ORIGINAL RESEARCH PAPER

Microbiology

BACTERIOLOGICAL PROFILE AND ANTIBIOTIC SUSCEPTIBILITY FROM CASES OF OTITIS MEDIA IN TERTIARY CARE HOSPITAL

KEY WORDS: Otitis media, bacteriological profile and antibiotic sensitivity.

Dr. Rozina Sheikh* Junior Resident MD ,Department of Microbiology, Indira Gandhi Government Medical college, Nagpur.*Corresponding Author

Dr Sonal Chavan Assistant Professor, Department of Microbiology, Indira Gandhi Government Medical college, Nagpur.

Dr Ravindra Khadse Associate Professer, Department of Microbiology, Indira Gandhi Government Medical college, Nagpur.

Dr Sharmila Raut Professer, Department of Microbiology, Indira Gandhi Government Medical college, Nagpur.

ABSTRACT

Introduction: Ear infection is one of major health problem in developing countries. It is classified as otitis media and otitis externa. Otitis media is inflammation of middle ear cleft. If not treated, complication such as recurrent acute otitis media, chronic otitis media, impairment in hearing, meningitis, brain abscess and sepsis may occur.
Aim and objective: To determine bacteriological profile and its antibiotic susceptibility in patient with otitis media.
Material and method : A total of 96 ear discharge samples of patients having signs and symptoms of otitis media were collected and were processed using standard microbiological procedures.
Result: A total of 96 patients , 66(68.75%) were females and 30(31.25%) were males. Peak prevalence of otitis media seen in age group 5-15yr (45.83%).Out of 96 ear swabs , 80 samples were culture positive. The predominant organism was *Staphylococcus aureus*(42.50%) followed by *Pseudomonas aeruginosa*(32.50%).Gram positive isolates were highest sensitivity to Vancomycin(100%) and Linezolid(100%) and highest resistance to penicillin(54.06%).Gram negative isolates showed highest sensitivity to Colistin(95.34%), Imipenam(93.02%), Pipercillin-tazobactum(83.72%) and least sensitivity to ampicillin(2.32%).
Conclusion: Continuous and periodic evaluations of etiological agents and its antibiotic susceptibility is important for otitis media for rationale use of antibiotic and to prevent progression of the disease.

INTRODUCTION:

Ear infection is one of the major health problem in developing countries which leads to burden of disease and economic impact to patients and healthcare (1) . Ear infection is classified as otitis media and otitis externa (1).Otitis media is inflammation of middle ear cleft(2). If not treated, complication such as recurrent acute otitis media, chronic otitis media, impairment in hearing, meningitis, brain abscess and sepsis may occur(3) .Normal flora of the skin such as *Pseudomonas aeruginosa, Staphylococcus aureus, Proteus mirabilis, Klebsiella pneumonia* and *Escherichia coli* that can easily enter through perforated ear have been reported as the main agents of otitis media (4,5).

Occurrence of different isolates and prevalence are varying in different geographical areas and climate (5,6) . So, antimicrobial resistance pattern of bacterial isolates also varies among population due to difference in geographical areas, antimicrobial agents prescribed by clinicians which is locally and easily available in that area and prevalence of resistant bacterial strains(7).

So latest information regarding antibiotic resistance are needed to guide clinician about the prevalent organisms and their drug sensitivity in cases of otitis media. Thus microbiological cultures and antibiotic susceptibility pattern helps us in appropriate treatment of otitis media in today's era.

The purpose of this study is to isolate aerobic bacteria causing otitis media and to detect the antibiotic sensitivity of organisms prevalent in our hospital.

METHOD AND MATERIALS

Study design: Prospective observational study

Study place: Department of Microbiology, in tertiary care hospital.

Duration: 6 months .The study was conducted from December 2020 to May 2021.

A total 96 ear discharge samples were collected by ENT specialists from OPD and wards using two sterile cotton swabs with all aseptic precautions from patients having sign and symptoms such ear pain ,feeling of fullness, decreasing hearing, tinnitus, dizziness, headache and fever. Samples were immediately transported to microbiology laboratory for further processing. Patients already on antibiotic treatment were not included in our study. In the laboratory, the first swab was used for Gram staining. Second swab was inoculated on Blood agar , MacConkey agar, and Chocolate agar for bacterial isolation.The culture plates were incubated at 37°C for 24 hours. The isolates were identified as per standard methods(8) .Antibiotic susceptibility was carried out using modified Kirby Bauer Disk Diffusion method(9) as per Clinical and laboratory standards institute (CLSI) guidelines(10).

