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Aerobic Bacteriological Profile and Invitro Antibiotic Sensitivity Pattern in Patients of Suppurative Otitis Media in a Tertiary Care Hospital

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Abstract: Otitis media (OM) is an inflammatory disease of middle ear mucosa. Its significance lies in the dreaded complications and chronicity associated with the disease process. The present study was a cross sectional study conducted in the Department of Microbiology in association with the Department of ENT, AIMSR, Bathinda, over a period of one year. 131 clinically diagnosed cases of otitis media fulfilling both clinical and microbiological criteria, attending ENT department were studied. Two sterile swabs were used to collect ear discharge from each patient. First swab was used for direct microscopy by Gram staining and KOH mount. Second swab was used for culture onto MacConkey agar and Blood agar media. After incubation for 24 – 48 hours the plates were observed for growth, and isolates after confirmation were further subjected to antibiotic sensitivity testing. A total of six bacterial genera were isolated. Highest number of organism isolated was *Pseudomonas aeruginosa*, 45 (38.46%), followed by *Staphylococcus aureus* 39 (33.33%), *Escherichia coli* 14 (11.97%), *Klebsiella pneumoniae* 12 (10.26%), Coagulase negative *Staphylococcus* 4 (3.42%) and *Enterococcus faecalis* 3 (2.56%). *Pseudomonas aeruginosa* showed maximum sensitivity to Colistin, Imipenem and Polymyxin B (100%).Maximum resistance was observed to Levofloxacin (31.11%). *Staphylococcus aureus* showed maximum sensitivity to Teicoplanin and Vancomycin (100%). Maximum resistance was seen for Erythromycin (48.72%), followed by Cotrimoxazole (46.15%). Bacterial predominance and antibiotic susceptibility pattern changing over time, makes continuous and periodic surveillance necessary in guiding appropriate antibacterial therapy.

Keywords: Otitis media, MacConkey agar, Blood agar media, Antibiotic sensitivity testing, *Pseudomonas aeruginosa, Staphylococcus aureus*.

INTRODUCTION

Otitis Media (OM) refers to a group of complex infections and inflammatory diseases affecting the middle ear. It has been broadly classified into two main types, Acute and Chronic [1].

Acute suppurative otitis media (ASOM) is characterized by the rapid onset of signs of inflammation, specifically bulging and possible perforation of the tympanic membrane, fullness and erythema. Symptoms associated with inflammation such as otalgia, irritability and fever may also be present [1].

Chronic suppurative otitis media (CSOM) is characterized by involvement of middle ear cleft in a long standing episode. It is found associated with ear discharge and a permanent perforation of tympanic membrane. A perforation becomes permanent due to covering of its edges by squamous epithelium and absence of spontaneous healing [2].

Typical pathogens reach the middle ear through Insufflations of respiratory pathogens through the Eustachian tube from the Nasopharynx and Spread from the external ear canal inwards through a non-intact tympanic membrane [3].

Bacteria, fungi and viruses are all potential pathogens in Otitis media. Knowledge of the true frequency of polymicrobial infection, particularly the extent of anaerobic involvement, is limited by differences in collection and culture techniques [4].

Bacteria commonly found responsible for causing Suppurative Otitis Media include: Aerobic or facultative anaerobic organisms (e.g. *Pseudomonas aeruginosa, Escherichia coli, Staphylococcus aureus, Streptococcus pyogenes, Proteus mirabilis, Klebsiella*

pneumoniae) and anaerobic organisms (e.g. *Bacteriodes, Peptostreptococcus, Propionibacterium*) [5].

These bacteria are occasionally found as a normal flora on the skin of the external ear canal, but may flourish due to trauma, inflammation, lacerations or high humidity. Thus eventually may then gain entry to the middle ear cleft through a chronic perforation [6].

Since Otitis Media can cause significant morbidity, knowledge of the pathogens for Otitis Media and their antibiotic susceptibility pattern helps in the appropriate usage of antibiotics which can minimize the complications.

MATERIALS AND METHODS

Present study was a cross sectional study conducted in the Department of Microbiology in association with the Department of ENT, AIMSR, Bathinda, over a period of one year (November 2016 – November 2017). All the patients with ear discharge in the Department of ENT were included in the study. Patient details and relevant information was recorded in a case record form. Patients fulfilling both clinical and microbiological criteria were considered into this study. The outcomes were studied by using frequencies and percentages.

