STUDY OF BACTERIOLOGY IN CHOLESTEATOMA CASES

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CERTIFICATE

This is to certify that this dissertation entitled **"STUDY OF BACTERIOLOGY IN CHOLESTEATOMA CASES"** submitted by **Dr.K.ARUMUGAM** to **THE TAMIL NADU Dr. M. G. R. Medical University**, Chennai is in partial fulfillment of the requirement for the award of **M.S (ENT)** and is a bonafide research work carried out by him under direct supervision and guidance.

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DECLARATION

I, **Dr.K.ARUMUGAM (M.S., ENT***),* Solemnly declare that the dissertation titled ***"*STUDY OF BACTERIOLOGY IN CHOLESTEATOMA CASES*"*** has been prepared by me.

This is submitted to the TamilNadu Dr. M.G.R. Medical University, Chennai, in partial fulfillment of the regulations for the award of MS Degree Branch-IV (OTO-RHINO-LARYNGOLOGY).

Place : Madurai **DR. K.ARUMUGAM**

Date :

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INTRODUCTION

As per the statistics one out of five patients attending a general hospital complaints of so for problems in his /her Ear, Nose, Throat or head and neck.

As the incidence of chronic suppurative otitis media depend on socio economic factor over crowding, poor hygiene and poor nutrition so the disease is wide spread in India.

Chronic suppurative otitis media is the most common clinical entity in otorhinolaryngology clinic especially in our part of the world.

Because of the strategic location of middle ear cleft which is separated by thinnest shell of bone from facial nerve, labyrinth and dura of middle and posterior cranial fossa, every case of otitis media carries with it potential complications of both intracranial and extracranial structures which causes the morbidity and mortality.

Chronic suppurative otitis media is classified into two groups.

i. Tubotympanic disease – safe type

ii. Atticoantral disease – unsafe type

Chronic suppurative otitis media with cholesteatoma is typically a persistent disease. Insidious in onset, often capable of causing severe destruction and irreversible sequele and clinically it manifests with aural discharge and deafness.

Chronic suppurative otitis media with cholesteatoma is classified as an unsafe disease due to ability to erode bone and uncover the neighbouring structures, such as duramater, lateral sinus, facial nerve, labyrinth causing spread of bacterial infection into

deeper tissues thus exposed by bone erosion leading to complication like meningitis, extradural abscess, subdural abscess, brain abscess, lateral sinus thrombosis, labyrinthitis and facial paralysis.

The virulence of bacteria also plays a role in destruction of bone by causing changes in the surrounding perimatrix of cholesteatoma which include activation of osteoblast and production of lysozymes. Thus infection & inflammation plays a greater role in the development of complications.

Management of chronic supportive otitis media with cholesteatoma has witnessed profound changes over the last 100 years. Earlier method of radical surgery at the expense of hearing loss were necessary to control the destructive disease associated with serious complication at a time when antibiotics were unavailable.

The introduction of antimicrobial therapy over the last four decades with development in microbiology and introduction of operative microscope and endoscope has modified the appropriate management with greatest emphasis towards hearing preservation.

Even though the statistics show an analyzing ten fold reduction in complication in the last 20 years with new era of antimicrobial agents.

Studies by Harker documented an annual incidence of cholesteatoma was six per 100000 population

Studies by Tos found an annual incidence of cholesteatoma was three per 100000 population

In human temporal bones with chronic otitis media , cholesteatoma was observed in 36% of ear with perforation and in 4% of ear without the perforated tympanic membranes

One of the problem we are facing today is indiscriminate use of antibiotics which lead to masked or latent infections with increasing complications. Changes in bacterial flora with appearance of unusual causative organism or resistant strain not responding to commonly used antibiotics.

Therefore the modern concept of management of chronic suppurative otitis media with cholesteatoma demand careful assessment of the clinical presentation, extent of destructive process, functional loss and the nature of microbial flora within the ear and their sensitivity pattern.

Although the wide range of microbes present in chronic suppurative otitis media has seen the subject of exhaustive investigation by culturing the aural swab, only two studies have reported the study of microbial flora by culturing cholesteatoma specimen obtained during surgery. In India only studies of the culture of aural swab have been reported.

So, the present work was undertaken to study the microbial flora and sensitivity pattern of the growth from aural swab and also from the cholesteatoma specimen collected intraoperatively during mastoid surgery. Attention was also focused on the incidence, prevalence of cholesteatoma in relation to pathology of tympanic membrane with review of literature and with previous studies.

AIMS OF THE STUDY

1. To study the microbial flora and sensitivity pattern of growth from culture of aural swab of patient diagnosed as case of chronic suppurative otitis media and cholesteatoma posted for mastoid surgery.

2. To study the microbial flora and sensitivity pattern of growth from the culture of cholesteatoma specimen obtained during mastoid surgery.

3. To compare the result of microbial flora and sensitivity pattern of aural swab culture with those of cholesteatoma specimen culture.

4. To compare the result of microbial flora sensitivity pattern of study of both aural swab and cholesteatoma specimen with results of previous studies.

5. To study of bacteriological flora in relation to age, sex, incidence of study cases.

HISTORICAL REVIEW

Aural cholesteatoma was first described by Cruveilhier in 1829 as “pearly” tumour of temporal bone. He describes the pathological feature of this disease. The term cholesteatoma was coined by the German physiologist Johannes Muller in 1838.

The term cholesteatoma is a misnomer as cholesteatoma is neither true neoplasm nor it contains cholesterol.

2. Earlier, it has been well appreciated by Antiquity when Hippocrates about 400 BC noted acute pain of ear dreaded by patient for they may become delirious and die.
3. Around 25 AD Roman physician Celsus mentioned that inflammation of ear leads sometime to insanity and death.
4. Morgagni first clearly recognized that ear infection came first and brain abscess was secondary. It was Rudolf Virchow who called the condition cholesteatoma in 1864. He noted cholesteatoma are shiny, onion like layered tumours in the posterior section of temporal bone which extended through the bone.
5. Unquestionably the most important single event in the history of otogenic intracranial complication was described in 1826. The surgical treatment for that was firmly established only publication of Lane in 1889 and Balance in

1890 describe surgical treatment of lateral sinus thrombosis.

