Bacteriological Profile and Antibiotic Susceptibility Pattern in Cases of Chronic Otitis Media – Active Mucosal Disease in a Tertiary Care Setting

Authors

Dr Jincy JP¹, Dr Susan James², Dr Jyothi R³, Dr Satheesh S⁴, Dr Shaiju A⁵

¹Junior Resident, Department of ENT, Government Medical College, Thiruvananthapuram
²Assistant Professor, Department of ENT, Government Medical College, Thiruvananthapuram
³Associate Professor, Department of Microbiology, Government Medical College, Thiruvananthapuram
⁴Professor and HOD, Department of ENT, Government Medical College, Thiruvananthapuram
⁵Assistant Professor, Department of ENT, Government Medical College, Thiruvananthapuram

Corresponding Author

Dr Susan James

Department of ENT, Assistant Professor, Government Medical College, Thiruvananthapuram

Abstract

Background: Chronic otitis media is defined by otorrhoea of at least six weeks duration in the presence of a chronic tympanic membrane perforation¹. It can cause many complications if not treated properly and is well known for its recurrence and persistent infection. Its incidence is increasing in the developing countries because of poor hygienic practices and lack of health education. The complications of chronic otitis media have been reduced to a greater extent because of the invention of antibiotics. But irrational use of antibiotic has led to the emergence of resistant organisms to the commonly used drugs. Knowledge of local microbiological flora is essential for initiating empirical therapy pending culture results, making it mandatory for periodic surveillance of microbiological profile & sensitivity pattern.

Materials and Method: This study is conducted over a period of 24 months (March 2016 to February 2018). A total of 166 cases of chronic otitis media active mucosal disease who were not on any antibiotic (systemic and topical treatment) for a minimum of 48hrs prior to sample collection were taken and pus sent for culture and sensitivity. The factors affecting the development of multidrug resistant organisms were also evaluated.

Results: Out of the 166 cases of chronic otitis media active mucosal disease, 76.5% cases were culture positive. Pseudomonas aeruginosa (31.9%) was the most common organism isolated followed by Staphylococcus aureus (24.1%) of which Methicillin Sensitive Staphylococcus aureus was 19.3% and Methicillin Resistant Staphylococcus aureus was 4.8% followed by mixed growth (9%), fungus (6.6%) [Candida species – 4.2% & Aspergillus species – 2.4%], Streptococci (1.8%), Acinetobacter & Enterococci (1.2%), Klebsiella (0.6%). Culture was sterile for 23.5% cases. The first line antibiotic (Ciprofloxacin and Gentamycin) sensitivity for Pseudomonas is only 35.8%, second line antibiotic (Amikacin) sensitivity is 47.2%. 54.7% of cases were sensitive to Ceftazidime, 86.8% of cases were sensitive to Piperacillin+ Tazobactum and 75.5% were sensitive to Cefoperazone + Sulbactum. Pseudomonas showed sensitivity to the higher antibiotic Imipenem in 52% cases. Among the first line antibiotics Staphylococcus aureus showed maximum sensitivity to Cloxacillin (80%), followed by Gentamycin (70%). Sensitivity for second line agents such as Amikacin is 88.9% and Trimethoprim – Sulfamethoxazole is 77.8%. 90.3% showed sensitivity to third line antibiotic (Vancomycin). According to our study, there is a significant association between multidrug resistant Pseudomonas aeruginosa and previous history of minor ear procedures that patients underwent (p value -0.000).

Keywords: Chronic otitis media, culture, Pseudomonas, Staphylococcus, Antibiotic, Sensitivity.
Introduction

Chronic Otitis Media (COM) is a permanent abnormality of pars tensa or flaccida, most likely a result of earlier acute otitis media, negative middle ear pressure or otitis media with effusion. Inflammation can result in long term or more often, permanent changes in the tympanic membrane like atelectasis, dimer formation, perforation, tympanosclerosis, retraction pocket development, or cholesteatoma. The complications of chronic otitis media have been reduced to a greater extent because of the invention of antibiotics. But irrational use of antibiotic has led to the emergence of resistant organisms to the commonly used drugs. Knowledge of local microbiological flora is essential for initiating empirical therapy pending culture results, making it mandatory for periodic surveillance of microbiological profile & sensitivity pattern. To deal with the emerging antibiotic resistance following are the general principles that should be followed by every clinician. Antibiotics should be used therapeutically only after thorough clinical assessment of the need, whenever possible on the basis of laboratory evidence of infection.

Factors to be considered should include:

- Type of infection
- Age & condition of patient
- Local prevalence of resistance pattern
- Pharmacological properties of agent in its various formulations
- The likelihood of adverse reactions
- Possible interactions with other medications
- Cost of medicine.