Single use mini-tip sterile cotton swabs were used for sample collection and were transported in peptone water to maintain the swabs moist until being analyzed. All specimens were processed within 1 hour of collection. Two sterile swabs will be used to collect ear discharges from each patient under strict aseptic precautions. The first swab was processed for direct microscopy by Gram staining and KOH mount, for the presence of pus cells, epithelial cells, bacteria and yeast. The second swab was cultured aerobically on blood agar and MacConkey agar, and then incubated at 37°C for 24 to 48 hours.

Isolates were identified from colony characters on Blood agar medium, MacConkey agar medium and any special media used for growth. Organisms were further confirmed on the basis of various biochemical tests and other special tests required for that particular organism.

Antibiotic sensitivity testing was done by Kirby Bauer disk diffusion method on Mueller Hinton agar. A suitable dilution (turbidity matching 0.5 Mc Farland standard) of peptone water growth of the test bacterium were inoculated on the surface of a solid medium (Mueller Hinton agar) as a lawn by spreading with a cotton swab. The predetermined antimicrobial discs were applied onto the surface of the inoculated agar. The plates were read after overnight incubation at 37 ^{0} C by measuring zone of inhibition around antibiotic discs as per CLSI (Clinical Laboratory Standards Institute) guidelines 2016.

RESULTS

In the present study, 110 (83.97%) specimens were positive for culture and 21 (16.03%) specimens were sterile for growth. Out of 110 (83.97%) culture positive samples, 103 (78.63%) samples showed growth of single organism and 7 (5.34%) samples showed growth of mixed organisms (two organisms). Total 117 isolates were obtained from 110 culture positive samples.

Table-1: Bacteriological profile

S. No.	Organism isolated	Number of isolates	Percentage (%)
1	*Pseudomonas aeruginosa*	45	38.46
2	*Staphylococcus aureus*	39	33.33
3	*Escherichia coli*	14	11.97
4	*Klebsiella pneumonia*	12	10.26
5	Coagulase negative *Staphylococcus*	4	3.42
6	*Enterococcus faecalis*	3	2.56
Total		117	100

In the present study, maximum number of organism isolated was *Pseudomonas aeruginosa*, 45 (38.46%), followed by *Staphylococcus aureus* 39 (33.33%), *Escherichia coli* 14 (11.97%), *Klebsiella pneumoniae* 12 (10.26%), Coagulase negative *Staphylococcus* 4 (3.42%) and *Enterococcus faecalis* 3 (2.56%).

Table-2: Distribution and percentage of mixed isolates

S. No.	Name of mixed isolates	Frequency	Percentage (%)
1	*Klebsiella pneumoniae*+ *Pseudomonas aeruginosa*	4	57.13
2	*Staphylococcus aureus* + *Pseudomonas aeruginosa*	1	14.29
3	*Staphylococcus aureus* + *Enterococcus faecalis*	1	14.29
4	*Escherichia coli* + Coagulase negative *Staphylococcus*	1	14.29
Total		7	100

Out of 110 (83.97%) pus samples, 7 (5.34%) pus samples showed mixed growth i.e. 4(57.14%) samples showed mixtures of *Klebsiella pneumoniae* and *Pseudomonas aeruginosa.* Mixtures of *Staphylococcus aureus* + *Pseudomonas aeruginosa*, *Staphylococcus aureus* + *Enterococcus faecalis* and *Escherichia coli* + Coagulase negative *Staphylococcus* from 1(14.29%) sample each.

