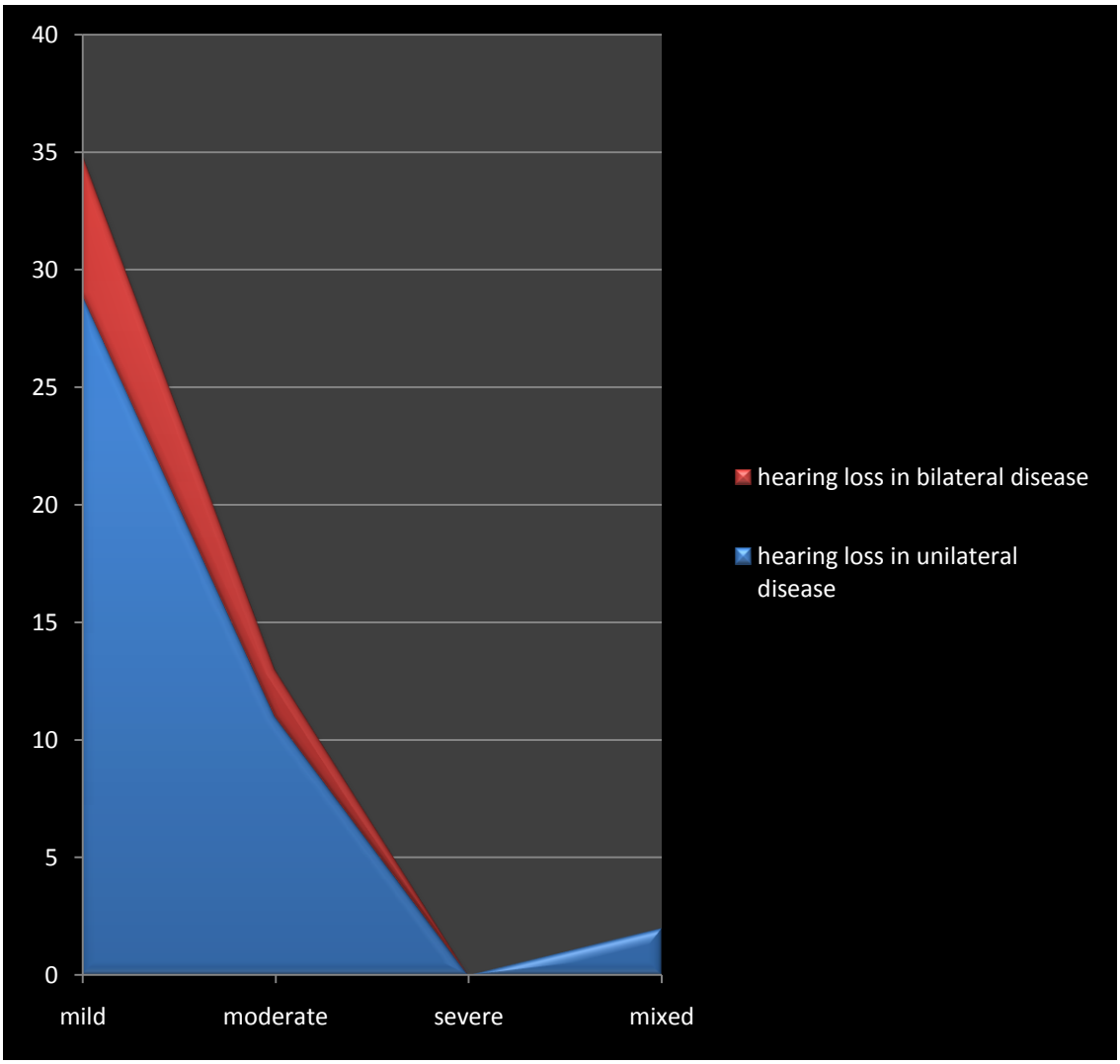


Table 8

Patients who underwent FESS

	No of patients
Cases	2
Control	3
Total	5

Table 8 shows number of COM patients having sinus disease who underwent FESS to clear the septic foci.