A helpful definition of appropriate antibiotic therapy might include the following:

1. Appropriate antibiotic prescribing should potentially benefit the patient
2. There should be clinical evidence supported where possible by laboratory tests of bacterial infection before starting on antibiotics.
3. Treatment should be limited to bacterial infections, using antibiotic directed against the causative agent.

It should be given in optimal dosage, interval, and length of treatment, with steps taken to ensure maximum patient compliance with the treatment regimen and only when benefit of treatment outweighs the individual & global risks.

Hospital Acquired Infections

The term ‘hospital acquired infection’ (nosocomial infection) is applied to any infection causing illness that was not present or in its incubation period when the subject entered the hospital or received treatment from the hospital. Now the better terminology is ‘healthcare associated infection’.

Modes of Spread of Infections in Hospital

- Air borne spread. E.g. Tuberculosis, Pneumococcal infections.
- Infection associated with water. E.g. Legionnaires disease.
- Infection acquired from food. E.g. Salmonellosis.
- Infection by contact – from staff/from patient’s environment/from equipment.
- The most important organisms spread by hand contact are Staphylococcus aureus and gram negative bacilli such as Klebsiella and Serratia species.
- Infection by inoculation. E.g. Infection transmitted by blood donation and tissue donation.

Pseudomonas aeruginosa is a notorious agent in ‘healthcare associated infections’ and is a common organism in chronic otitis media active mucosal disease. It is recognized as a pathogen of hospital patients in the modern era of intensive treatment and antibiotic administration. The ability of pseudomonas aeruginosa to grow in moist condition with simple nutrients and its comparative resistance to antibiotic and disinfectants have allowed it to become established in very large numbers in fluids and wet places and to colonize the mucous membrane and skin.
Aim
To study the bacteriological profile and antibiotic susceptibility pattern of chronic otitis media active mucosal disease and the factors affecting the development of multidrug resistant organisms.

Materials and Methods
This is a descriptive study and is conducted over a period of 24 months (March 2016 to February 2018). A total of 166 cases of chronic otitis media active mucosal disease that were not on any antibiotic (systemic and topical treatment) for a minimum of 48hrs prior to sample collection were taken and pus sent for culture and sensitivity. The factors affecting the development of multidrug resistant organisms were also evaluated.

Inclusion Criteria
1. All patients who are diagnosed as having chronic otitis media – active mucosal disease of all age group and both sex.
2. Patients who were not on antibiotic (systemic and topical treatment) for a minimum of 48hrs prior to sample collection.

Exclusion Criteria
1. Patients not giving consent for study.

Observations

Fig.1 Percentage distribution of the sample according to laterality of ear discharge
According to our study, 84.9% cases had unilateral ear discharge and 15.1% had bilateral ear discharge.

Fig.2 Percentage distribution of the sample according to organism isolated from present C&S
In this study positive culture yield is 76.5% and Pseudomonas aeruginosa was the most common organism isolated (31.9%) followed by Staphylococcus aureus (24.1%), MSSA was 19.3% and MRSA was 4.8% followed by mixed growth (9%), fungus (6.6%) [Candida species – 4.2% & Aspergillus – 2.4%], Streptococci (1.8%), Acinetobacter & Enterococci (1.2%), Klebsiella (0.6%). Culture was sterile for 23.5% cases
Among the 53 cases of culture positive Pseudomonas the first line antibiotics Gentamicin and Ciprofloxacin was sensitive only in 35.8% of cases. The second line antibiotic Amikacin was sensitive in 47.2% of cases. 54.7% of cases were sensitive to Ceftazidime, 86.8% of cases were sensitive to Piperacillin+ Tazobactum and 75.5% were sensitive to Cefoperazone + Sulbactum. Pseudomonas showed sensitivity to the higher antibiotic Imipenem in 52% cases. In conclusion only 49.1% cases showed sensitivity to first and second line group of antibiotics and antibiotic sensitivity is 92.5% for third line group of antibiotics.

Table 2 Distribution of the sample according to Staphylococcus aureus antibiotic sensitivity

| Staphylococcus aureus                  | Sensitive | Resistant |
|----------------------------------------|-----------|-----------|
|                                        | Count     | %         | Count     | %         |
| Penicillin sensitivity                 | 2         | 5.3       | 36        | 94.7      |
| Cloxacillin sensitivity                | 32        | 80.0      | 8         | 20.0      |
| Gentamicin sensitivity                 | 28        | 70.0      | 12        | 30.0      |
| Erythromycin sensitivity               | 5         | 16.1      | 26        | 83.9      |
| Amikacin sensitivity                   | 32        | 88.9      | 4         | 11.1      |
| Trimethoprim + Sulfamethoxazole sensitivity | 28    | 77.8      | 8         | 22.2      |
| Vancomycin sensitivity                 | 28        | 90.3      | 3         | 9.7       |
| First & second line group of antibiotic sensitivity | 37  | 92.5      | 3         | 7.5       |
| Third line group of antibiotic sensitivity | 28      | 90.3      | 3         | 9.7       |

