

Retroprospective Study of Microbiological Profile and Antimicrobial Sensitivity Pattern in Chronic Otitis Media (Squamous Type) in and Around Prayagraj Uttar Pradesh

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Abstract: ***Aim:** Isolate and identify the common microorganism causing chronic otitis media (squamous type). Determine the antimicrobial sensitivity pattern in COM (squamous type) in Prayagraj and surrounding areas. **Material & Methods:** Total number of samples (n) in our study diagnosed as COM (Squamous type) were 170. Data of 100 samples were collected from retrospective study and 70 samples from prospective study. The specimen for microbiological study was taken from the middle ear cavity and mastoid antrum (under planned OT after meatotomy and anrostomy respectively) in the form of two ear swab under sterile conditions and transferred immediately for staining, culture and sensitivity testing. Both swabs were processed for direct smear examination for Gram staining, AFB staining, culture (under inoculation in Mac Conkey agar, blood agar plate and chocolate agar). and sensitivity testing (Kirby Bauer disc diffusion method). Organism isolated was identified by standard microbiological methods and antimicrobial sensitivity pattern was obtained for further analysis. **Results:** Chronic otitis media (COM) is an important global public health problem. Monomicrobial etiology, especially Staphylococcus aureus and Pseudomonas species was found most common in our study. Staphylococcus aureus was most sensitive to cefoperazone + sulbactam (56.92%), followed by ceftriaxone and highly resistance to amoxyclav. Pseudomonas was most sensitive to piperacillin+tazobactam.*

Keywords: Staphylococcus aureus, Pseudomonas, cefoperazone + sulbactam, sensitive, resistance.

1. Introduction

Definition

Chronic otitis media (COM) implies a permanent abnormality of the pars tensa or flaccida, most likely a result of earlier acute otitis media, negative middle ear pressure or otitis media with effusion.¹

Active (squamous) COM

Retraction of the pars flaccida or tensa that has retained squamous epithelial debris and is associated with inflammation and the production of pus often from the adjacent mucosa.

Retraction of pars flaccida or posterosuperior quadrant of pars tensa result in cholesteatoma.²

World Health Organization (WHO) estimated that 65-330 million people worldwide are affected by CSOM, of whom 50% suffer from hearing impairment and approximately 28000 death per annum are attributable to the complications of OM.¹

Chronic otitis media (COM) is an important global public health problem, leading to hearing impairment which may have serious long-term effects on early communication, language development, auditory processing, psychological as well as cognitive development and educational progress.³

COM is associated with history of acute otitis media, parental history of COM, crowded conditions and certain racial group. COM most common in developing countries. Infants and young children are especially at risk because Eustachian tubes are short, horizontal and floppy.⁴

In COM, common etiological agent may be – ⁴erobic Bacteria (eg Pseudomonas aeruginosa, Staphylococcus aureus, Proteus sp, Klebsiella sp, E. coli. Haemophilus influenza etc)

Anaerobic Bacteria (eg Bacteroides sp, Fusobacterium sp etc)

Fungi (Aspergillus sp, Candida sp etc)

Dysfunction of the Eustachian tubes and bacterial infection are the most relevant pathogenic factors for COM. Irreversible inflammatory changes of acute otitis media causes mucosal edema and effusion which result in decrease

Volume 12 Issue 11, November 2023

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blood circulation and thus inhibiting availability of systemic and local antibiotics and anti-inflammatory agents. These changes bring about significant alterations in bacterial strains.^{5,6}

Bacterial biofilm plays an important role in persistent chronic otitis media and cholesteatoma.⁷

Some Gram-negative bacteria (*Pseudomonas* sp) may cause Lipopolysaccharide induced osteoclast formation and bone resorption.⁸

Bone resorption causes destruction of ossicular chain and otic capsule which result in hearing problem, vestibular dysfunction, facial paralysis and cranial complication⁹

COM may cause life threatening complications, classified as extracranial and intracranial. Extracranial complications include mastoid abscess, labyrinthitis, petrositis, facial nerve paralysis and Bezold abscess. Intracranial complications include lateral sinus thrombophlebitis, meningitis and intracranial abscess.^{10,11}

Treatment of COM is controversial and subject to change particularly in the developing countries, the prevalence, and antibiogram of these organisms which has been reported to vary with time and geographical area as well as continent to continent probably due to indiscriminate use of antibiotics. Hence the periodic update of prevalence and antibiogram of the etiological agents for COM would be helpful in the treatment and management of the patient.¹²

The wide spread and haphazard use of antibiotics and poor follow up of patients has precipitated the emergence of many resistant strains of bacteria which can produce both primary and post-operative infections.¹³

Therefore, the present study will be undertaken to know the local pattern of microorganism causing chronic otitis media (squamous type) and their antibiotic susceptibility pattern to help the clinician for use of appropriate antibiotic and to prevent antibiotic resistance.