6. Maltzer in 1953 stated the cholesteatoma malodorous (fetid) discharge, perforation in pars flaccida, granuloma in attic region (or) postero superior region – sometime perforation can't be seen, polyp or granulation is seen.
7. Cowthorne in 1961 described the way in which cholosteatoma mass causes slight deafness, tinnitus and vertigo.
8. Guilford in 1963 suggested that early case of cholesteatoma may be seen as formation of greyish shadow behind the intact tympanic membrane.
9. Smith in 1968 stated that cholesteatoma usually is seen in attic region. He diagnosed early cholesteatoma on the basis of small pearl like mass in attic region which may be mistaken for foreign body.
10. Sade et al in 1961 studied ossicular damage by the cholesteatoma mass by review of 104 cases.
11. Zollner in 1955 – occasionally hearing may be normal (or) improved hearing by firm cholesteatoma that was bridging the ossicular chain.
12. Brooke et al in 1981 studied culture organism of cholesteatoma cases.
13. Jean Louis Petit (1674 -1750) credited – with developing first successful operation on mastoid for the purpose of evacuation of pus.
14. Sir William Wilde (1815-1876) introduced the post auricular incision for mastoid surgery in 1833.
15. Hermann Schwaltze (1859-1919) introduced the simple mastoidectomy for

resistant otitis media in 1873. He laid down clear indication for mastoid surgery.

16. Ernst Kuster and Ernst Von Bergymann both are credited with developing radical mastoidectomy procedure.
17. Manual Zaufal (further advanced radical mastoidectomy) along with Ludwig Stacke credited with introduction of radical mastoidectomy operation.
18. Gustave Bondy in 1910 for developing modified radical mastoidectomy procedure with a goal of preservation of hearing.
19. Zollner in 1951 and Wullstein in 1952 described the tympanoplasty technique along with use of operative microscope has entirely changed mastoidectomy result with improved hearing result.

PATHOGENESIS

Cholesteatoma:

It is a cystic bag like mass containing desquamated keratinized squamous epithelium lying in the fibrous stroma. It is a hallmark of atticoantral disease. Simple definition of cholesteatoma is "skin in the wrong place."

The term epidermosis was proposed by Tumarkin in 1961 and Kerotosis by Mc Guckin in 1963. The term keratoma as suggested by Schuknecht in 1974 is the most appropriate term.

Types of cholesteatoma:-

1. Congenital cholesteatoma
2. Acquired – primary acquired cholesteatoma

   secondary acquired cholesteatoma
3. Iatrogenic cholesteatoma – Trauma , surgery
4. Residivistic cholesteatoma
5. Atypical situational cholesteatoma
   - Petrous apex cholesteatoma
   - External auditory canal cholesteatoma
   - Antral cholesteatoma

Congenital cholesteatoma:-

It is inclusion epidermoid of histological transition zone in the antero superior quadrant of tympanic membrane due to non absorption of embryonic cell rest in the

dorsolateral epitympanum in a human foetus.

Derlacki and Clemis in 1965 have proposed criteria for the diagnosis of congenital cholesteatoma.

1. Pearly white mass behind the intact tympanic membrane.
2. No previous history of otorrhoea or perforation.
3. No previous history of any otological procedures
4. Normal pars tensa and pars flaccida.
5. Canal atresia (or) stenosis and intra membranous cholesteatoma are excluded.

Acquired cholesteatoma:

1. Primary acquired cholesteatoma
2. Secondary acquired cholesteatoma

   This may be caused by variety of pathogenic event and various theories have been put forward.

1. Invagination theory – (Bezold and Wittmack 1930) This theory is widely supported mechanism for formation of majority of primary acquired cholesteatoma. The long standing (or) frequent intermittent eustachian tube obstruction leads to impaired middle ear and mastoid ventilation under the influence of negative middle ear pressure. Tympanic membrane becomes flaccid and prone to retraction particularly in attic and postero superior region of pars tensa. By continued desquamation and accumulation of keratin debris, cholesteatoma formation occurs . As retraction of tympanic membrane is

associated with middle ear inflammation it may lead to adhesive otitis media.

2. Squamous metaplasia theory – wendt in 1873 and Sade in 1971 under the influence of infection squamous metaplasia of middle ear mucosa occurs and then cholesteatoma was formed.
3. Papillary ingrowth theory (Basal cell hyperplasia theory) – Lange & Ruedi 1959 production of cholesteatoma by papillary ingrowth of epithelium through its own basement membrane.
4. Epithelial migration (invasion) theory:

    i) Migration theory I – Habermann in 1889

    Migration of epithelium from deep external auditory canal and ear drum through perforation into middle ear leading to cholesteatoma formation.

    ii) Migration theory -2 (Tumarkin)

    Emphasize the role of a proceeding collapse of part (or) whole of tympanic membrane (Atelectasis) in the pars flaccida (or) postero superior quadrant later keratin accumulate and develops into cholesteatoma.

ROUTES OF SPREAD AND COMPLICATIONS

Regardless of pathogenesis of aural cholesteatoma, they all have certain properties in common. Cholesteatoma are prone to recurrent infection and characteristically erode the bone including ossicles and otic capsule.

The bony destruction is produced by cholesteatomas is believed to be one of the following mechanisms.

1. Pressure necrosis Theory
2. Enzymatic theory
3. Pyogenic osteitis theory.

It was long held that the bone resorption was result of pressure necrosis. However clinical observation leads to the abandonment of pressure necrosis theory.

Since most cholesteatoma arise by invagination of pars flaccida, their growth is limited by the mucosal folds and suspensory ligaments of ossicles and muscles. Cholesteatoma usually develops by invasion of Prussak's space and then into attic. Some may originate from a posterior marginal defect in the tympanic membrane to invade the inferior incudal space and then through the posterior tympanic isthmus into the antrum.