According to our study, 94.7% cases of Staphylococcus aureus was resistant to penicillin, 20% cases showed resistance to Cloxacillin (MRSA), 70% cases showed sensitivity to Gentamicin, only 16.1% cases were sensitive to Erythromycin, Amikacin sensitivity is 88.9%, 77.8% were sensitive to Trimethoprim – Sulfamethoxazole, Vancomycin sensitivity is 90.3%. 92.5% cases showed sensitivity to first & second line groups of antibiotics and 90.3% cases showed sensitivity to third line group of antibiotics.
Association of Staphylococcus Aureus First and Second Line Antibiotic Sensitivity and Previous Usage of Antibiotics and Ear Procedures Done

Table 4: Association of Staphylococcus aureus 1st & 2nd line antibiotic sensitivity and previous usage of antibiotics and ear procedures done

|                                | Sensitive | Resistant | $\chi^2$ | P   |
|--------------------------------|-----------|-----------|----------|-----|
| **Recent intake of oral antibiotics** |           |           |          |     |
| Present                        | 17        | 89.5      | 2        | 10.5| 0.48 | 0.489 |
| Absent                         | 20        | 95.2      | 1        | 4.8 |      |       |
| **Name of antibiotic**         |           |           |          |     |
| Penicillin group               | 12        | 85.7      | 2        | 14.3| 1.43 | 0.232 |
| Quinolones                     | 2         | 100.0     | 0        | 0   | 0.17 | 0.679 |
| Macrolides                     | 4         | 100.0     | 0        | 0   | 0.36 | 0.548 |
| Cephalosporins                 | 3         | 100.0     | 0        | 0   | 0.26 | 0.608 |
| **Recent Intake of parenteral antibiotics** |       |           |          |     |
| Present                        | 7         | 87.5      | 1        | 12.5| 0.36 | 0.548 |
| Absent                         | 30        | 93.8      | 2        | 6.3 |      |       |
| **Recent Intake of topical antibiotics** |       |           |          |     |
| Present                        | 17        | 89.5      | 2        | 10.5| 0.48 | 0.489 |
| Absent                         | 20        | 95.2      | 1        | 4.8 |      |       |
| **Recent h/o ear procedures**  |           |           |          |     |
| Minor ear procedures           | 11        | 84.6      | 2        | 15.4| 1.75 | 0.418 |
| Examination under Microscope   | 1         | 100.0     | 0        | 0   |      |       |
| None                           | 25        | 96.2      | 1        | 3.8 |      |       |

There is no statistically significant association was found between first and second line antibiotic sensitivity of Staphylococcus aureus and recent usage of antibiotics or ear procedures done.

Discussion

In this study, the bacteriological profile and antibiotic susceptibility pattern of cases of COM – active mucosal disease were found out. The factors affecting the development of multidrug resistant organisms were also evaluated. For this 166 cases of COM – active mucosal disease who were not on antibiotics (both systemic and topical) at least 48 hours prior to sample collection was selected. Study was conducted at the ENT department, Government medical college Thiruvananthapuram, during the period March 2016 to February 2018. After a detailed history taking and ENT examination, ear discharge was collected under aseptic precaution and sent to microbiology lab for culture and sensitivity. The results were entered in a proforma and analysed. The results were then compared with that of similar studies conducted elsewhere previously. According to our study, 84.9% cases had unilateral ear discharge and 15.1% had bilateral ear discharge. In this study positive culture yield was 76.5% and Pseudomonas aeruginosa was the most common organism isolated (31.9%) followed by Staphylococcus aureus (24.1%) of which MSSA was 19.3% and MRSA was 4.8% followed by mixed growth (9%), fungus (6.6%)[Candida species – 4.2% & Aspergillus species – 2.4%], Streptococci(1.8%), Acinetobacter & Enterococci (1.2%), Klebsiella (0.6%). Culture was sterile for 23.5% cases. In a study conducted by Prakash M et al out of the 80 samples, 75 were culture positive. The most common organism isolated was Staphylococcus aureus (41.25%), followed by Pseudomonas...
species (37.5%), coagulase negative Staphylococci (11.25%), Klebsiella pneumonia (7.5%), Ecoli & Proteus species 5% each. In another study conducted by Dr Yogesha B S\textsuperscript{16}, Pseudomonas species (47.7%) was most common followed by Staphylococcus aureus (32.9%), Proteus (4%), Klebsiella(4%), E coli and coagulase negative Staphylococci 2% each.