Figure 19 showing patients who underwent sinus surgery

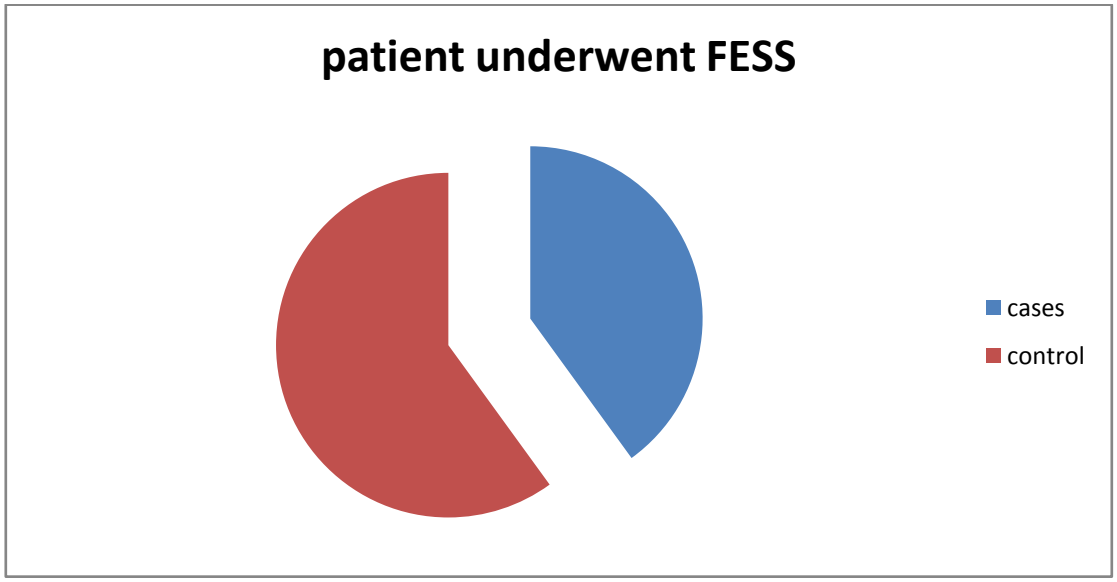


Table 9

Cortical mastoidectomy with myringoplasty vs. Myringoplasty alone

Procedure	Control	Cases	Total
Myringoplasty	6	12	18
Cortical mastoidectomy with myringoplasty	19	13	32