Epitympanic cholesteatoma may break the confines of Prussak's space and may extend in one of the three directions.

i) Posterior route:

Commonest spread, where cholesteatoma penetrate the superior incudal space which lies in the postero lateral portion of attic above the incudal body from there it penetrates aditus ad antrum and then into mastoid antrum.

ii) Inferior route

Second common, this allows cholestroatoma descend into posterior mesotympanum via posterior pouch of vonTroltsch.

iii) Anterior route

Rare; cholesteatoma penetrate anterior to malleus head leading to involvement of

anterior epitympanum and supratubal recess. It extend into anterior mesotympanum via anterior pouch of vonTroltsch.

Complications of chronic suppurative otitis media:

Because of the strategic location of middle ear cleft and its adjoining pneumatic cell, every case of cholesteatoma should be viewed as potentially serious disease with the possibility of intracranial complication.

Now a days most otological experience indicate that chronic middle ear infection is the greatest hazard, although the over all incidence of complication has fallen greatly with newer antibiotics treatment.

Spread of infection can be possible via the following routes

1) Extension through pathological bony defect caused by demineralization in acute suppurative otitis media, bony erosion by cholesteatoma and granulation tissue in chronic suppurative otitis media
2) Spread of infected thrombus within small veins through bone and dura to adjacent venous sinus and from there to intracranial structures, particularly via lateral sinus to cerebellar abscess and superior petrosal sinus to temporal lobe abscess.
3) Through normal anatomical pathways. These include oval and round window and cochlear and vestibular aqueduct. The additional anatomical dehiscence of bone covering jugular bulb, middle cranial fossa and intratympanic facial nerve can facilitate spread of infection

through these structures.

4) Non anatomical bony defect caused by trauma either accidental or surgical or neoplastic erosion. Iatrogenic defect include oval window after stapedectomy, lateral semicircular canal fistula after fenestration.

5) Brain tissue infection can spread via periarteriolar space of Virchow Robin.

Complications of suppurative otitis media:

I. Extracranial:

1. Facial Nerve paralysis
2. Labyrinthitis and labyrinthine fistula
3. Mastoiditis
   - Acute
   - Masked
   - Chronic
4. Sub periosteal Abscess
5. Petrositis

II. Intracranial:-

1. Extradural abscess
2. Subdural abscess
3. Lateral sinus thrombosis
4. Meningitis

5. Brain abscess – Temporal lobe & Cerebellar

6. Otitic hydrocephalus

7. Cortical Thrombophlebitis

III. Otogenic tetanus.

IV.

HISTOPATHOLOGY OF CHOLESTEATOMA

Macroscopically there is a pearly white mass of variable size often surrounded by friable granulations from infected bone or polyp formation with infected mucosa.

Microscopically cholesteatoma is a benign keratinizing squamous cell cyst, in the centre are fully differentiated keratin squamous, surrounded by an epithelium several layers thick in turn surrounded by a matrix of inflamed subepithelial connective tissue. The epithelial matrix of acquired cholesteatoma has approximately 15 layers, whereas that of congenital cholesteatoma has about five layers.

Electron microscopy shows normal epidermal cells plus Langerhans cell , Merkel cells and Giant cells .

MICROBIOLOGY OF CHOLESTEATOMA

The wide range of microbes both aerobic and anaerobic organisms present in chronic suppurative otitis media has been the subject of exhaustive investigations. Earlier studies reported the predominance of gram positive bacteria.

Friedman (1952) isolated Staphylococcus aureus in 32.7% of the 318 cases of which 41% were penicillin resistant and 59% sensitive, among the gram negative organism proteus was isolated in 27%; Pseudomonas aeruginosa in 16% and Escherichia coli in 10.7% Subsequent studies have stressed the widespread presence of mixed gram positive and negative organism in varying proportion with gram negative aerobes predominating.

Examination of various report on the nature of aerobic bacterial flora in chronic suppurative otitis media either tubotympanic or in cholesteatoma has failed to demonstrate any significant difference in the type of aerobic gram negative organisms. However, there is a greater predominance of Staphylococcus aureus among the gram positive organisms. The presence of multiple strains of both gram positive and negative aerobes is the rare rather than an exception. In a quantitative study, Sweeny (1982) showed rather exceptionally high count of Pseudomonas of 10^{11} bacilli per millimeter compared with other species. The presence of β-lactamase producing microbes of both aerobic and anaerobic type in 69% of 33 patients was reported by Brook (1985) and has considerable implication on chemotherapeutic management.

Perhaps the most exciting development in the field of microbial study of chronic

suppurative otitis media in recent years is the discovery of presence of non-sporing aerobes. This may be an important factor in the failure of resolution in the acute phase otitis media. The main species of anaerobes isolated were bacteroids. Culturing anaerobes is a difficult process and requires highly trained personnel to obtain reliable results.

Since cholesteatoma contain keratin debris enclosed in a tissue space, they are subject to recurrent infections. The bacteria found in infected cholesteatomas are different from those found in acute otitis media or otitis media with effusion. The most common aerobic bacteria found is Pseudomonas and the most common anaerobic bacteria found is Bacteroides species.

The route of entry of some of these organism is still uncertain. Gram negative aerobes are not usually discovered in domestic environment. The alternate route through the ear is a possibility. The reduction of partial pressure of oxygen due to obstruction of air flow around cholesteatoma causes an increase in carbon dioxide pressure and anaerobes multiply. Evidence of synergy between gram negative bacilli particularly coli forms and Proteus with, Bacteroids species was elaborated by Ingham (1977). He reported inhibition of phagocytosis of these gram negative bacilli by human leukocytes in the presence of Bacteroides species studies in vitro.

Infection of cholesteatoma is difficult to treat because of the **inability to obtain required antibiotic level within the sac** where the infection exist. This has important implications in the management. The elimination of organisms depend upon eradication of cholesteatoma by surgery.

CLINICAL FEATURES

I. SYMPTOMS

1. Otorrhoea

Usually the discharge from a case of cholesteatoma is scanty but may be profuse in the presence of active infection. There is always a foul odour. In some cases the patient may not be aware of discharge at all especially in the early stages of attic retraction cholesteatoma.