Aims and Objective

The aim of the study is to

Isolate and identify the common microorganism causing chronic otitis media (squamous type).

Determine the antimicrobial sensitivity pattern in COM (squamous type) in Prayagraj and surrounding areas.

2. Material and Methods

This retrospective study was conducted in the Department of EAR NOSE, THROAT & HEAD AND NECK Surgery, Motilal Nehru Medical College and Swaroop Rani Nehru Hospital, Prayagraj from August 2020 to July 2021. This study will be conducted after due clearance from the Institutional Ethics Committee. Patients were thoroughly informed regarding the nature of the disease, expected outcome and the study. Written and

informed consent was taken from the patients who participate in our study.

Exclusion Criteria:

- Patients' refusal to enrol in the study.
- Patients of age below 10 years and above 60 years.
- Patients clinically diagnosed as chronic otitis media (mucosal type) with or without complications.
- Patients diagnosed with any immunodeficiency or autoimmune disorder.
- Patients receiving steroids, chemotherapy, radiotherapy.
- Patients who received topical/systemic antibiotics within one week of presentation.
- Patients diagnosed with any malignant lesion of external and middle ear.

Methodology:

For retrospective study previous data of pattern of microbiological profile and antimicrobial sensitivity was collected from the case file of chronic otitis media (squamous type), from August 2019 up to July 2020, from the record keeping section of the Department of ENT & Head Neck Surgery, SRN Hospital, MLN Medical College Prayagraj Uttar Pradesh.

For prospective study patients were selected from August 2020 up to July 2021, from OPD of the Department of ENT & Head Neck Surgery, SRN Hospital, MLN Medical College Prayagraj Uttar Pradesh.

Patients attending ENT OPD with chief complaint of otorrhea more than 3 months duration with permanent abnormality of pars tensa or pars flaccida and hearing loss, were thoroughly examined by proper history taking, examination by otoscope, audiological examination (TFT, PTA) and radiological examination (X-Ray mastoid, CT scan temporal bone).

On the basis of above examinations, patients diagnosed as chronic otitis media (squamous type) were included in our study. Patients were admitted in the ENT department and routine investigation was carried out and patients were planned for surgery.

The specimen for microbiological study was taken from the middle ear cavity and mastoid antrum (under planned OT after meatotomy and antrostomy respectively) in the form of two ear swab under sterile conditions and transferred immediately for staining, culture and sensitivity testing.

In patients with bilateral disease, swabs were taken from the ear which was being operated.

Both swabs were processed for direct smear examination for Gram staining, AFB staining, culture (under inoculation in Mac Conkey agar, blood agar plate and chocolate agar). and sensitivity testing (Kirby Bauer disc diffusion method).

Organism isolated were identified by standard microbiological methods and antimicrobial sensitivity pattern was obtained for further analysis. The antibiotic

disc of specific concentrations was procured from Himedia.

Interpretation was according to zone size interpretation chart of Himedia (Antimicrobial Susceptibility System, Himedia Laboratories, Himedia Laboratories Pvt. Ltd., USA and Canada).

3. Results

The present study “RETROSPROSPECTIVE STUDY OF MICROBIOLOGICAL PROFILE AND ANTIMICROBIAL SENSITIVITY PATTERN IN CHRONIC OTITIS MEDIA (SQUAMOUS TYPE) IN

AND AROUND PRAYAGRAJ UTTAR PRADESH” was done in the Department of E. N. T. & H. N. S. Moti Lal Nehru Medical College, Prayagraj during the period August 2020 to July 2021. Total number of samples (n) in our study diagnosed as COM (Squamous type) were 170. Data of 100 samples were collected from retrospective study and 70 samples from prospective study.

There was no significant difference between gender distribution of the groups ($p > 0.05$). There was no significant difference between ages of the groups ($p > 0.05$).