Figure 20 Schematic representation of type of surgical procedure

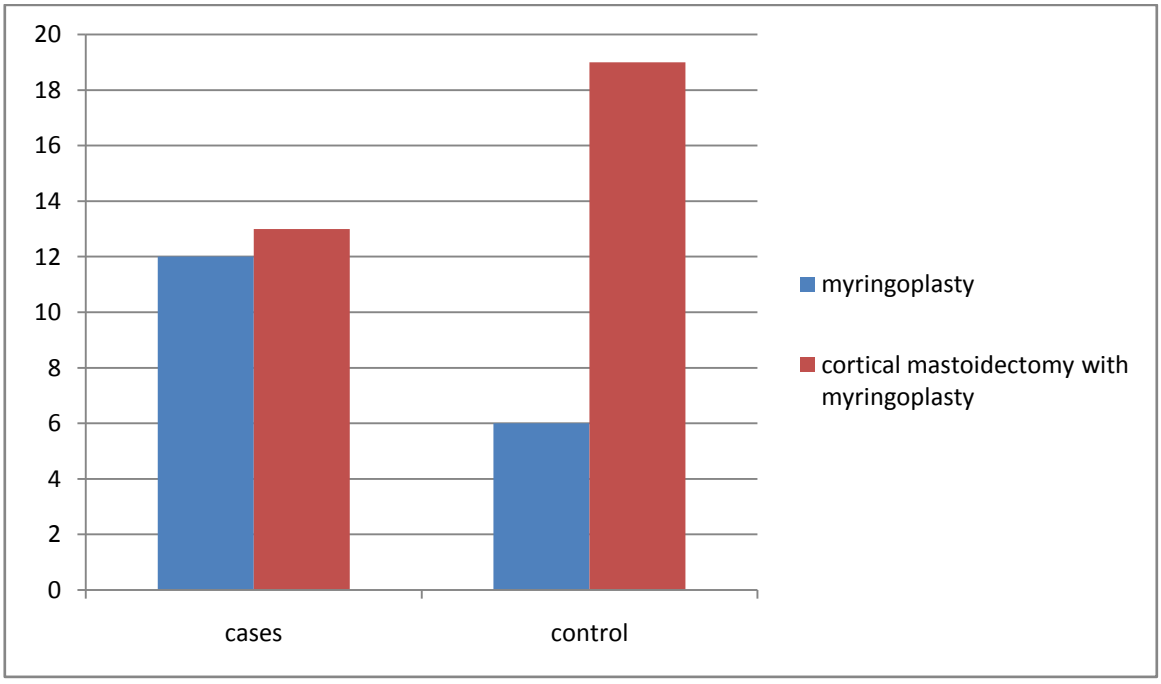


Table 10

Ossicular chain status

Ossicle disrupted	Cases	Control	Total
Malleus	1	2	2
Incus	7	3	11
Stapes	0	0	0

Figure 21 Showing ossicular chain statuses in the study group

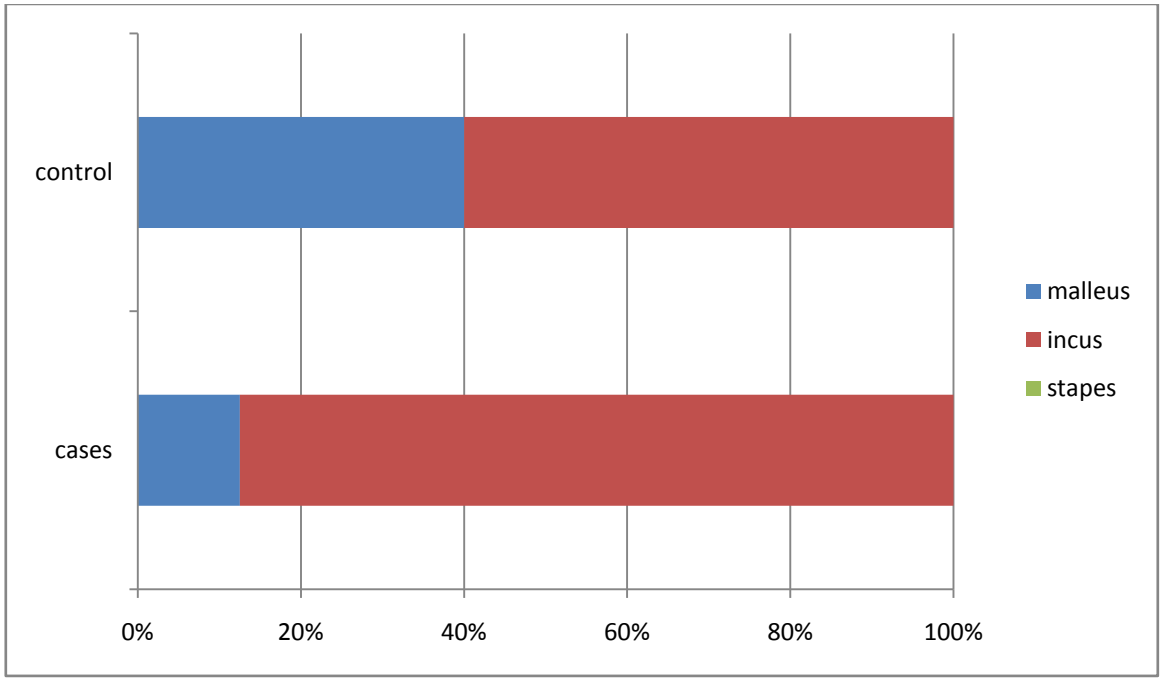


Table 11

Anaesthesia during surgery

	No of patients	percentage
General anaesthesia	46	92
Local anaesthesia	4	8
Total	50	100

Table 11 shows number of patients who are operated under general or local anaesthesia.