2. Hearing loss

This may be vary from a normal hearing threshold to a total deafness. Early retraction pocket cholesteatoma may not impede ossicular movements and hearing may be normal. Occasionally hearing is found near normal in patients with firm cholesteatoma bridging an ossicualr chain defect. These are the so called cholesteatoma hearers. Patient very often show surprisingly little concern when the deafness is slowly progressive. Sudden changes in the hearing are more like to bring the patient to otologist.

3. Bleeding

It is very characteristic of atticoantral type of disease. This occur from trauma to granulation or polyp.

4. Earache

Is seen with sudden reactivation of a quiescent cholesteatoma and with inflammation of canal skin or it may indicate mastoiditis or intracranial complication.

5. Dizziness

With progressive cholesteatoma particularly with acute aggravations, a serous labyrinthitis may develop either by extension through window especially when the granulations are present on the foot plate or by erosion of bony lateral semicircular canal by fistula formation.

6. Headache

The onset of headache is highly suggestive of intracranial extension.

II. SIGNS

Clinical examination form the basis of assessing the type and extent of the disease and includes inspection of ear by head mirror.

Otoscopic examination may reveal the presence of a crust, polyp, granulations obscuring the cholesteatoma in the attic. A posterior retraction may be associated with keratin debris and a necrosed lenticular process of incus with granulation in the deep meatal margin.

The mobility of tympanic membrane is tested and in the presence of history of vertigo, evidence of spontaneous and induced nystagmus is sought and tested for fistula sign. Integrity of facial nerve is noted.

Tuning fork test are done to find out the type of hearing loss if any, whether conductive or sensorineural and worst hearing ear if the disease is bilateral.

MANAGEMENT

INVESTIGATIONS

1. Bacteriological evaluation

In chronic ear infection saprophytic as well as pathogenic organism may be involved and also the prior antibiotic treatment may causes emergence of resistant strain or emergence of unusual organisms. So culture and sensitivity test assume an important role in a planning therapy. These studies can be done immediately before the surgery so that proper antibiotic can be used in the immediate post operative period.

But successful eradication is depends on elimination of cholesteatoma that harbour these organism rather the use of specific antibiotics.

2. Audiometric evaluation

Is necessary to determine the status of conductive and cochlear function. By air and bone conduction pure tone audiometry and speech discrimination scores, the amount of ossicular damage may be estimated and the hearing benefit which may be gained by reconstructive middle ear surgery can be assessed.

The following observation will be helpful.

i. A simple perforation usually cause no more than a 15dB to 20dB conductive loss.

ii. Damaged ossicular chain causes a 30-50dB conduction if perforation is present. In cholesteatoma hearer hearing loss will be minimal.

iii. Discontinuity of ossicular chain behind an intact tympanic membrane causes a 55-65 dB conductive loss.

iv. Marked impairment of speech discrimination, regardless of bone conduction indicate severe cochlear damage.

III. RADIOLOGICAL EVALUATION

It is of limited diagnostic value compared to otoscopy and audiometry.

1. Law's view (Lateral oblique)

Shows the extent of pneumatization of mastoid. This is of value during surgery by defining position of lateral sinus and tegmen. This is particularly useful in sclerotic mastoid to forewarn the surgeon and thus prevent entry into duramater or lateral sinus.

2. Schuller View

Shows mastoid air cells, internal auditory meatus below external auditory meatus, epitympanum and ossicles.

3. Owen (Modified Mayer) view

Shows the external meatus and ossicles especially the malleus head.

4. Computerised Tomography

High Resolution Computerised Tomography (HRCT) is very useful imaging in the pre operative diagnosis of middle ear, attico antral cholesteatoma . It is useful not only

the localization of cholesteatoma sac and to determine the type of surgical approach

I. To findout the erosion of ossicles , bony labyrinth and fallopian canal , tegmen , sigmoid plate.
II. To find out the dehiscense in the fallopian canal , tegmen , sigmoid plate
III. To useful in early identification of occult cholesteatoma and atypically situated cholesteatoma eg. Petrous apex
IV. To find out the spread of intra cranial complications very early

5. Magnetic resonance imaging :

I. Provide the information by soft tissue density lesion, particularly to differentiate cholesteatoma from cholesterol granuloma
II. To differentiate the Petrous apex cholesteatoma from other cerebello pontine angle lesions
III. To define relationship between middle ear disease and intracranial pathology.

MEDICAL MANAGEMENT

It is generally accepted that medical management has no place in the treatment of uncomplicated cholesteatoma. However there are a few exceptions wherein continued medical management by aspiration debridement at suitable intervals, aimed at controlling infection appears, to be the best alternative.

i) An elderly patient with other medical problems who may not be able to with stand surgery.

ii) A small cholesteatoma sac confined to attic with normal hearing; the keratinous debris may be successfully cleared by aspiration debridement. A careful watch and followup is required in case the disease spread with the onset of infection.

iii) Those patients who refuse surgery.

Irrigation with 1:1 distilled white vinger and 70% isopropyl alcohol may keep some cholesteatomas stable or removal of keratin debiris with saline irrigation under operative microscope.

SURGICAL MANAGEMENT

Surgery is the only mode of treatment for aural cholesteatoma except in the few cases mentioned above. The principle is to eradicate the disease and to convert a potentially dangerous ear to a relatively safe ear.

Surgery of cholesteatoma has witnessed profound changes in the lifetime of some of our eminent otologists. Earlier pioneers in the late 19th and early 20th century successfully achieved the principles of treatment by radical and modified radical mastoidectomy. Operations were designed to expose, excise and exteriorize the disease to the external auditory meatus. Aim of surgery :

i Eradication of disease

ii Management of complications

iii Reconstruction of middle ear

Judgement of operative procedure depends on

i Nature and extend of disease

ii Existence of complications

iii Mastoid pneumatization

iv Eustachian tube function

v Hearing status of both ears

vi Experience and skill of sugerons

vii Patient factor – medical conditions, age, occupation and reliability

Surgeries for cholesteatoma

1. **Stacke's Radical mastoidectomy**

   It is an operation to eradicate disease from middle ear and mastoid without reconstructing hearing mechanism, where posterior canal wall, entire middle ear (except footplate) attic, antrum, mastoid is made into single cavity with obliteration of eustachian tube with piece of muscle (or) cartilage.