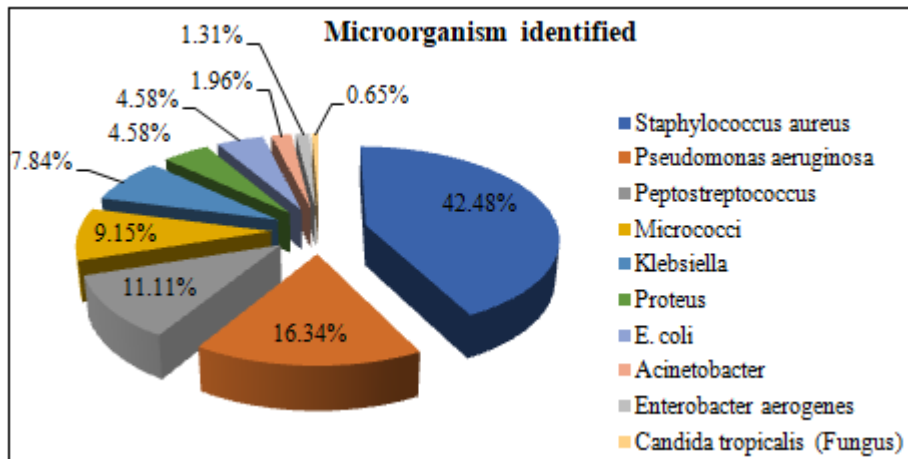


Figure 1: Distribution of study populations according to Microorganism identified

Figure no 1 represent that all samples with positive result show monomicrobial growth pattern. *Staphylococcus aureus* was the most common micro-organism (42.48%) present in the study followed by, *Pseudomonas aeruginosa* (16.34%), *Peptostreptococcus* (11.11%), *Micrococci*

(9.15%), *Klebsiella* (7.84%), *Proteus* (4.58%) *E. coli* (4.58%) *Acinetobacter* (1.96%), *Enterobacter aerogenes* (1.31%) Fungus-*Candida tropicalis* present in 1 sample (0.65%).

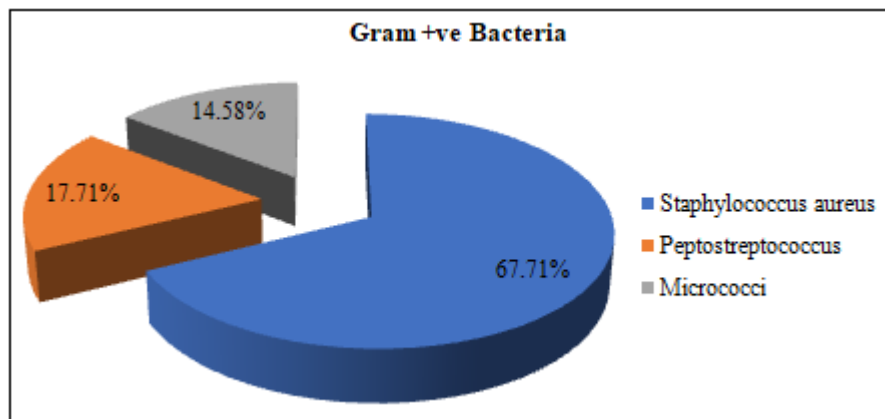


Figure 2: Distribution of study populations according to Gram Positive organism identified

Fig. no 2 shows that out of 96 Gram +ve bacteria, most common gram-positive isolate in the study was

Staphylococcus aureus (67.71%) followed by *Peptostreptococcus* (17.71%) and *Micrococci* (14.58%).

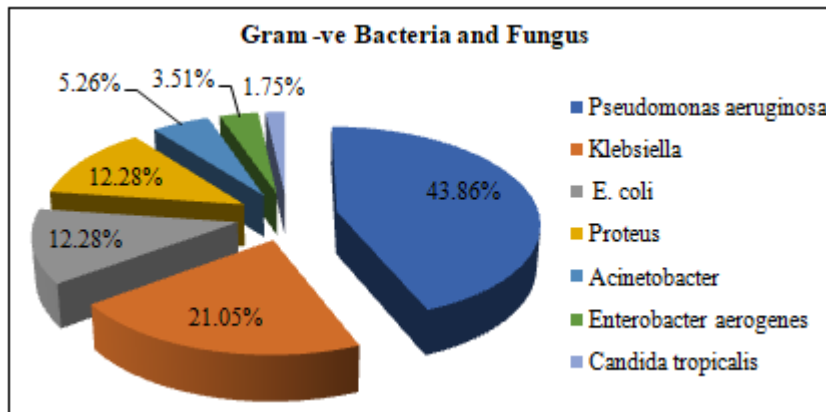


Figure 3: Distribution of study populations according to Gram Negative and fungus organism identified

Figure no 3 show out of 56 Gram-ve bacteria, *Pseudomonas aeruginosa* (43.86%) was the most common Gram Negative bacteria followed by *Kliebseilla* (21.05%), *E. coli* (12.28%), *Proteus* (12.28%) *Acinetobacter* (5.26%) and *Enterobacter*

aerogenes (3.51%) in our study. In our study *Candida tropicalis* was the only one fungal isolate and observed in single sample.