Table-3: Antibiotic susceptibility pattern of *Pseudomonas aeruginosa* isolates

Antibiotic	Number		Percentage (%)	
	Sensitive	Resistant	Sensitive	Resistant
Amikacin	38	7	84.44	15.56
Aztreonam	43	2	95.56	4.44
Ceftazidime	38	7	84.44	15.56
Cefipime	38	7	84.44	15.56
Cefaperazone-Sulbactam	38	7	84.44	15.56
Ciprofloxacin	37	8	82.22	17.78
Colistin	45	0	100	0
Gentamicin	36	9	80	20
Imipenem	45	0	100	0
Levofloxacin	31	14	68.89	31.11
Piperacillin-Tazobactam	42	3	93.33	6.67
Polymyxin B	45	0	100	0
Total	45		100	

Pseudomonas aeruginosa showed maximum sensitivity to Colistin, Imipenem and Polymyxin B (100%), followed by Aztreonam (95.56%), Piperacillin-Tazobactam (93.33%), Amikacin, Ceftazidime, Cefipime, Cefaperazone-Sulbactam (84.44%), moderate sensitivity to Ciprofloxacin (82.22%) and Gentamicin (80%). Maximum resistance was observed to Levofloxacin (31.11%).

Table-4: Antibiotic susceptibility pattern of *Staphylococcus aureus* isolates

Antibiotic	Number		Percentage (%)	
	Sensitive	Resistant	Sensitive	Resistant
Amoxicillin-Clavulanic acid	32	7	82.05	17.95
Cefoxitin	34	5	87.18	12.82
Chloramphenicol	28	11	71.80	28.20
Ciprofloxacin	25	14	64.10	35.90
Clindamycin	34	5	87.18	12.82
Cotrimoxazole	21	18	53.85	46.15
Doxycycline	36	3	92.31	7.69
Erythromycin	20	19	51.28	48.72
Gentamicin	29	10	74.36	25.64
Levofloxacin	27	12	69.23	30.77
Teicoplanin	39	0	100	0
Vancomycin	39	0	100	0
Total	39		100	

Staphylococcus aureus showed maximum sensitivity to Teicoplanin and Vancomycin (100%), followed by Doxycycline (92.31%), Cefoxitin and Clindamycin (87.18%), Amoxicillin-Clavulanic acid (82.05%), Gentamicin (74.36%), Chloramphenicol (71.80%), Levofloxacin (69.23%) and Ciprofloxacin (64.10%). Maximum resistance was seen for Erythromycin (48.72%), followed by Cotrimoxazole (46.15%).

Table-5: Antibiotic susceptibility pattern of *Escherichia coli* isolates

Antibiotic	Number		Percentage (%)	
	Sensitive	Resistant	Sensitive	Resistant
Amikacin	13	1	92.86	7.14
Amoxicillin+Clavulanic acid	8	6	57.14	42.86
Aztreonam	13	1	92.86	7.14
Cefaperazone+Sulbactam	11	3	78.57	21.43
Cefipime	10	4	71.43	28.57
Ceftazidime	9	5	64.29	35.71
Cefuroxime	7	7	50	50
Ciprofloxacin	9	5	64.29	35.71
Cotrimoxazole	8	6	57.14	42.86
Gentamicin	9	5	64.29	35.71
Imipenem	14	0	100	0
Levofloxacin	9	5	64.29	35.71
Piperacillin+Tazobactam	14	0	100	0
Total	14		100	

Escherichia coli showed 100% sensitivity to Imipenem and Piperacillin+Tazobactam, followed by 92.86 % sensitivity to Amikacin and Aztreonam. 78.57 % of the isolates were sensitive to Cefaperazone +Sulbactam, 71.43% to Cefipime, and 64.29% to Ceftazidime, Ciprofloxacin, and Gentamicin & Levofloxacin. Maximum resistance was observed to Cefuroxime (50%).

Table-6: Antibiotic susceptibility pattern of *Klebsiella pneumoniae* isolates

Antibiotic	Number		Percentage (%)	
	Sensitive	Resistant	Sensitive	Resistant
Amikacin	10	2	83.33	16.67
Amoxicillin+Clavulanic acid	7	5	58.33	41.67
Aztreonam	11	1	91.67	8.33
Cefaperazone+Sulbactam	11	1	91.67	8.33
Cefipime	10	2	83.33	16.67
Ceftazidime	9	3	75	25
Cefuroxime	8	4	66.67	33.33
Ciprofloxacin	10	2	83.33	16.67
Cotrimoxazole	8	4	66.67	33.33
Gentamicin	10	2	83.33	16.67
Imipenem	12	0	100	0
Levofloxacin	11	1	91.67	8.33
Piperacillin+Tazobactam	12	0	100	0
Total	12		100	

Klebsiella pneumoniae isolates were 100 % sensitive to Imipenem and Piperacillin+Tazobactam. They showed high sensitivity (91.67%) to Aztreonam, Cefaperazone+Sulbactam, and Levofloxacin, followed by a sensitivity of 83.33% to Amikacin, Cefipime, Ciprofloxacin, and Gentamicin. Maximum resistance was seen for Amoxicillin+Clavulanic acid (41.67%).