2. **Modified Radial mastoidectomy**

   It is a modification of Radical mastoidectomy. Hearing mechanism is preserved as much as possible and reconstructed.

3. **Atticoantrostomy (BONDY'S MASTOIDECTOMY)**

   It is type of modified radical mastoidectomy, which is indicated for only primary acquired cholesteatoma with perforation in pars flaccida. Disease is limited to attic and antrum and intact pars tensa, not involving middle ear space.

4. **Combined approach tymopanoplasty (Intact canal wall tympanoplasty)**

   Which is indicated in postero superior cholesteatoma into and aditus to avoid open mastoid cavity problem.

5. **Atticotomy**

   Procedure is used when cholesteatoma is limited to epitympanum (or) attic region.

REVIEW OF LITERATURE

1. Harkar LA, koontz FP:

The bacteriology of cholesteatoma – In Mc cabe BF, Sade I, editors Cholesteatoma –first international conference New York, 1977, 264-267.

Nature of study:-

To assess the total bacterial flora of a number of cholesteatomas collected during surgery.

Specimens were collected from cases between June 1975 and February 1976. Attempts were made to culture al cholesteatoma matrix surgically exposed of atticotomy or mastoidectomy.

Results:-

The study revealed that peak incidence is in the second decade of life. Pseudomonas aeruginosa was the most frequent aerobic organism identified. The rest of the aerobes include Proteus, klebsiella, Escherichia coli, Strepto coccus, Staphylococcus aureus and epidermidis.

2. Itzhak Brook, Bethesda –Aerobic and anaerobic bacteriology of cholesteatoma – The laryngoscope 91: 1981, 250-253.

Nature of study:-

Cholesteatoma specimens were obtained from 28 patients under going surgery and

all specimens were cultured.

Results:-

Bacterial growth was present in 24 of the 28 patients Aerobes were isolated from 8 of culture positive patients. 12 had both aerobic and anaerobic bacteria, 4 yielded only anaerobes. The most commonly isolated organism was pseudomonas aeruginosa(a); proteus SP (7), klebsiella pneumoniae (5), staphylococcus aureus (5), and escherichia coli (4).

3. B.N. Rao, M.S.Reddy – Chronic suppurative

Otitis media – A prospective study

Indian Journal of otolaryngology and head and neck surgery.

Volume 3, April - June 1994 ,72-77.

Nature of study

A return selection of 120 cases of chronic suppurative otitis media were investigated for bacterial isolates and their susceptibility to various antibiotics

Results

Staphylococcus was the predominant isolate (42.5%) followed by Pseudomonas aeruginosa (21.6% and proteus spices (18.35) Escherichia coli (10.83) and klebsiella species (10%). Less commonly isolated organism were hemolytic streptococci (2.5% streptococcus pneumoniae (2.5%) streptococcus viridans (3.33%)

4. Beena Antony : Rajamma Rajan – Prevalence of anaerobes in chronic suppurative

otitis media in coastal Karnataka region – Indian Journal of otolaryngology , Volume 48 No 2 April June 1996- 153-156.

Nature of study

To find out the incidence of anaerobes in chronic suppurative otitis media and also the changing pattern of antibiogram in a total specimen of 120.

Results

Among the aerobes, prevalence of pseudomonas and staphylococcus aureus were observed and among anaerobes bacteroids followed by peptostreptococci.

Gentamycin was found to be the choice of drug for aerobes and metronidazole for anaerobes.

5. Pale and hailstorm 1965- Types of aerobic microbes isolable in chronic Suppurative otitis media- from Scott- Browns otolaryngology, otology- Volume, 218- 219, 5th edition.

Nature of Study:

To study the type of aerobic microbes isolated in 100 cases of chronic Suppurative otitis media.

Results:-

Pseudomonas aeruginosa formed 24% followed by staphylococcus aureus 13% Proteus species 8% and Escherichia coli 4%.

Jokipii A.M.M.Karma P.Ojala.K 1977

6. Anaerobic bacteria in chronic otitis media in archives of otolarynglogy 86, 110-

Nature of study

To study the bacteria isolated from cases of chronic suppurative otitis media.

Results

Staphylococcus formed 19% proteus 8% Escherichia coli 7% and Pseudomonas aeruginosa 4%.

7. Ojala et al Aerobi microbes is located in chronic suppurative otitis media from scott brown's otolarynglogy – otology volume 218-219 , 6th edition

Nature of study

To the aerobic bacteria from study of 806 cases study of chronic suppurative otitis media.

Results

Staphylococcus aureus formed 22% pseudomonas aeruginosa 19%, proteus species 12.9% Escherichia coli 6.8% and klebsiella 3.7%

8. Sugita et al 1981 – studies on aerobic bacteria in chronic suppurative otitis media – the laryngoscope 91:1987 , 816-820

Nature of study

The study of the aerobic microbial isolated from 62 cases of chronic suppurative otitis media.

Results

Proteus species formed 21.1%

Pseudomonas aeruginosa 7.8%

Staphylococus aureus 6.3%

Klebsiella 1.6%

9. Constable and buttle 1982- Aerobic microbes isolated in chronic suppurative otitis media from scott brown's otolaryngology fifth edition – Otology volume – 218-219

Nature of study

To study aerobic isolate in 100 patients of chronic suppurative otitis media.

Results

Staphylococcus aureus formed 29 isolates proteus species 26 isolates, Pseudomonas aeruginosa 15 isolates, Escherichia coli 15 isolates and klebsiella 3 isolates.

10. Brook 1985 Microbes isolated in chronic suppurative otitis media – Scott brown's otolaryngology – fifth edition otology volume , 218-219

Nature of study

To study the baterial isolates from 48 patients of chronic suppurative otitis media.

Results

Pseudomonas aeruginosa formed 14 isolates Staphylococcus aureus formed 10 isolates, Klebsiella 10 isolates Proteus 4 isolates and Escherichia coli 2 isolates.