Table 1: Antibiotics sensitivity of micro – organism

Antibiotics	Organism showing Percentage (%) of Antibiotics sensitivity								
	<i>Staphylococcus aureus</i>	<i>Pseudomonas aeruginosa</i>	<i>Peptostreptococcus</i>	<i>Micrococci</i>	<i>Klebsiella</i>	<i>Proteus</i>	<i>E. coli</i>	<i>Acinetobacter</i>	<i>Enterobacter aerogenes</i>
Amoxiclav	20.00	0.00	11.76	7.14	0.00	0.00	0.00	0.00	0.00
Piperacillin+ Tazobactam	30.77	84.00	11.76	57.14	66.67	42.86	85.71	0.00	100.00
Cefuroxime	15.38	36.00	0.00	7.14	75.00	0.00	14.29	0.00	0.00
Ceftriaxone	50.77	8.00	41.18	7.14	25.00	0.00	0.00	0.00	0.00
Cefoperazone+ Sulbactam	56.92	68.00	23.53	7.14	50.00	0.00	14.29	0.00	100.00
Ofloxacin	49.23	72.00	52.94	35.71	8.33	0.00	42.86	0.00	50.00
Levofloxacin	46.15	60.00	29.41	64.29	8.33	0.00	14.29	100.00	50.00
Moxifloxacin	41.54	48.00	47.06	0.00	8.33	0.00	0.00	33.33	0.00
Linezolid	38.46	16.00	35.29	35.71	8.33	28.57	14.29	0.00	50.00
Clindamycin	36.92	40.00	11.76	42.86	8.33	57.14	0.00	0.00	100.00
Norfloxacin	44.62	12.00	52.94	35.71	0.00	0.00	28.57	0.00	0.00
Azithromycin	44.62	4.00	64.71	7.14	16.67	14.29	14.29	33.33	0.00
Doxycycline	32.31	4.00	52.94	28.57	0.00	14.29	0.00	100.00	50.00

Table no 1 shows that-*Staphylococcus aureus* was most sensitive to cefoperazone + sulbactam (56.92%), followed by ceftriaxone (50.77%), ofloxacin (49.23%), levofloxacin (46.15%), norfloxacin (44.62%), azithromycin (44.62%) moxifloxacin (41.54%), linezolid (38.46%), clindamycin (36.92%), doxycycline (32.31%), piperacillin+tazobactam (30.77%), amoxiclav (20.00%) cefuroxime (15.38%).

Pseudomonas aeruginosa was most sensitive to piperacillin+tazobactam (84%), followedby ofloxacin (72.00%), cefoperazone+sulbactam (68%), levofloxacin (60%), moxifloxacin (48%), clindamycin (40%), cefuroxime (36%), linezolid (16%), norfloxacin (12%), ceftrixone (08%), azithromycin (4%) and doxycycline (4%). *Pseudomonas aeruginosa* wasmost resistant to amoxiclav (100.00%).

Peptostreptococcus was most sensitive to azithromycin (64.71%), followed by norfloxacin (52.94%) and ofloxacin

(52.94%) %), doxycycline (52.94%), moxifloxacin (47.06%), ceftriaxone (41.18%), linezolid (35.29%), levofloxacin (29.41%), cefoperazone+sulbactam (23.53%), while piperacillin+tazobactam amoxiclav, and clindamycin show only 11.76% sensitivity *Peptostreptococcus* was most resistance to cefuroxime (100%).

Micrococci were most sensitive to levofloxacin (64.29%), followed by Piperacillin+tazobactam (57.14%), clindamycin (42.86%), ofloxacin (35.71%), norfloxacin (35.71%), linezolid (35.71%), doxycycline (28.57%) amoxiclav (7.14%), azithromycin (7.14%), ceftriaxone (7.14%), cefuroxime (7.14%), cefoperazone+sulbactam (7.14%) while most resistant to moxifloxacin (100.00%).

