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

Authors
Dr Jincy JP[1], Dr Susan James[2], Dr Jyothi R[3], Dr Satheesh S[4], Dr Shaiju A[5]
[1]Junior Resident, Department of ENT, Government Medical College, Thiruvananthapuram
[2]Assistant Professor, Department of ENT, Government Medical College, Thiruvananthapuram
[3]Associate Professor, Department of Microbiology, Government Medical College, Thiruvananthapuram
[4]Professor and HOD, Department of ENT, Government Medical College, Thiruvananthapuram
[5]Assistant 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 perforation[1]. 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[1]. Inflammation can results in long term or more often, permanent changes in the tympanic membrane like atelectasis, dimer formation, perforation, tympanosclerosis, retraction pocket development, or cholesteatoma.[1]. 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[3]

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

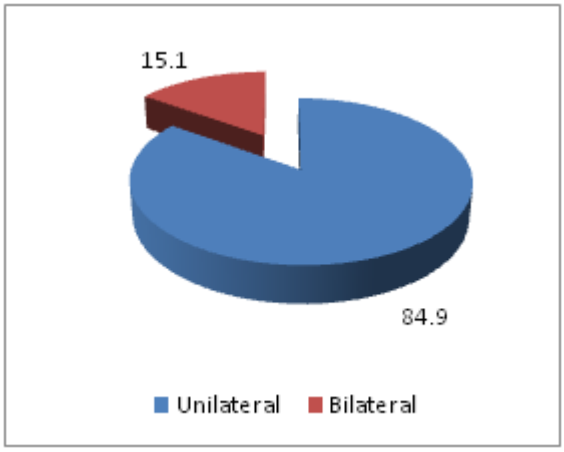

Fig.1 Percentage distribution of the sample according to laterality of ear discharge

According to our study, 84.9% cases had unilateral ear discharge and 15.1% had bilateral ear discharge.

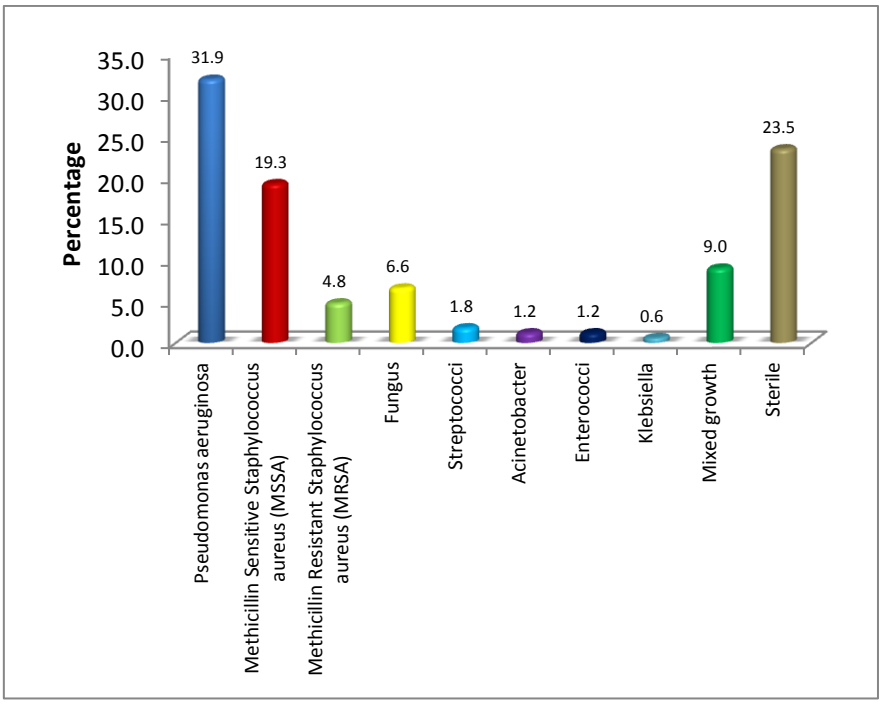

Fig.2 Percentage distribution of the sample according to organism isolated from present C&S

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

Table 1 Distribution of the sample according to Pseudomonas antibiotic sensitivity

Pseudomonas	Sensitive		Resistant	
	Count	%	Count	%
Gentamicin Sensitivity	19	35.8	34	64.2
Ciprofloxacin Sensitivity	19	35.8	34	64.2
Amikacin Sensitivity	25	47.2	28	52.8
Ceftazidime Sensitivity	29	54.7	24	45.3
Piperacillin+ Tazobactum Sensitivity	46	86.8	7	13.2
Cefoperazone +Sulbactum Sensitivity	40	75.5	13	24.5
Imipenem Sensitivity	26	52.0	24	48.0
1st & 2nd line group of Antibiotic Sensitivity	26	49.1	27	50.9
3rd line group of Antibiotic Sensitivity	49	92.5	4	7.5

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.

Table 3 Association of Pseudomonas 1st & 2nd line antibiotic sensitivity and previous usage of antibiotics and ear procedures done

		Sensitive		Resistant		χ^2	p
		Count	%	Count	%		
Recent intake of oral antibiotics	Present	14	56.0	11	44.0	0.91	0.339
	Absent	12	42.9	16	57.1		
Name of antibiotic	Penicillin group	10	47.6	11	52.4	0.03	0.865
	Quinolones	2	50.0	2	50.0	0	0.969
	Macrolides	3	60.0	2	40.0	0.26	0.607
	Cephalosporins	5	83.3	1	16.7	3.18	0.075
Recent Intake of	Present	0	0.0	3	100.0	3.06	0.080

parenteral antibiotics	Absent	26	52.0	24	48.0		
Recent Intake of topical antibiotics	Present	13	39.4	20	60.6	3.27	0.071
	Absent	13	65.0	7	35.0		
Recent h/o ear procedures	Minor ear procedures	7	25.0	21	75.0	13.75**	0.000
	None	19	76.0	6	24.0		

Sensitive – sensitive to minimum one of the first/second line agent

Resistant - resistant to all first & second line antibiotic agents

Odds ratio for minor ear procedures- 9.5, which is significant (p value – 0.000)

Association of Staphylococcus Aureus First and Second Line Antibiotic Sensitivity and Previous Usage of Antibiotics and Ear Procedures Done

Table 4: Association of Staphylococcus aureus1st & 2nd line antibiotic sensitivity and previous usage of antibiotics and ear procedures done

		Sensitive		Resistant		χ^2	P
		Count	%	Count	%		
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	0.17	0.679
	Macrolides	4	100.0	0	0.0	0.36	0.548
	Cephalosporins	3	100.0	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	0.0		
	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 48hours 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[10] 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[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-Gentamicinand 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[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 [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[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[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 Staphylo-coccus 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 aerugi-nosa 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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