MATERIALS AND METHODS

The materials for the present study were collected from cases of chronic suppurative otitis media with clinical diagnosis of cholesteatoma who were admitted and underwent mastoidectomy operation in Government Rajaji Hospital, Madurai during the period from 2005 - 2007

80 cases admitted as chronic suppurative otitis media of attico –antral type for mastoid surgery were studied and a complete clinical examination of ear, nose and throat was carried out. Radiological investigation of mastoid was also done and pus obtained during aural toilet was also sent for bacteriological and antibiotic sensitivity studies.

A few cases of tubo tympanic type of chronic suppurative otitis media which turned out to contain cholesteatoma on mastoid exploration were also included in the study and cholesteatoma matrix sent for bacteriological study.

Thus a total of eighty cases were included in the study.

Containers and swabs for collection of specimens

Strong glass tubes of 4x3/8 inches sterilized in autoclave were used for collecting aural swabs and cholesteatoma matrix. Swabs were prepared from wooden sticks of 5-6 inches length with cotton wool pledge wrapped around one end. The glass tube with the swab was plugged with cotton wool and autoclaved for use.

Collection of specimens:

Aural swab: At the first examination, the external auditory canal was cleaned with

a dry sterile swab and fresh pus was collected by using another dry sterile swab under good illumination.

Cholesteatoma matrix:

During mastoid surgery, the cholesteatoma matrix exposed was collected in sterile glass tube and transported to the laboratory for bacteriological study.

Culture study was done:

To isolate the bacteria

To demonstrate their properties

To determine sensitivity to antibiotics

Identification of bacteria was done by

1) Morphology
2) Staining Reaction
3) Cultural Characteristics
4) Biochemical reactions

Processing of the specimens:

In the laboratory, the swabs and cholesteatoma matrix collected were put in glucose broth for enrichment and was incubated at 37° centigrade for twenty four hours. Then with a standard loop the inoculam (glucose broth) was spread over the following media.

NUTRIENT AGAR PLATE which forms the basal medium to carry out further biochemical tests.

Blood AGAR PLATE (heated blood agar) which also serve as enriched media.

Mac CONKEY'S AGAR PLATE-differential media to differentiate lactose and non –lactose fermentors.

These plates were examined after 24 hours to observe the type, number and morphology of the colonies. Accordingly the biochemical tests were carried out for further identification and also their antibiotic sensitivity pattern were determined by using appropriate antibiotic discs.

The cholesteatoma matrix specimens were also processed in the similar way.

The anaerobic culture was not done due to limited facility.

OBSERVATION AND DISCUSSION

Table 1 shows the culture results of aural swab and cholesteatoma matrices of the 80 cases included in this study.

Organism	Total	Aural swab	Cholesteatoma matrix
Gram positive			
Staphylococcucs aureus	80	14 (17.5%)	13 (16.75%)
Staphylococcus epidermidis	80	11 (13.75%)	10 (12.5%)
β- hemolytic streptococci	80	3 (3.75%)	1 (1.25%)
α - Hemolytic streptococci	80	1 (1.25%)	0 (0%)
Gram negative			
Pseudomonas aeruginosa	80	22 (27.5%)	25 (31.25%)
Proteus mirabilis	80	2 (2.50%)	4 (5%)
Klebsiella sp.	80	7 (8.75%)	11 (13.25%)
Escherichia Coli	80	5 (6.25%)	6 (7.5%)
Citrobacter sp.	80	2 (2.50%)	2 (2.5%)
Mixed	80	13 (16.25%)	8 (10%)

Table 2

MIXED FLORA

Combination of organism isolated	Aural swab	Cholesteatoma matrix
Staphylococcus aureus & Klebsiella sp.	9	5
Staphylococcus aureus & Escherichia coli	2	1
Pseudomonas & Klebsiella sp.	1	1
Escherichia coli & Klebsiella sp.	1	0
Proteus & Klebsiella sp.	0	1
TOTAL	13	8
TOTAL PERCENTAGE	16.25%	10%

AGE AND SEX DISTRIBUTION

The present study consist of 80 patient who underwent mastoid surgery for chronic suppurative otitis media with cholesteatoma. Of this 47 (58.75%) cases were males and 33 (41.25%) were females. The distribution to given in the Table 3.

TABLE 3

Age	Male		Female		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
0-10 years	2	2.5%	2	2.5%	4	5%
11-20 years	12	15%	6	7.5%	18	22.5%
21-30 years	28	35%	19	23.75%	47	58.75%
31-40 years	2	2.5%	3	3.75%	5	6.25%
41-50 years	1	1.25%	3	3.75%	4	5%
>51 years	2	2.5%	0	0%	2	2.5%

CLINICAL PRESENTATION

All the 80 patients complained of aural discharge, 66 patients complained of loss of hearing, followed bleeding from ear in 8 patients and vertigo in one patient 3 patients presented with aural polyps.

TABLE 4

PRESENTING SYMPTOMS

	Total Number	**Aural Discharge**	**Loss of Hearing**	**Bleeding From ear**	**Vertigo**
Number	80	80	66	8	2
Percentage	100	100	82.5	10%	2.5%

TABLE 5

PRESENTING SIGN

	Total Number	**Attic Perforation**	**Postero superior retraction / marginal perforation / cholesteatoma**	**Subtotal perforation**	**Aural polyp**
Number	80	42	27	8	3
Percentage	100	52.5%	33.75	10	3.75

BACTERIOLOGICAL STUDY

Among the gram positive organisms isolated from aural swab culture, staphylococcus aureus formed the majority 17.5%, staphylococcus epidermidis 13.75%, β-hemolytic streptococci 3.75% and α-hemolytic streptococci 1.25%.

Among the gram negative organism isolated from aural swab culture, pseudomonas aeruginosa formed the majority 27.5%, followed by klebsiella 8.75%, Escherichia coli 6.25%, proteus mirabilis and citrobactor each 2.5%, mixed growths were isolated from 13 cases 16.25%.

Among the gram positive organisms isolated from the cholesteatoma matrix culture staphylococcus aureus formed the majority 16.75%, followed by staphylococcus epidermidis 12.5%, β-hemolytic streptococci 1.25%. Among the gram negative organisms isolated from the cholesteatoma matrix culture, pseudomonas aeruginosa formed the majority 31.25% followed by klebsiella 13.25%, Escherichia coli 7.5%, proteus 5%, citrobactor 2.5%, mixed growth 10%.