Klebsiella was most sensitive to cefuroxime (75.00%) followed by piperacillin+tazobactam (66.67%), cefoperazone+ sulbactam (50.00%), ceftriaxone (25.00%), azithromycin (16.67%), ofloxacin (8.33%), levofloxacin

(8.33%), moxifloxacin (8.33%), linezolid (8.33%), clindamycin (8.33%) and most resistance to amoxiclav (100%), norfloxacin (100%) doxycycline (100%).

Proteus was most sensitive to clindamycin (57.14%) followed by piperacillin+tazobactam (42.86%), linezolid (28.57%), azithromycin (14.29%), doxycycline (14.29%), while show 100% resistance to amoxiclav, cefuroxime, ceftriaxone, cefoperazone+sulbactam, ofloxacin, levofloxacin, moxifloxacin and norfloxacin.

E. coli was most sensitive to piperacillin + tazobactam (85.71%) followed by ofloxacin (42.86%), norfloxacin (28.57%), and 14.29% sensitive to cefuroxime, cefoperazone+sulbactam, levofloxacin, linezolid and

azithromycin. *E. coli* was 100% resistance to amoxiclav, ceftriaxone, moxifloxacin, clindamycin and doxycycline.

Acinetobacter was 100% sensitive to doxycycline and levofloxacin, 33.33% sensitive to azithromycin and moxifloxacin. *Acinetobacter* was 100% resistance to amoxiclav, piperacillin+tazobactam, cefuroxime, ceftriaxone, cefoperazone+sulbactam, ofloxacin, norfloxacin, linezolid and clindamycin.

Enterobacter aerogenes was 100% sensitive to piperacillin+tazobactam, cefoperazone+sulbactam and clindamycin and 50% sensitive to ofloxacin, levofloxacin and doxycycline linezolid. *Enterobacter aerogenes* was 100% resistance to amoxiclav, cefuroxime, ceftriaxone, moxifloxacin, norfloxacin and azithromycin.

Table 2: Antibiotics Resistance of microorganism

Antibiotics	Organism showing Percentage (%) of Antibiotics Resistance								
	<i>Staphylococcus aureus</i>	<i>Pseudomonas aeruginosa</i>	<i>Peptostreptococcus</i>	<i>Micrococci</i>	<i>Klebsiella</i>	<i>Proteus</i>	<i>E. coli</i>	<i>Acinetobacter</i>	<i>Enterobacter aerogenes</i>
Amoxiclav	80.00	100.00	88.24	92.86	100.00	100.00	100.00	100.00	100.00
Piperacillin+ Tazobactam	69.23	16.00	88.24	42.86	33.33	57.14	14.29	100.00	0.00
Cefuroxime	84.62	64.00	100.00	92.86	25.00	100.00	85.71	100.00	100.00
Ceftriaxone	49.23	92.00	58.82	92.86	75.00	100.00	100.00	100.00	100.00
Cefoperazone+ Sulbactam	43.08	32.00	76.47	92.86	50.00	100.00	85.71	100.00	0.00
Ofloxacin	50.77	28.00	47.06	64.29	91.67	100.00	57.14	100.00	50.00
Levofloxacin	53.85	40.00	70.59	35.71	91.67	100.00	85.71	0.00	50.00
Moxifloxacin	58.46	52.00	52.94	100.00	91.67	100.00	100.00	66.67	100.00
Linezolid	61.54	84.00	64.71	64.29	91.67	71.43	85.71	100.00	50.00
Clindamycin	63.08	60.00	88.24	57.14	91.67	42.86	100.00	100.00	0.00
Norfloxacin	55.38	88.00	47.06	64.29	100.00	100.00	71.43	100.00	100.00
Azithromycin	55.38	96.00	35.29	92.86	83.33	85.71	85.71	66.67	100.00
Doxycycline	67.69	96.00	47.06	71.43	100.00	85.71	100.00	0.00	50.00

Table no 2 shows that *Staphylococcus aureus* was most resistance to cefuroxime (84.62%) followed by amoxiclav (80%), piperacillin+tazobactam (69.23%), doxycycline (67.69%), clindamycin (63.08%), linezolid (61.54%), moxifloxacin (58.46%), norfloxacin (55.38%), azithromycin (55.38%), levofloxacin (53.85%), ofloxacin (50.77%), ceftriaxone (49.23%), and least resistance to cefoperazone+sulbactam (43.08%).