Coagulase negative *Staphylococcus* showed maximum sensitivity (100%) to Amoxicillin-Clavulanic acid, Cefoxitin, Chloramphenicol, Doxycycline, Teicoplanin and Vancomycin. Maximum resistance was seen for Erythromycin (75%). Other antibiotics showed a sensitivity of 50% (Table-7).

Enterococcus faecalis showed 100% sensitivity to Teicoplanin and Vancomycin, followed by 66.67% sensitivity to Amoxicillin+Clavulanic acid. 66.67% resistance was seen to Cefoxitin, Chloramphenicol, Clindamycin, Doxycycline, Gentamicin and Levofloxacin. 100% resistance was seen to Ciprofloxacin, Cotrimoxazole and Erythromycin (Table-8).

DISCUSSION

The present study conducted on 131 Otitis Media patients, 110 (83.97%) were positive for culture and 21 (16.03%) were sterile. A total of six bacterial genera were isolated with *Pseudomonas aeruginosa,* 45 (38.46%) as the predominant organism followed by *Staphylococcus aureus* 39 (33.33%). So, an attempt is made to know the bacteriology of suppurative otitis media with antimicrobial susceptibility pattern of the bacterial isolates.

Table-7: Antibiotic susceptibility pattern of Coagulase negative *Staphylococcus* isolates

Antibiotic	Number		Percentage (%)	
	Sensitive	Resistant	Sensitive	Resistant
Amoxicillin-Clavulanic acid	4	0	100	0
Cefoxitin	4	0	100	0
Chloramphenicol	4	0	100	0
Ciprofloxacin	2	2	50	50
Clindamycin	2	2	50	50
Cotrimoxazole	2	2	50	50
Doxycycline	4	0	100	0
Erythromycin	1	3	25	75
Gentamicin	2	2	50	50
Levofloxacin	2	2	50	50
Teicoplanin	4	0	100	0
Vancomycin	4	4	100	0
Total	4		100	

Table-8: Antibiotic susceptibility pattern of *Enterococcus faecalis* isolates

Antibiotic	Number		Percentage (%)	
	Sensitive	Resistant	Sensitive	Resistant
Amoxicillin-Clavulanic acid	2	1	66.67	33.33
Cefoxitin	1	2	33.33	66.67
Chloramphenicol	1	2	33.33	66.67
Ciprofloxacin	0	3	0	100
Clindamycin	1	2	33.33	66.67
Cotrimoxazole	0	3	0	100
Doxycycline	1	2	33.33	66.67
Erythromycin	0	3	0	100
Gentamicin	1	2	33.33	66.67
Levofloxacin	1	2	33.33	66.67
Teicoplanin	3	0	100	0
Vancomycin	3	0	100	0
Total	3		100	

Culture results in accordance with type of growth

In the present study, analysis of the total of 131 specimens revealed that 110 (83.97%) were culture positive and 21 (16.03%) were culture sterile. Out of 110 positive cultures, 103 (78.63%) were with pure growth and mixed growth was seen in 7 (5.34%). Overall 117 isolates were obtained from 131 samples.

The culture results correlates with Wadile *et al*. [7] found 86.81% with pure growth, 13.18% with mixed growth and 10% with no growth. Aliyu *et al*. [8] had shown a similar result having 80.20% with pure growth, 8.50% with mixed growth and 11.30% samples with no growth.

Sterile cultures can be attributed to anaerobic bacteria, non-bacterial organisms, presence of antimicrobial enzymes i.e. lysozyme alone or in combination with immunoglobulins that suppress the bacterial growth. Availability and use of topical and systemic broad spectrum antibiotics in the period before consultation was probably responsible for the lower incidence of mixed infection. Polymicrobial growth in ear samples could be because of contamination from the external auditory meatus.