Single pathogens were isolated from 67 of aural swab culture (83.75%) 72 cases of cholesteatoma matrix culture (90%). Mixed growths were isolated from 13 cases (16.25%) of aural swab culture and 8 cases (10%) of cholesteatoma matrix culture.

The same organism was identified from the cultures of both aural swab and cholesteatoma matrix in 68 cases. In some showed mixed growth with another organism.

In 5 patients aural swab culture showed gram positive pathogen whereas

cholesteatoma culture showed gram negative pathogen. In 10 patients of gram negative pathogens from culture of cholesteatoma and aural swab were different.

In 13 of the culture of aural swab and 8 of the culture of cholesteatoma matrix mixed growths were seen. Staphylococcus aureus was found more often in mixed growth than as a single pathogen.

Antibiotic sensitivity pattern

Staphylococcus aureus from cultures of aural swab and cholesteatoma matrix are more sensitive to cefotaxime, cephalexin, and ciprofloxacin. They are more resistant to ampicillin, doxycycline, amoxicillin.

β-hemolytic streptococci are more sensitive to ampicillin, ciprofloxacin, cefotaxime. α-hemolytic streptococci are sensitive to ampicillin and ciprofloxacin.

Pseudomonas aeruginosa is more sensitive to gentamycin, cefotaxime, ciprofloxacin and ceftriaxone. They are resistant to ampicillin, doxycycline and cephalexin.

Citrobacter species resistant to all routine antibiotics in the study cases.

Escherichia coli and proteus are more sensitive to gentamycin, ciprofloxacin and cefotaxime and amikacin , ceftriaxone .

Klebsiella are more sensitive to gentamycin, ceftriaxone, amikacin and they are resistant to doxycycline and ampicillin.

In the study by Itzhak Brook and Bethesda on the bacteriology of cholesteatoma, they have reported that staphylococcus aureus was the predominant gram positive

pathogen (5 in 24 patients) and pseudomonas aeruginosa, the most predominant gram negative organism (9 in 24 patients) followed by proteus mirabilis (5), klebsiella pneumoniae (5) and Escherichia coli (4). They have also reported the presence of mixed growth in 8 patients.

In another study by L.A. Harker and F.P. Koontz on the bacteriology of cholesteatoma. They have reported that in 57% of cases more than one organism was identified and pseudomonas aeruginosa was the most frequent gram negative organisms identified followed by mixed flora of enteric organisms.

In a study by B.N. Rao and M.K.Reddy on the 'bacteriology of aural swab culture' of 120 cases in 1994, they have reported that staphylococcus aureus formed the predominant pathogen (42.5%) followed by pseudomonas aeruginosa (21.6%), proteus (18.35%), Escherichia coli (10.83%) and klebsiella species (10%). A single pathogen was isolated from 68.52% and mixed growth was isolated from the remainder. The antimicrobial sensitivity of the isolates showed that ciprofloxacin formed the drug of choice for treating cases due to either gram positive or negative organisms which showed a high rate of activity against staphylococcus aureus, pseudomonas aeruginosa and proteus species with sensitivity incidence of 92.15%, 84.61% and 90.9% respectively followed by cefotaxime, ceftriaxone and amikacin.

The results obtained from the present study also concur with the data obtained from their other studies. The most gram positive organism obtained from aural swab culture in the present study is staphylococcus aureus 17.5% followed by staphylococcus

epidermidis 13.75% β-hemolytic streptococci 3.75%, α-hemolytic streptococci 1.25% whereas those obtained from cholesteatoma matrix are staphylococcus aureus 16.75%, staphylococcus epidermidis 12.5%, β-hemolytic streptococci 1.25%.

The most common gram negative organism obtained from aural swab culture pseudomonas aeruginosa 27.5%, klebsiella 8.75%, Escherichia coli 6.25%, proteus 2.5%, Citrobactor 2.5% and those obtained from culture of cholesteatoma matrix are Pseudomonas aeruginosa 31.25%, klebsiella 13.75%, Proteus 5%, Escherichia coli 7.5%, Citrobacter 2.5%, mixed growth was obtained from 16.25% cases of aural swab cultures and 10% cases of cholesteatoma matrix culture. Thus mixed growth is more common in culture of aural swab.

In the present study, ciprofloxacin shows a high rate of activity against staphylococcus aureus, pseudomonas aeruginosa, escherichia coli klebsiella and proteus with sensitivity index of 91.35%, 82.75%, 81.63%, 73.66% and 54.72 respectively among the oral antibiotics.

Ceftriaxone and cefotaxime shows a much better sensitivity near 100% and 93% respectively against these organism. Most of the organisms resistant to doxycycline.

Thus we can see the result of the present study concurring with the result of previous studies and also the sensitivity pattern of antimicrobial agents including gentamycin changing slowly due to the emergence of resistance probably due to indiscriminate use of antibiotics and mixed growth of organisms.

Ciprofloxacin has now emerged as the drug of choice with high degree of

sensitivity against both gram positive and negative organisms among oral available antibiotics.