Pseudomonas aeruginosa most resistance to amoxiclav (100%), followed by azithromycin (96%), doxycycline (96%), ceftriaxone (92%), norfloxacin (88%), linezolid (84%), cefuroxime (64%), clindamycin (60%), moxifloxacin (52%), levofloxacin (40%) cefoperazone+sulbactam (32%) and ofloxacin (28%) and least resistance to piperacillin+tazobactam (16%).

Peptostreptococcus was most resistance to cefuroxime (100%) followed by amoxiclav (88.24%), piperacillin+tazobactam (88.24%), clindamycin (88.24%), cefoperazone+sulbactam (76.47%), levofloxacin (70.59%), linezolid (64.71%), ceftriaxone (58.82%), moxifloxacin (52.94%), ofloxacin (47.06%), norfloxacin (47.06%)

doxycycline (47.06%), and least resistance to azithromycin (35.29%).

Micrococci were 100% resistance to moxifloxacin, 92.86% to amoxiclav, cefuroxime, ceftriaxone, cefoperazone+sulbactam and azithromycin, 71.43% to doxycycline, 64.29% to ofloxacin, norfloxacin and linezolid, 57.14% to clindamycin, 42.86% to piperacillin+tazobactam and least resistance to levofloxacin (35.71%).

Klebsiella was 100% resistance to amoxiclav, norfloxacin and doxycycline, 91.67% resistance to ofloxacin, levofloxacin, moxifloxacin, linezolid and clindamycin, 83.33% resistance to azithromycin, 75% to ceftriaxone, 50% to cefoperazone+sulbactam, 33.33% to piperacillin+tazobactam, and least resistance to cefuroxime (25.00%).

Proteus was 100% resistance to amoxiclav, cefuroxime, ceftriaxone, cefoperazone+sulbactam, ofloxacin, levofloxacin, moxifloxacin and norfloxacin, 85.71% to azithromycin, and doxycycline, 71.43% to linezolid, and 57.14% to piperacillin+tazobactam. *Proteus* was least resistance to clindamycin (42.86%).

E. coli was 100% resistance to **amoxiclav, ceftriaxone, moxifloxacin, clindamycin and doxycycline**, 85.71% resistance to cefuroxime, cefoparazone+sulbactam, levofloxacin, linezolid and azithromycin, 71.43% to norfloxacin, 57.14% to ofloxacin. *E. coli* was least resistance to piperacillin+tazobactam (14.29%).

Acinetobacter was 100% resistance to **amoxiclav, piperacillin+tazobactam, cefuroxime, ceftriaxone, cefoparazone+sulbactam, ofloxacin, linezolid, clindamycin** and **norfloxacin**, and 66.67% to moxifloxacin and azithromycin. *Acinetobacter* was 100% sensitive to levofloxacin and doxycycline.

Enterobacter aerogenes was 100% resistance to **amoxiclav, cefuroxime, ceftriaxone, moxifloxacin, norfloxacin**, and **azithromycin**, 50% to ofloxacin, levofloxacin and linezolid and doxycycline. *Enterobacter aerogenes* was 100% sensitive to piperacillin+tazobactam, cefoparazone+sulbactam and clindamycin.

4. Discussion

Chronic otitis media (COM) is considered as a major public health problem in the developing world and India is one of the countries with high prevalence where urgent attention is needed.

It is a persistent disease with risk of irreversible complication and is an important cause of preventable hearing loss in children and adult.

Since chronic otitis media is a disease which can cause significant morbidity, early microbiological diagnosis ensures effective treatment. Hence knowledge of pathogens and their antibiotic susceptibility pattern in different regions of the country would guide the treating physicians in selection of appropriate antibiotics which would help us in reducing the complications and emergence of resistant strains.

Staining and culture result was found positive in 90% samples with mono-microbial pattern of growth, whereas staining and culture show no growth of any microorganism in 10% samples. Approximate similar finding was found study done by John NM et al (2020)²⁴ which show positive result in 92% samples and negative result in 8% samples.