Figure 22 showing anaesthesia during surgery

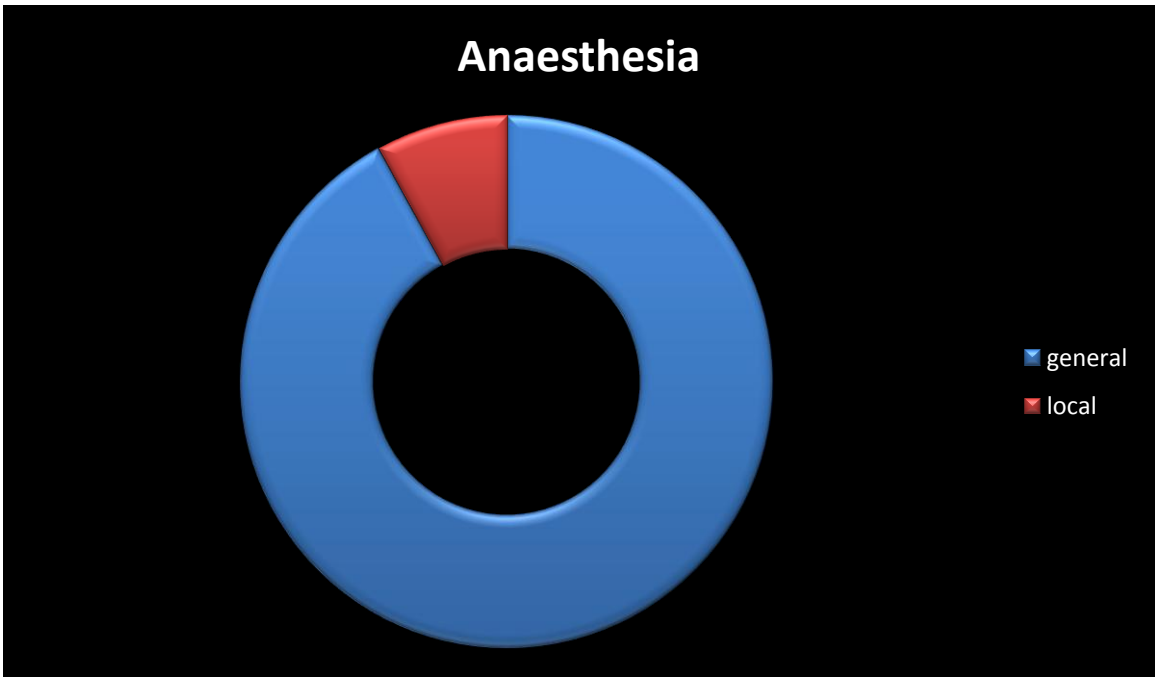
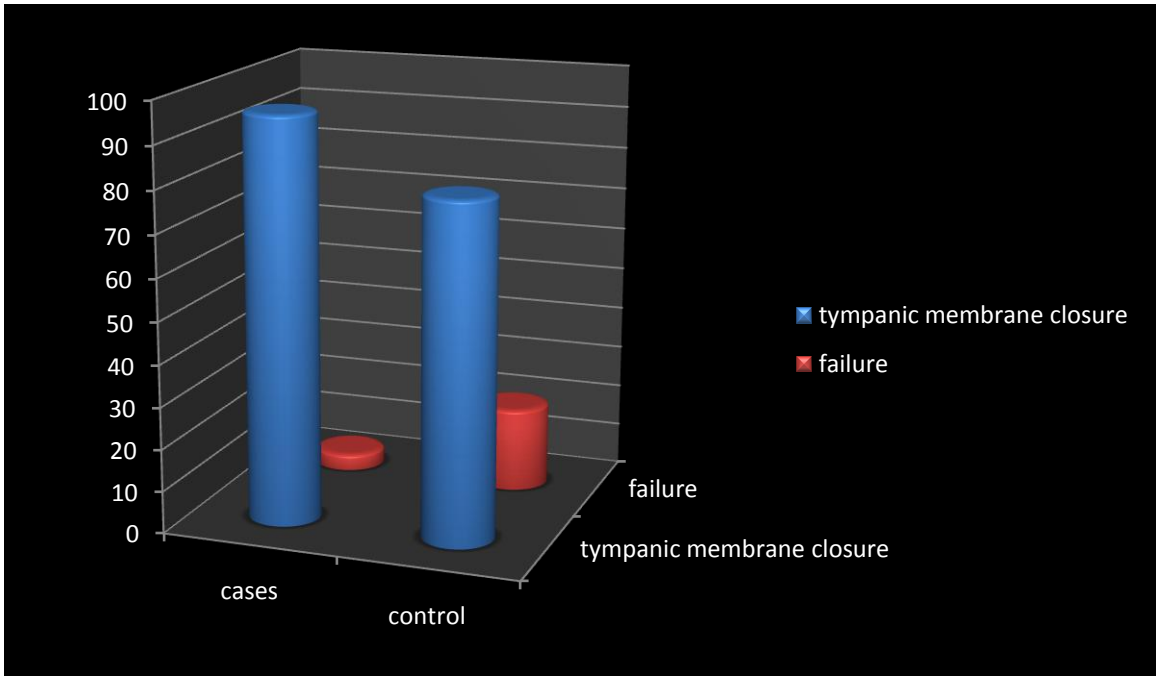


Table 12

Final outcome

	Cases		Controls	
No of patients	25		25	
Tympanic membrane closure	Cases	24	Controls	20
	Percent	96	Percent	80
Failure	1		5	

Figure 23 showing the outcome of surgery



DISCUSSION

In our study out of the 50 patients who underwent surgery, 30 were females (60 percent) and 20 (40 percent) were males. This is in contrast to UK national study of hearing; according to them the incidence is equal in both male and female.

The age of distribution of chronic otitis media in our study population was compared with the previous data. It shows that the disease is common in 20 to 30 yrs age group in our study population whereas according to UK national study of hearing it is common in 41 to 80 years age group.

The disease is common in lower socioeconomic groups which is similar to the previous literature review. In our study only one patient out of 50 patients belong to higher socioeconomic status, whereas about 72 percent of patients were from lower class and 26 percent of patient belongs to middle class, which again reflects the prevalence of this disease in lower class. The increased incidence of this disease in this lower class is due to overcrowding, poor sanitation, poor nutrition and illiteracy.

About 84 percent (42 patients) of people in the study population had unilateral ear disease whereas remaining 16 percent (8 patients) had bilateral disease. In cases 19 patients had unilateral disease and 6 patients had bilateral disease. In controls 23 patients had unilateral disease whereas 2 patients had bilateral disease. Among the unilateral disease in controls 13 patients had right ear disease whereas 10 patients had left ear disease. Among cases 7 patients had right ear disease and 12 patients had left ear disease. Bilateral disease is commonly due to bilateral Eustachian tube dysfunction.