Among the 53 cases of culture positive Pseudomonas aeruginosa the first line antibiotics- Gentamicin and Ciprofloxacin sensitivity was only 35.8%. The second line antibiotic Amikacin sensitivity was 47.2%. Sensitivity for third line agents was, 54.7% of cases were sensitive to Ceftazidime, 86.8% of cases were sensitive to Piperacillin+ Tazobactum and 75.5% were sensitive to Cefoperazone + Sulbactum. Pseudomonas aeruginosa showed sensitivity to the higher antibiotic Imipenem only in 52% cases. In conclusion only 49.1% cases showed sensitivity to first and second line groups of antibiotic and third line group of antibiotic sensitivity is 92.5%. This is contrast to a study conducted by Dr S Indira Devi\textsuperscript{11} where Pseudomonas aeruginosa is highly sensitive to Ciprofloxacin(95.52%), followed by Amikacin (73.6%), Gentamicin (57.7%), Ofloxacin (37.81%), Piperacillin + Tazobactum (33.38%) and Cefoperazone + Sulbactum (22.38%). A study conducted by Sowmya Tumkur Rangaiah\textsuperscript{14} Pseudomonas aeruginosa was sensitive to Piperacillin + Tazobactum (88.09%), Meropenem (80.95%), Ciprofloxacin (73.80%), Amikacin (66.66%), Ceftazidime (64.285), Gentamicin (59.52%) and Ceftazidime and Clavulanic acid (54.76%).

According to our study, Staphylococcus aureus was sensitive to first line agents like Cloxacillin in 80% cases, Penicillin in 5.3%, and Gentamicin in 70%, and Erythromycin in 16.1% cases. Its sensitivity to second line agents such as Amikacin was 88.9% and Trimethoprim – Sulfamethoxazole is 77.8%. Sensitivity for Vancomycin (third line antibiotic) was 90.3%. A study conducted by Dr. S Indira Devi\textsuperscript{11}, Staphylococcus aureus showed sensitivity to Amikacin (79.64%), Ciprofloxacin (75.12%), Gentamicin (66.32%), Cefoperazone + Sulbactum (22.88%) and Ofloxacin (18.8%). A similar study conducted by Sowmya Tumkur Rangaiah\textsuperscript{14} Linezolid is the most sensitive agent for Staph aureus, followed by Cefoxitin (55.81%), Erythromycin (51.16%), Vancomycin (37.20%), Gentamicin(37.20%) and Ciprofloxacin (32.55%). We evaluated the factors affecting the development of multidrug resistance in Pseudomonas aeruginosa and Staphylococcus aureus. The factors taken into consideration are recent intake of antibiotics (oral, topical and parenteral), and the ear procedures they underwent. These factors were based on a structured proforma and questionnaire method. They cannot be measured by any objective method. We have found that there is a significant association between multidrug resistant Pseudomonas aeruginosa [resistant to all first and second line group of antibiotics] and the minor ear procedures they underwent with an odds ratio of 9.5, which is highly significant (0.000). No association was found between multidrug resistant Pseudomonas aeruginosa and previous usage of antibiotics. No association was found between multidrug resistant Staphylococcus aureus and previous usage of antibiotics or minor ear procedures.

Conclusion
The major conclusions drawn from our study are:
- Pseudomonas aeruginosa (31.9%) was the most common organism isolated from cases of chronic otitis media active mucosal disease. Second most common organism was Staphylococcus aureus (24.1%).
- First line antibiotic sensitivity for Pseudomonas aeruginosa was only 35.8%; sensitivity to second line antibiotic was 47.2%. The highest sensitivity is for third line agents (92.5%).
- Among the first line agents Staphylococcus aureus showed higher sensitivity for Cloxacillin (80%), Amikacin was the...
most effective second line agent (88.9%) and sensitivity for Vancomycin (third line antibiotic) was 90.3%.

- A significant association between multidrug resistant Pseudomonas aeruginosa (resistant to all the first and second line antibiotics) and minor ear procedures was found (odds ratio – 9.5; p value -0.000).
- No association was found between multidrug resistant Pseudomonas aeruginosa and previous usage of antibiotics. No association was found between multidrug resistant Staphylococcus aureus and previous usage of antibiotics or minor ear procedures.

To deal with the emerging antibiotic resistance following are the general principles that should be followed by every clinician.

- Antibiotics should be used only after thorough clinical assessment of the need and if possible on the basis of laboratory evidence of infection.
- All healthcare workers need to ensure that effective infection control practices are implemented in the care of patients to achieve a reduction in ‘healthcare associated infection’.
- All ear procedures should be done in sterile conditions, which can prevent occurrence and transmission of multidrug resistant organisms.
- Antibiotics should be given in optimal dosage, interval, and length of treatment, with steps taken to ensure maximum patient compliance with the treatment regimen.

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