In our study isolated predominant pathogen was *Staphylococcus aureus* (42.48%) followed by, *Pseudomonas aeruginosa* (16.34%), *Peptostreptococcus* (11.11%), *Micrococci* (9.15%), *Klebsiella* (7.84%), *Proteus* (4.58%) *E. coli* (4.58%) *Acinetobacter* (1.96%), *Enterobacter aerogenes* (1.31%) Fungus-*Candida* present in 1 sample (0.65%). Approximate similar findings were also found with the study done by John NM et al (2020)²⁴ in which predominant pathogen was *Staphylococcus aureus* (40%) followed by *Pseudomonas aeruginosa* (21%). Arti Agarwal et al (2013)¹⁸ study also demonstrates that most common isolated bacteria were *Staphylococcus aureus* (37.6%) followed by *Pseudomonas aeruginosa* (32, 8%). Prakash R. et al. (2013)¹² study also shows that predominant pathogen was *Staphylococcus aureus* (48.69%) followed by

Pseudomonas aeruginosa (19.89%). Contrast to this study done by, Sahu MC et al (2019)²¹, Harshika Y K et al (2015)²⁰, Prayaga N et al (2013)¹⁹, Deb T, Ray D (2011)¹⁶ and Loy A H C at al (2002)¹⁵ demonstrate that commonest bacterial isolate was *Pseudomonas aeruginosa* followed by *Staphylococcus aureus*. Study done by Pavani K et al (2019)²² and Madana J et al (2011)⁵ demonstrate that most common bacterial isolate was *Pseudomonas aeruginosa* followed by *Proteus mirabilis* and *Staphylococcus aureus*. Buhaibeh Q et al (2019)²³ observed that predominant pathogen was *Pseudomonas aeruginosa* followed by *Hemophilus influenza* and *Staphylococcus aureus*. Variation in microorganism is due to effect of climate.

In our study Gram-positive isolates were found in 63% samples. The most common Gram-positive isolate was *Staphylococcus aureus* (67.71%) followed by *Peptostreptococcus* (17.71%) and *Micrococci* (14.58%). Study done by John NM et al (2020)²⁴, Prayaga N et al (2013)¹⁹ and Loy A H C at al (2002)¹⁵, demonstrates that most common Gram-positive bacteria was *Staphylococcus aureus*.

In our study Gram negative isolates were found in 37% samples. The most common Gram-negative bacteria, was *Pseudomonas aeruginosa* (43.86%), followed by *Klebsiella* (21.05%), *E. coli* (12.28%), *Proteus* (12.28%) *Acinetobacter* (5.26%) and *Enterobacter aerogenes* (3.51%). Study done by Pavani K et al (2019)²², Harshika Y K et al (2015)²⁰, Prakash R. et al (2013)¹², Madana J et al (2011)⁵ and Loy A H C at al (2002)¹⁵, demonstrate that most common Gram-negative bacteria, was *Pseudomonas aeruginosa*.

In our study *Peptostreptococcus* was only obligate anaerobe and found in 17 samples (11.11% of total microbial isolates) Study done by Itzhak Brook (1995)¹⁴ demonstrates incidence of anaerobe was found in 41.37%. Most common anaerobic bacterial isolate was *Peptostreptococcus species* (50% of total anaerobes). In their study other bacterial isolates were *Gram positive bacilli*, *Fusobacterium*, *Bacteroides*, *Prevotella* and *Porphyromonas*. Study done by Prakash R. et al. (2013)¹² study demonstrates incidence of anaerobe was found in 22.4% samples. Predominant anaerobic bacteria were *Clostridium species* (26.09%) followed by *Peptococcus species* (23.19%), *Peptostreptococcus species* (23.19%), *Prevotella* (15.94%), and *Bacteroides* (11.59%), present in their study. Study done by Loy A H C at al (2002)¹⁵ demonstrate that most common anaerobic bacterial isolate was *Bacteroides species*.

In our study *Proteus*, *E. coli*, *Klebsiella*, *Acinetobacter* and *Enterobacter aerogenes* were other important bacterial isolates. These bacterial isolates were also observed in the study done by Pavani K et al (2019)²², Harshika Y K et al (2015)²⁰

In our study *Candida tropicalis* was the only fungal isolate. Study done by Prakash R. et al. (2013)¹² demonstrates that *Aspergillus niger*, *Aspergillus fumigatus*, *Candida albicans* and *Candida species* were the fungus isolated in their study.

Classification of different aerobic, anaerobic and fungal isolates show that different condition of COM could be differentiated on microbiological ground. Thus, for better management of COM microbial classification as well as drug susceptibility test of organism is essential for making appropriate decision of antimicrobials that will effectively eradicate the pathogen.