In our study large and subtotal perforation is very common in comparison to other perforations. Among cases 2 patients had small perforation, 7 patients had medium, 6 patients had large and 10 patients had subtotal perforation. In controls 3 small, 2 medium, 11 large and 9 subtotal perforations was seen. According to the study conducted by Braccini F regarding the relevance of Choukroun's Platelet-Rich Fibrin (PRF) during middle ear surgery residual perforations were noticed in 4 percent of cases, all of them had large perforation preoperatively. Out of 6 failures in our study 5 occurred in large/ subtotal perforations which similar to the above study.

In our study population most of the patient had mild conductive hearing loss. Among the unilateral disease patients, 29 had mild conductive hearing loss, 11 had moderate conductive hearing loss where as 2 had mixed hearing loss. Among bilateral disease both ears having mild conductive hearing loss was seen in 5 patients. Right ear having mild conductive loss is seen in 1 patient, and left ear having mild loss is seen in 2 patients. Moderate conductive hearing loss was seen in right ear in 2 patients and in left ear in one patient. None of the patient with bilateral ear disease had mixed hearing loss.

According to study conducted by Bluestone et al, sinus disease is one of the important causes for Eustachian tube dysfunction which can lead to chronic otitis media. Treating the sinus disease along with the ear disease is very important to get complete cure. In our study 5 patients (2 cases and 3 controls) with ear discharge even after the medical management had features of chronic sinusitis. CT scan was taken and they all underwent Functional Endoscopic sinus surgery. All patients had improvement in ear discharge after sinus surgery and subsequently they underwent ear surgery.

X – ray both mastoids was the important investigation based on which surgery for the patient is decided. All patients underwent this investigation after attaining dry ear for 6 to 8 weeks. Among cases 12 patients had well pneumatised mastoids, they underwent myringoplasty and 13 had sclerosed mastoids or clouding of air cells, they underwent cortical mastoidectomy with myringoplasty. Among control 6 patients had well pneumatised mastoids whereas 19 had sclerosed mastoids.

Ossicular chain discontinuity was noted in 13 patients in the study population. Among them incus problem was seen in most of the cases. 7 patients among cases and 3 patients among controls had incus erosion, commonly the long process. Malleus problems were seen in 1 case and 2 controls. None of the patients had stapes problems. Ossiculoplasty was done in all these patients. Homograft's like remnant ossicles and cartilage were commonly used.

All the patients who underwent cortical mastoidectomy with myringoplasty were operated under general anaesthesia. Local anaesthesia was done in 4 cases that underwent myringoplasty alone. 2 patients among cases and 2 among controls were operated under local

anaesthesia. They were operated using transcanal endoscopic approach. All 4 patients had wide canal with posterior quadrant perforation. There is no risk of general anaesthesia complications and no postaural wound or hematoma. Overall there is reduction in post operative morbidity of the patient by this approach.

The graft take up rate in our study is comparable with the reference studies. According to Maria Luisa Navarrete Alvaro use of platelet rich plasma during myringoplasty had a satisfactory result. A study was conducted by Mehmet Habesoglu M.D in 2011 among 32 patients with acute tympanic membrane perforations. He concluded that use of platelet rich fibrin accelerated the tympanic membrane closure. In our study among 25 cases that underwent myringoplasty with use of platelet rich fibrin, 24 had complete tympanic membrane closure and only one failure has been noticed. In controls 5 out of 25 cases had failure. At the end of first month follow up, 72 percent of cases had closure of tympanic membrane, while only 40 percent of controls had tympanic membrane closure. At the end of second month 92 percent of cases had closure while only 72 percent of control had closure. At the end of 3 months 96 percent of cases had closure, whereas only 80 percent of control had closure. Thus

Our study shows that autologous platelet concentrates accelerates the tympanic membrane closure.

Among cases, only one failure is noted which is due to infection. Among controls, 5 failures were noted 4 of them due to graft displacement and one due to infection. According to Maria Luisa Navarrete Alvaro use of platelet rich plasma during myringoplasty will prevent graft displacement, which is seen in our study also.

CONCLUSION

Our study concludes the following

- Platelet rich plasma is a cheap and cost effective platelet concentrate with enriched growth factors.
- It accelerates the tympanic membrane closure following myringoplasty.
- It prevents graft migration.
- It improves the overall success rate of myringoplasty.
- It has no noticeable side effects.