Bacteriological profile

In the present study, 6 bacterial genera were isolated in 110 positive cultures. The most common organism isolated was *Pseudomonas aeruginosa* 45 (38.46%) followed by *Staphylococcus aureus* 39 (33.33%), *Escherichia coli* 14 (11.97%), *Klebsiella pneumoniae* 12 (10.26%), Coagulase negative *Staphylococcus* 4 (3.42%) and *Enterococcus faecalis* 3 (2.56%).

Pseudomonas aeruginosa was the predominant organism isolated in studies reported by, Shetty *et al*. (37.80%) [9], Haneefa *et al.* (43.36%) 10 and Ghosh *et al*. (40.76%) 11, which correlates at par with our series.

The occurrence of *Pseudomonas aeruginosa* as the predominant offending organism could be attributed to several factors. *Pseudomonas aeruginosa* survives competition with other pathogens could be due to minimum nutritional requirements, its relative resistance to antibiotics and its armamentarium of

antibacterial products i.e., pyocyanin and bacteriocin. Apart from the above said reasons, it uses the pili to attach to the necrotic or diseased epithelium of middle ear. Once attached, the organism produces enzymes like proteases, lipopolysaccharides, etc. to elude from normal defense mechanism of the body required for fighting infections. In addition, the organism acts as an opportunistic pathogen, flourishes in external auditory canal and causes suppurative disease.

The second most common organism isolated was *Staphylococcus aureus* (33.33%) and find correlation with studies conducted by, Shetty *et al*. (30.49%) [9], Haneefa *et al*. (33.65%) [10] and Ghosh *et al*. (28.46%) [11].

The frequency of *Staphylococcus aureus* in the middle ear infections can be attributed to their ubiquitous nature and high carriage of resistant strains in external auditory canal and upper respiratory tract.

In the present study various other bacteria isolated were, *Escherichia coli* 14 (11.97%), *Klebsiella pneumoniae* 12 (10.26%), Coagulase negative *Staphylococcus* 4 (3.42%) and *Enterococcus faecalis* 3 (2.56%). The similar organisms have been found to be associated with OM in studies conducted by Shetty *et al*. [9], Haneefa *et al*. [10] and Ghosh *et al*. [11].

Organisms like *Escherichia coli* and *Klebsiella pneumoniae* become opportunistic pathogens in the middle ear when resistance is low. Although CONS are generally considered as non-pathogenic, their association in some cases can be attributed to the extreme lowering of resistance in middle ear due to invasion by other organisms. Under these circumstances they assume pathogenic role either singly or more often in combination with other organisms.

Distribution and percentage of mixed isolates

In present study, out of 110 samples, 7 (5.34%) showed mixed growth. 4(57.14%) samples showed mixtures of *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*. 1(14.29%) each showed mixtures of *Staphylococcus aureus* + *Pseudomonas aeruginosa*, *Staphylococcus aureus* + *Enterococcus faecalis* and *Escherichia coli* + Coagulase negative *Staphylococcus.*

Chirwa *et al*. [12] found that among polymicrobial cultures, *Pseudomonas aeruginosa* and *Proteus mirabilis* were the most common finding (16.4%). Mixtures of *Proteus mirabilis* and *Escherichia coli* were found in 6.9% and *Staphylococcus aureus* with *Proteus mirabilis* was found in 6%. Aliyu *et al.* [8] identified mixed bacterial infections in 6 (8.5%) of the samples. *Staphylococcus aureus* and *Pseudomonas aeruginosa* mixed culture were frequent than others. Mixed growth of organisms are usually associated with contamination from external meatus or unhygienic practices.

Antibiotic susceptibility pattern of various isolates

Antibiotic susceptibility was carried out for 117 bacterial isolates by Kirby-Bauer disc diffusion method by using antibiotic discs. The invitro susceptibility testing of antimicrobial agents has become very important because of introduction of many new antibiotics and for identification of clinical isolates that showed inherent or developed resistance to the drugs being used empirically in the treatment of Otitis Media.