In our study patients of Chronic Otitis Media (squamous type) showed maximum sensitivity to piperacillin + tazobactam (46.71%) and maximum resistance to amoxiclav (89.47%). Study done by John NM et al (2020)²⁴ demonstrates that most of the bacterial pathogen were sensitive to commonly used antibiotic group which included amoxicillin-clavulanic acid, cephalosporin, aminoglycoside and fluoroquinolones. Most of the organism was resistance to antibiotics azithromycin and ampicillin (85%). Study done by Prakash R. et al. (2013)¹² demonstrate that antimicrobial profile of aerobic isolate revealed maximum sensitivity to amikacin (95.5%) ceftriaxone (83.4%) and gentamycin (82.7%). Prayaga N et al (2013)¹⁹ study demonstrates that most of the cultured organism were sensitive to drug ciprofloxacin.

In our study cefoperazone + sulbactam (56.92%) was the most sensitive drug against *Staphylococcus aureus* followed by ceftriaxone (50.77%), ofloxacin (49.23%), levofloxacin (46.15%), norfloxacin (44.62%), azithromycin (44.62%) moxifloxacin (41.54%), linezolid (38.46%), clindamycin (36.92%), doxycycline (32.31%), piperacillin+tazobactam (30.77%), amoxiclav (20.00%) cefuroxime (15.38%). Study done by Arti Agarwal et al (2013)¹⁸ demonstrates that susceptibility of *Staphylococcus* species was high (80-85%) with moxifloxacin, levofloxacin and doxycycline among the commonly used antibiotics.

In our study *Pseudomonas aeruginosa* was most sensitive to piperacillin+tazobactam (84%), followed by ofloxacin (72.00%), cefoperazone+sulbactam (68%), levofloxacin (60%), moxifloxacin (48%), clindamycin (40%), cefuroxime (36%), linezolid (16%), norfloxacin (12%), ceftriaxone (8%), azithromycin (4%) and doxycycline (4%). Most resistant to amoxiclav (100.00%). Study done by John NM et al (2020)²⁴ demonstrates that *Pseudomonas aeruginosa* was sensitive to only higher antibiotics. Study done by Buhaibeh Q et al (2019)²³ demonstrates that *Pseudomonas aeruginosa* was 100% sensitive to cotrimoxazole, vancomycin and piperacillin, 96% sensitive to cefepime and gentamycin and 88.2% sensitive to ciprofloxacin. Study done by, Arti Agarwal et al (2013)¹⁸ demonstrates that *Pseudomonas aeruginosa* was 100% sensitive to colistin, polymyxin B and carbapenems. It is highly sensitive (80%-90%) to aminoglycoside and piperacillin/tazobactam. Its sensitivity was 60-70% with commonly used antibiotics viz cephalosporins and fluoroquinolones. Afolabi OA et al (2012)¹⁷ study show that ciprofloxacin is still most sensitive antibiotics in vitro. Madana J et al (2011)⁵ demonstrates that 100% of *Pseudomonas* isolates shows susceptibility to ceftazidime and high sensitivity (92% of isolates) to ciprofloxacin and 88% isolates were sensitive to amikacin.

In our study *Peptostreptococcus* was most sensitive to

azithromycin (64.71%).

In our study *Proteus* was most sensitive to clindamycin (57.14%) followed by and piperacillin+tazobactam (42.86%). Madana J et al (2011)⁵ study demonstrates that *Proteus mirabilis* was 100% sensitive to ceftazidime and ciprofloxacin.

In our study *E. coli* was most sensitive to piperacillin + tazobactam (85.71%) followed by ofloxacin (42.86%). Study done by Madana J et al (2011)⁵ demonstrates that *E. coli* was 100% sensitive to amikacin, ciprofloxacin, and ceftriaxone.

5. Conclusion

Chronic otitis media (COM) is an important global public health problem. Monomicrobial etiology, especially *Staphylococcus aureus* and *Pseudomonas* species was found most common in our study. *Staphylococcus aureus* was most sensitive to cefoperazone + sulbactam (56.92%), followed by ceftriaxone and highly resistance to amoxiclav. *Pseudomonas* was most sensitive to piperacillin+tazobactam. Microbiological profile and antimicrobial susceptibility pattern of chronic otitis media (squamous type) vary with time and geographical area as well as continent to continent. With the development and widespread use of antibiotics, the type of pathogenic micro-organism and their resistance to antibiotics have been changed. Continuous and periodic evaluation of microbiological profile and antimicrobial susceptibility pattern is necessary to decrease potential risk of complications by early use of appropriate treatment. As the disease common in early decade of life so educating parents and guardians on possible risk factors of the disease may be a preventive strategy that might reduce occurrence of disease.

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