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ANNEXURE

PROFORMA

Name: Age: Sex:

IP/OP.No:

Address:

Occupation:

Chief Complaints:

EAR

A. Discharge

I. Duration

II. Onset

III. Nature

IV. Colour

V. Amount

VI. Smell

VII. Blood stained

VIII. Aggravating / Relieving Factors

IX. Associated Symptoms

B. **Hard of Hearing**

Onset

Unilateral / Bilateral

Gradual / Fluctuating

C. **Earache**

D. **Vertigo / Tinitus**

NOSE

A. **Nasal Obstruction**

- Unilateral / Bilateral

- Continuous / Intermittent

B. **Nasal Discharge**

- Unilateral / Bilateral

- Scanty / Profuse

- Colour

- Smell

C. **Headache**

D. **Anosmia**

E. **Post Nasal Drip**

F. **Sneezing**

H/o Previous Treatment – Medical / Surgical

Clinical Examination:

EAR	**Right**	**Left**
Pinna		
Preauricular Region		
Postauricular Region		
External Auditory Canal		
Tympanic Membrane		
Perforation		
Site		
Size		
Small		
Large		
Subtotal		
Middle Ear Mucosa		
Moist		
Boggy (Polypoidal)		

NOSE

Anterior Rhinoscopy

Posterior Rhinoscopy

Sinus Tenderness

Cold Spatula Test

THROAT

Tonsils – Normal / Hypertrophied / Shrunken

Posterior Pharyngeal Wall – Normal / Granular / Congested /

Postnasal Drip

OTOENDOSCOPY

1. Perforation : Small / Large / Subtotal

2. Ear Discharge: Scanty / Copious

3. Middle Ear Mucosa: Moist / Boggy

DIAGNOSTIC NASAL ENDOSCOPY:

First Pass	**Right**	**Left**
Turbinoseptal		
Classification		
Inferior Turbinate		
Ridges / Spicules		
Eustachian Tube Orifice		
Mucosa		
Movement		
Secretions		
Nasopharynx		
Choana		
Others		
Second Pass		
Head of Middle Turbinate		
Uncinate Process		
Ethmoidal Bulla		
Accessory Ostia		
Middle Meatus Discharge		
Third Pass		

Sphenoethmoidal Recess

Superior Turbinate

Superior Meatus

Others

PLAN

Medical management:

Surgical management : Myringoplaty / Cortical mastoidectomy with myringoplasty / FESS followed by cortical mastoidectomy / myringoplasty

POST OP FOLLOWUP

MASTER CHART - CASES

S .no	Name ,Age ,Sex OP/IP No	Diagnosis	Procedure	Date of surgery	Investi gation	Anaes thesia	Complica tion	Follow up
1	Ammu ,46/f 5617	Lt CSOM with CP	Lt cortical mastoidectomy with myringoplasty	14/03/12	N	GA	Nil	Graft taken well
2	Kanimozhi ,19/f 5118	B/L CSOM with CP	Lt myringoplasty	02/03/12	N	LA	Nil	Graft taken well
3	Sangeetha ,13/f 964	Lt CSOM with CP	Lt myringoplasty	01/02/12	N	GA	Nil	Graft taken well
4	Renuka ,23/f 3044	Lt CSOM with CP	Lt myringoplasty	05/02/12	N	GA	Nil	Graft taken well
5	Sagar ,13/m 5465	Lt CSOM with CP	Lt myringoplasty	12/03/12	N	GA	Nil	Graft taken well
6	Sathya ,17/f 10606	B/L CSOM with CP	Lt myringoplasty	09/04/12	N	GA	Nil	Graft taken well
7	Manjula ,36/f 13823	Lt CSOM with CP	Lt cortical mastoidectomy with myringoplasty	21/05/12	N	GA	Nil	Graft taken well
8	Bhavani ,44/f 249202	Rt CSOM with CP	Rt cortical mastoidectomy with myringoplasty	16/12/11	N	GA	Nil	Graft taken well
9	Abdulla ,47/m 269641	Rt CSOM with CP	Rt cortical mastoidectomy with myringoplasty	19/12/11	N	GA	Nil	Failure
10	Sofiya ,20/f 29186	B/L CSOM with CP	Lt cortical mastoidectomy with myringoplasty	26/12/11	N	GA	Nil	Graft taken well
11	Suryakala, 52/f 29189	B/L CSOM with CP	Rt cortical mastoidectomy with myringoplasty	30/12/11	N	GA	Nil	Graft taken well
12	Naveen kumar ,18 /m 458	Lt CSOM with CP	Lt cortical mastoidectomy with myringoplasty	09/01/12	N	GA	Nil	Graft taken well
13	Aneesha ,28/f 994322	B/L CSOM with CP	Rt cortical mastoidectomy with myringoplasty	06/03/12	N	GA	Nil	Graft taken well
14	Zeenath farhana,40/f 995965	B/L CSOM with CP	Lt cortical mastoidectomy with myringoplasty	30/03/12	N	GA	Nil	Graft taken well
15	Ganga ,20/f 996222	Lt CSOM with CP	Lt cortical mastoidectomy with myringoplasty	03/04/12	N	GA	Nil	Graft taken well
16	Akthar basha ,25/m 995619	Lt CSOM with CP	Lt cortical mastoidectomy with myringoplasty	20/03/12	N	GA	Nil	Graft taken well