Antibiotic susceptibility pattern of *Pseudomonas aeruginosa*

In the present study, *Pseudomonas aeruginosa* showed maximum sensitivity to Colistin, Imipenem and Polymyxin B (100%), followed by Aztreonam (95.56%),Piperacillin-Tazobactam (93.33%), Amikacin, Ceftazidime, Cefipime, Cefaperazone-Sulbactam (84.44%), moderate sensitivity to Ciprofloxacin (82.22%) and Gentamicin (80%). Maximum resistance was observed to Levofloxacin (31.11%).

Shetty *et al*. [9] in their study on 31 *Pseudomonas aeruginosa* isolates showed maximum sensitivity to Colistin and Polymyxin B (100%), followed by Aztreonam, Cefaperazone-Sulbactam, Piperacillin-Tazobactam (96.8%), Imipenem (93.6%), Ceftazidime (90.4%), Cefipime (87.1%), Amikacin (83.9%), moderate sensitivity to Ciprofloxacin (74.2%) and Gentamicin (67.8%). Maximum resistance was observed to Levofloxacin (22.5%), which is in accordance with the present study.

Orji *et al*. [13] in their study on 109 *Pseudomonas aeruginosa* revealed that Gentamicin and Ciprofloxacin were the most effective drugs. 82.5 % isolates were sensitive to Gentamicin and 78.1% isolates were sensitive to Ciprofloxacin.

Agarwal *et al.* [14] in their study on 88 *Pseudomonas aeruginosa* revealed that all isolates were susceptible for Colistin. Piperacillin-Tazobactam (63.63%) and Imipenem (55.68%) were next two most sensitive antibiotics. Moderate sensitivity was reported to Ceftazidime, Ciprofloxacin, and Gentamicin, which is comparable to present series.

Antibiotic susceptibility pattern of *Staphylococcus aureus*

In the present study, *Staphylococcus aureus* showed maximum sensitivity to Teicoplanin and Vancomycin (100%), followed by Doxycycline (92.31%), Cefoxitin and Clindamycin (87.18%), Amoxicillin-Clavulanic acid (82.05%), Gentamicin (74.36%), Chloramphenicol (71.80%), Levofloxacin (69.23%) and Ciprofloxacin (64.10%). Maximum

resistance was seen for Erythromycin (48.72%), followed by Cotrimoxazole (46.15%).

Shetty *et al*. [9] in their study on 25 *Staphylococcus aureus* isolates showed maximum sensitivity to Teicoplanin and Vancomycin (100%), followed by Doxycycline and Clindamycin (92%), Gentamicin (68%) and Cefoxitin (64%), which is in accordance with our study. However a higher resistance was observed for Amoxicillin-Clavulanic acid (68%), Ciprofloxacin (64%), Levofloxacin (60%) and Cotrimoxazole (52%).

Orji *et al*. [13] in their study on 42 *Staphylococcus aureus* isolates found 100% sensitivity to Amoxicillin-Clavulanic acid followed by Gentamicin (83.8%) and Ciprofloxacin (54.3%). Erythromycin was the most resistant drug and a higher resistance to Erythromycin (80.3%) was obtained as compared to our study.

Agarwal *et al*. [14] in their study on 37 *Staphylococcus aureus* revealed that Vancomycin and Teioplanin were 100% sensitive. Higher resistance to Erythromycin (79.38%) was obtained as compared to our study.

Antibiotic susceptibility pattern of *Escherichia coli*

In the present study, *Escherichia coli* showed 100% sensitive to Imipenem and Piperacillin + Tazobactam, followed by 92.86% sensitivity to Amikacin and Aztreonam.78.57 % of the isolates were sensitive to Cefaperazone+Sulbactam,71.43% to Cefipime, and 64.29% to Ceftazidime, Ciprofloxacin, and Gentamicin & Levofloxacin. Maximum resistance was observed to Cefuroxime (50%).

Shetty *et al*. [9] in their study on *Escherichia coli* isolates showed 100% sensitivity to Imipenem, Amikacin, Cefaperazone+Sulbactam and Piperacillin+ Tazobactam, which is in accordance with our study. Higher resistance was observed to Aztreonam, Cefipime, Cefuroxime, Ceftazidime, Ciprofloxacin, Gentamicin and Levofloxacin.