ANTIBIOGRAM OF ISOLATES OF AURAL SWAB CULTURE

	Total	Ampi	Genta	Cotri	Cipr	Cefotax	Doxy	Cepha	Ceftria	Amik
Staphylococcus aureus	14	5 35.71%	9 64.28%	3 21.42%	14 100%	14 100%	1 7.14%	10 71.42%	14 100%	1 7.14%
Staphylococcus epidermidis	11	R	R	R	3 27.27%	5 45.45%	R	R	2 18.18%	R
β-hemolytic streptococci	3	1 33.33%	2 66.66%	1 33.33%	3 100%	3 100%	R	2 66.66%	3 100%	R
α-hemolytic streptococci	1	R	R	R	1 100%	1 100%	R	R	1 100%	R
Pseudomonas aeruginosa	22	4 18.18%	20 90.90%	4 18.18%	6 27.27%	20 90.90%	R	16 72.72%	22 100%	22 100%
Klebsiella pneumoniae	7	R	6 85.71%	4	6 85.71%	7 100%	R	2 28.57%	7 100%	7 100%
Proteus microbilis	2	R	1 50%	1 50%	2 100%	2 100%	R	1 50%	2 100%	2 100%
Citrobactor	2	R	R	R	R	R	R	R	R	R
Escherichia coli	5	R	5 100%	R	4 80%	5 100%	R	4 80%	5 100%	5 100%
Mixed	13	R	11 84.61%	12 92.30%	9 69.23%	11 84.61%	R	10 76.92%	13 100%	13 100%

Ampi – Ampicillin
Cipro- Ciprofloxacin
Cepha- Cephalexine

Genta - Gentamycin
Cefotax – Cofotaxime
Ceftria – Cetfriaxone

Cotri – Contrimoxazol
Doxy – Doxycycline
Amik - Amikacin

ANTIBIOGRAM OF ISOLATES FROM CHOLESTEATOMA MATRIX CULTURE

	Total	Ampi	Genta	Cotri	Cipro	Cefotax	Doxy	Cepha	Ceftria	Amik
Staphylococcus aureus	13	5 38.46%	8 61.53%	2 15.38%	13 100%	13 100%	1 7.69%	11 84.61%	13 100%	13 100%
Staphylococcus epidermidis	10	R	R	1 10%	8 80%	10 100%	R	8 80%	10 100%	R
β-hemolytic streptococci	1	1 100%	R	R	1 100%	R	R	R	R	R
α-hemolytic streptococci	0	-	-	-	-	-	-	-	-	-
Pseudomonas aeruginosa	25	3 12%	22 88%	5 20%	24 96%	20 80%	2 8%	22 88%	25 100%	25 100%
Klebsiella pneumonia	11	2 18.18%	9 81.81%	2 18.18%	9 81.81%	8 72.72%	1 9.09%	6 54.54%	11 100%	11 100%
Proteus microbalis	4	3 75%	3 7%	1 25%	2 50%	4 100%	1 25%	3 75%	4 100%	4 100%
Citrobactor	2	R	R	R	R	R	R	R	R	R
Escherichia Coli	6	0	4 66.66%	1 16.66%	5 83.33%	6 100%	R	4 66.66%	6 100%	6 100%
Mixed	8	R	2 25%	2 25%	3 37.5%	4 50%	R	2 25%	4 50%	5 62.5%

Ampi – Ampicillin
Genta - Gentamycin
Cotri – Contrimoxazol
Cipro- Ciprofloxacin
Cefotax – Cofotaxime
Doxy – Doxycycline
Cepha- Cephalexine
Ceftria – Cetfriaxone
Amik - Amikacin
R- Resistance

CONCLUSION

Culture of aural swab and cholesteatoma matrix demonstrates the polymicrobial bacteriology consisting of both gram positive and gram negative pathogens.

Gram negative pathogen form the majority of aural swab and cholesteatoma matrix but the percentage is more in cholesteatoma matrix cultures.

Mixed growth is more common in culture of aural swab the cholesteatoma matrix cultures probably due to contaminant of infection from external auditary canal, ascending infection via Eustachian tube and indiscriminate use of antibiotics.

The antibiotic sensitivity study shows emerging resistant strain for the commonly used antibiotics including gentamycin which formed the drug of choice of earlier studies. It is probably due to the indiscriminate use of antibiotics.

Even though the treatment for cholesteatoma is primarily surgical, because the elimination of pathogens depend upon the eradication of cholesteatoma, the knowledge of pathogens and their sensitivity will help in choosing the appropriate antibiotics during the post operative period which will prevent the development of resistant strain and complications.

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DEPARTMENT OF ENT

MADURAI MEDICAL COLLEGE

PROFORMA

Name :

Date of Admission:

Age / Sex:

Date of Discharge:

IP No:

Date of Surgery:

Address:

I. HISTORY OF PRESENT ILLNESS

1. Discharge

a. Side – right / left

b. Type – mucoid / purulent / blood stained

c. Duration

d. Odour – foul smelling / no

e. Quantity – scanty / profuse

f. Continuous / intermittent

2. Hearing Loss

Side – right / left

Onset – sudden / progressive

Duration –

Degree – mild / moderate / severe

3. Vertigo

a) Duration b) Type c) Nausea / vomiting

4. Tinnitus

a) Duration b) Continuous c) Character

5. Pain in the ear

a) Side – right / left b) Duration

c) Location d) Character – dull / severe

6. Head ache

a) Duration b) Location c) Nausea / vomiting

II. EXAMINATION OF EARS

1. a) preauricular region

b) postauricular region

c) Auricle (or) Pinna

d) External auditory canal

e) Tympanic membrane

i. Appearance – glistening grey – dull

ii. Position – retracted / bulging

iii. Perforation – attic / marginal / central

iv. Mobility – normal restricted / absent

v. Visible cholesteatoma / granulation / polyp

2. Fistula test - positive / negative

3. Tuning Fork Test Right Left

a. Rinnes

b. Weber

c. ABC

4. Facial nerve and other cranial nerves

III. EXAMINATION OF NOSE

a. External nose

b. Anterior rhinoscopy

- Mucous membrane
- Septum
- Turbinates

c. Post Rhinoscopy - Discharge

- Adenoids
- Eustuchian tube orifice

IV. EXAMINATION OF THROAT

a. Oral cavity

b. Oropharynx including tonsils

c. Posterior pharyngeal wall

V. INVESTIGATIONS

a. Routine investigations

TC DC Hb% Urine Albumin / Sugar

b. Aural Swab for culture & sensitivity

i) Growth

ii) Sensitivity

c. Audiological Evaluation

Right - Conductive / Sensoryneural / mixed

Left - Conductive / Sensoryneural / mixed

d. Radiological Evaluation

X ray mastoids

Right - Sclerotic / cellular / diploic / other bony erosion

Left - Sclerotic / cellular / diploic / other bony erosion

VI. MICROBIAL STUDY OF CHOLESTEATOMA MATRIX

i. Culture – Growth

ii. Sensitivity