S .no	Name ,Age ,Sex OP/IP No	Diagnosis	Procedure	Date of surgery	Investi gation	Anaes thesia	Complica tion	Follow up
17	Raja , 24/m 992044	Lt CSOM with CP	Lt myringoplasty	03/02/12	N	GA	Nil	Graft taken well
18	Soundarya ,28/f 993610	Rt CSOM with CP	Rt myringoplasty	17/02/12	N	LA	Nil	Graft taken well
19	Vennila ,22/f 995750	Rt CSOM with CP	Rt myringoplasty	27/03/12	N	GA	Nil	Graft taken well
20	Mumtaz ,27/f 994107	Lt CSOM with CP	Lt cortical mastoidectomy with myringoplasty	02/03/12	N	GA	Nil	Graft taken well
21	Priya ,34/f 103118	Rt CSOM with CP	Rt cortical mastoidectomy with myringoplasty	13/07/12	N	GA	Nil	Graft taken well
22	Shakira begham ,22/f 104711	Lt CSOM with CP	Lt myringoplasty	07/08/12	N	GA	Nil	Graft taken well
23	Neela ,30/f 105625	Rt CSOM with CP	Rt myringoplasty	21/08/12	N	GA	Nil	Graft taken well
24	Sarala ,36/f 991794	Lt CSOM with CP	Lt myringoplasty	31/01/12	N	GA	Nil	Graft taken well
25	Balaji ,27/m 489	Lt CSOM with CP	Lt myringoplasty	07/02/12	N	GA	Nil	Graft taken well

MASTER CHART - CONTROL

S no	Name ,age,sex OP/IP no	Diagnosis	Procedure	Date of surgery	Investi gation	Anaes thesia	Compli cation	Follow up
1	Murugan ,36/m 23456	Rt CSOM with CP	Rt cortical mastoidectomy with myringoplasty	30/01/12	N	GA	Nil	Graft taken well
2	Malathy ,18/f 1439	Lt CSOM with CP	Lt cortical mastoidectomy with myringoplasty	06/02/12	N	GA	Nil	Graft taken well
3	Sukumar, 42/m 2151	Lt CSOM with CP	Lt cortical mastoidectomy with myringoplasty	16/02/12	N	GA	Nil	Failure
4	Saravanan ,35/m 5019	Lt CSOM with CP	Lt cortical mastoidectomy with myringoplasty	24/02/12	N	GA	Nil	Graft taken well
5	Kumar ,24/m 4628	Lt CSOM with CP	Lt cortical mastoidectomy with myringoplasty	27/02/12	N	GA	Nil	Graft taken well
6	Elumalai ,32/m 3119	Rt CSOM with CP	Rt cortical mastoidectomy with myringoplasty	05/03/12	N	GA	Nil	Graft taken well
7	Ramesh ,32/m 5610	Rt CSOM with CP	Rt myringoplasty	09/03/12	N	GA	Nil	Failure
8	Jiyauddin ,60/m 5490	B/L CSOM with CP	Lt cortical mastoidectomy with myringoplasty	02/04/12	N	GA	Nil	Graft taken well
9	Suseela ,33/f 7150	Rt CSOM with CP	Rt cortical mastoidectomy with myringoplasty	26/03/12	N	GA	Nil	Graft taken well
10	Sudalai,40/m 3782	Rt CSOM with CP	Rt cortical mastoidectomy with myringoplasty	02/04/12	N	GA	Nil	Graft taken well
11	Sheela ,22/f 8559	Lt CSOM with CP	Lt cortical mastoidectomy with myringoplasty	09/04/12	N	GA	Nil	Graft taken well
12	Devi ,42/f 10515	Rt CSOM with CP	Rt myringoplasty	30/04/12	N	LA	Nil	Graft taken well
13	Manikandan,21/m 12148	Lt CSOM with CP	Lt myringoplasty	07/05/12	N	GA	Nil	Graft taken well
14	Suja ,40/f 16031	Lt CSOM with CP	Lt cortical mastoidectomy with myringoplasty	16/12/11	N	GA	Nil	Graft taken well
15	Lakshmi ,23/f 14822	Lt CSOM with CP	Lt cortical mastoidectomy with myringoplasty	20/12/11	N	GA	Nil	Graft taken well