Sahu *et al*. [15] revealed that Amikacin (100%) is the most sensitive drug, followed by Ciprofloxacin (66%). Piperacillin+Tazobactam (66%) and Imipenem (66%) were found less sensitive. All the strains were found resistant to Amoxicillin-Clavulanic acid.

Antibiotic susceptibility pattern of *Klebsiella pneumoniae*

In the present study, *Klebsiella pneumoniae* isolates were 100 % sensitive to Imipenem and Piperacillin+Tazobactam. They showed high sensitivity (91.67%) to Aztreonam, Cefaperazone+Sulbactam, and Levofloxacin, followed by a sensitivity of 83.33% to Amikacin, Cefipime, Ciprofloxacin, and Gentamicin. Maximum resistance was seen for Amoxicillin+Clavulanic acid (41.67%).

Shetty *et al*. [9] in their study on *Klebsiella pneumoniae* isolates showed 100% sensitivity to Imipenem, Amikacin, Aztreonam, Cefaperazone + Sulbactam, Piperacillin+ Tazobactam, Cefipime, Cefuroxime, Ceftazidime, Ciprofloxacin, Gentamicin and Levofloxacin. Our study showed similar results.

Sahu *et al*. [15] revealed that Amikacin (83.3%)%) is the most sensitive drug for *Klebsiella pneumoniae* isolates ,which is comparable to our study. Piperacillin+Tazobactam Ciprofloxacin and Imipenem were found less sensitive and all the strains were found resistant to Amoxicillin-Clavulanic acid likewise.

Antibiotic susceptibility pattern of Coagulase negative *Staphylococcus*

In the presnt study, Coagulase negative *Staphylococcus* showed maximum sensitivity (100%) to Amoxicillin- Clavulanic acid, Cefoxitin, Chloramphenicol, Doxycycline, Tiecoplanin and Vancomycin. Maximum resistance was seen for Erythromycin (75%). Other antibiotics showed a sensitivity of 50%.

Ghosh *et al*. [11] demonstrated that Coagulase negative *Staphylococcus* showed maximum sensitivity (80%) to Amoxicillin- Clavulanic acid and Erythromycin, followed by 60% sensitivity to Ciprofloxacin and 40% sensitivity to Gentamicin.

Antibiotic susceptibility pattern of *Enterococcus faecalis*

In the present study, *Enterococcus faecalis* showed 100% sensitivity to Teicoplanin and Vancomycin, followed by 66.67 % to Amoxicillin+Clavulanic acid. 66.67% resistance was seen to Cefoxitin, Chloramphenicol, Clindamycin, Doxycycline, Gentamicin and Levofloxacin. 100% resistance was seen to Ciprofloxacin, Cotrimoxazole and Erythromycin.

Shetty *et al*. [9] in their study found *Enterococcus faecalis* strains were 100% sensitivity to to Amoxicillin+ Clavulanic acid, Teicoplanin and Vancomycin, and 100% resistant to Ciprofloxacin, Levofloxacin, Doxycycline and Gentamicin.

CONCLUSION

The present study conducted on 131 Otitis Media patients, 110 (83.97%) were positive for culture and 21 (16.03%) were sterile. A total of six bacterial genera were isolated with *Pseudomonas aeruginosa*, 45 (38.46%) as the predominant organism followed by *Staphylococcus aureus* 39 (33.33%).

Pseudomonas aeruginosa showed maximum sensitivity to Colistin, Imipenem and Polymyxin B

(100%) and maximum resistance to Levofloxacin (31.11%). *Staphylococcus aureus* showed maximum sensitivity to Teicoplanin and Vancomycin (100%) and maximum resistance for Erythromycin (48.72%), followed by Cotrimoxazole (46.15%).

In the modern era of antibiotics the emergence of antibiotic resistance is becoming more common due to human negligence, irrational use and self-medication of antibiotics. Moreover, patients stop taking antibiotics before completion of therapy as and when symptoms subside, thus allowing partially resistant microbes to flourish. Such practice should be discouraged strongly and patients should be educated to avoid the same.

So it becomes very important to study bacteriology of Otitis Media to formulate local antibiotic policy for appropriate use of antibiotics. This will certainly help in reducing the complications associated with otitis media and to control the development of resistance among organisms to prevalent antibiotics.

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