S no	Name ,age,sex OP/IP no	Diagnosis	Procedure	Date of surgery	Investi gation	Anaes thesia	Compli cation	Follow up
16	Rajeswari ,39/f 8275	Rt CSOM with CP	Rt cortical mastoidectomy with myringoplasty	30/12/11	N	GA	Nil	Failure
17	Gowri ,36/f 14304	Rt CSOM with CP	Rt myringoplasty	06/01/12	N	LA	Nil	Graft taken well
18	Jeganathan ,21/m 3690	Rt CSOM with CP	Rt cortical mastoidectomy with myringoplasty	06/01/12	N	GA	Nil	Graft taken well
19	Senthil kumar,27/m 11902	Rt CSOM with CP	Rt myringoplasty	10/01/12	N	GA	Nil	Failure
20	Padmavathy ,30/f 6258	Rt CSOM with CP	Rt myringoplasty	13/01/12	N	GA	Nil	Graft taken well
21	Sundaramoorthy,27/m 992306	B/L CSOM with CP	Rt cortical mastoidectomy with myringoplasty	10/02/12	N	GA	Nil	Graft taken well
22	Usha ,30/f 992842	Lt CSOM with CP	Lt cortical mastoidectomy with myringoplasty	14/02/12	N	GA	Nil	Graft taken well
23	Mariappan ,28/m 996606	Rt CSOM with CP	Rt cortical mastoidectomy with myringoplasty	10/04/12	N	GA	Nil	Graft taken well
24	Thara ,45/f 997056	Rt CSOM with CP	Rt cortical mastoidectomy with myringoplasty	17/04/12	N	GA	Nil	Failure
25	Sathish kumar,30/m 997288	Lt CSOM with CP	Lt cortical mastoidectomy with myringoplasty	20/04/12	N	GA	Nil	Graft taken well

ஒப்புதல் படிவம்

..... ஆகிய நான் எனது காது ஜவ்வில் ஏற்பட்டுள்ள ஓட்டைக்கு அறுவை சிகிச்சை செய்யும்போது, சுய பிளேட்லெட் ரிச் பிளாஸ்மாவை பயன்படுத்திக்கொள்ள ஒப்புக்கொள்கிறேன். இதனுடைய சிறப்பு அம்சங்கள் மற்றும் பின் விளைவுகள் குறித்து மருத்துவர் மூலம் அறிந்துகொண்டேன். இது ஒரு புதிய வகையான முயற்சி என்பதனை மருத்துவர் மூலம் அறிந்துகொண்டேன். இது என்னுடைய நலனுக்காக செய்யப்படுவதால், முழு ஒத்துழைப்பு அளிப்பேன். அறுவை சிகிச்சைக்கு பின் தாங்கள் சொல்லும் நேரங்களில் பரிசோதனைக்கு வந்து ஒத்துழைப்பு அளிப்பேன் என்று உறுதியளிக்கிறேன்.

இந்த ஆராய்ச்சியின் விவரங்களும் அதன் நோக்கமும் முழுமையாக எனக்கு தெளிவாக விளக்கப்பட்டது.

எனக்கு விளக்கப்பட்ட விஷயங்களை நான் புரிந்துகொண்டு எனது சம்மதத்தை தெரிவிக்கிறேன்.

இந்த ஆராய்ச்சியில் பிறரின் நிர்பந்தமின்றி என் சொந்த விருப்பத்தின்பேரில்தான் பங்கு பெறுகின்றேன். இந்த ஆராய்ச்சியில் இருந்து நான் எந்நேரமும் பின் வாங்கலாம் என்பதையும் அதனால் எந்த பாதிப்பும் ஏற்படாது என்பதையும் நான் புரிந்துகொண்டேன்.

நான் என்னுடைய சுய நினைவுடனும் மற்றும் முழு சுதந்திரத்துடனும் இந்த மருத்துவ ஆராய்ச்சியில் என்னை சேர்த்துக்கொள்ள சம்மதிக்கிறேன்.

ஆராய்ச்சியாளர் மற்றும் அவரைச் சாரந்தவர்களோ, நெறிமுறைக்குழு உறுப்பினர்களோ நான் இந்த ஆராய்ச்சியில் இருந்து விலகினாலும் என்னுடைய அனுமதியின்றி என்னுடைய உடல்நிலை குறித்த தகவல்களை இந்த ஆராய்ச்சிக்கோ இது தொடர்பான வேறு ஆராய்ச்சிகளுக்கோ பயன்படுத்திக்கொள்ள முடியும் என்று புரிந்து கொண்டு சம்மதம் அளிக்கிறேன். ஆனாலும் என்னுடைய அடையாளம் வெளியிடப்படமாட்டாது என்று புரிந்துகொள்கிறேன்.

இந்த ஆராய்ச்சியின் தகவல்களையும் முடிவுகளையும் அறிவியல் நோக்கத்திற்காக பயன்படுத்துவதற்கு நான் அனுமதிக்கிறேன். நான் ஆராய்ச்சியில் பங்குபெற சம்மதிக்கிறேன்.

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கையொப்பம்

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இடம்
தேதி