For quality control E.coli ATCC 25922, Pseudomonas aeruginosa ATCC 27853 and Staphylococcus aureus ATCC 25923 were used as per CLSI guidelines (10).

Antibiotic discs used for Gram positive organisms were penicillin(P;10U), cefoxitin(CX;30µg), erythromycine (E;15µg), clindamycin(CD;2µg), gentamicin (GEN;30µg), amikacin(AK;30µg), ciprofloxacin(CIP;5µg),high level gentamicin(HLG;120µg), vancomycin(VAN;30µg), Linezolid (LZ;30µg), Doxycycline (DOX;30µg).

Antibiotic discs used for Gram negative organisms were ampicillin(AMP;10µg) ,cefazoline(CZ;30 µg) , cefuroxime(CU;30 µg),ceftazidime(CAZ;30 µg), cetriaxone(CTR;30 µg), cefepime(CPM;30µg), amoxicillin+clavulanic acid(AMC;20+10 µg), piperacillin+tazobactum(PIT;100+10 µg), imipenam(IPM;10 µg), gentamicin(GEN;30µg), amikacinAK;(30µg,), ciprofloxacin(CIP;5µg),doxycycline(DOX;30µg), aztreonam(AT;30µg),colistin(CL;10µg).

RESULTS:

A total 96 patients having sign and symptoms of otitis media were included in study.The age and gender wise distributions of patients is shown in Table/Fig-1. Peak of prevalence of otitis media was documented in age group of 5-15yr (45.83%)

Amongst 96 ear swabs, 74(77.08%) had shown organisms in direct microscopy,80(83.33%) ear swabs found to be culture positive. Gram negative organisms (53.75%) were predominant over gram positive organisms (46.25%).

In this study *Staphylococcus aureus* (42.5%) was the most predominant organisms followed by *Pseudomonas aeruginosa*(32.5%) and *E.coli*(16.25%). Other predominant organisms were *Klebsiella spp*(2.5%),Proteus spp(2.5%), *Enterococcus spp*(2.5%) and *Streptococcus pneumoniae* (1.25%) respectively showed in Table/Fig-2.

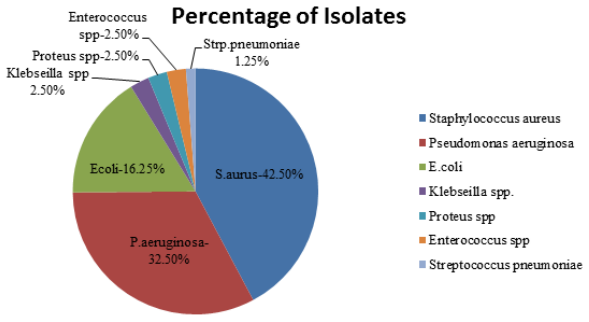
Gram positive isolates were 100% sensitive to Vancomycin and Linezolid followed by Ciprofloxacin (72.97%) and Doxycycline(72.97%).Penicillin(45.94%) was found to be the most resistant antibiotic.

Gram negative isolates showed highest sensitivity to Colistin(95.34) followed by Imipenem(93.02%),Pipercillin-tazobactum(83.72%),Gentamicin(76.74%). Highest resistance was shown to Ampicillin(2.32%), Cefazoline (20.93%) Cefuroxime (20.93%) Ceftriaxone (27. 90%)and Amoxyclav(32.55%).

Table/Fig-1.- Age and gender wise distribution of cases of otitis media

AGE GROUPS	No. of Female	No. of Male	Number
0-5YR	9(64.28%)	5(35.71%)	14(14.58%)
5-15YR	34(77.27%)	10(22.72%)	44(45.83%)
16-35 YR	15(62.5%)	9(37.5%)	24(25%)
36-50YR	6(60%)	4(40%)	10(10.41%)
>51 YR	2(50%)	2(50%)	4(4.16%)
TOTAL	66(68.75%)	30(31.25%)	96(100%)

Table/Fig-2- :Percentage of Bacterial Isolates from cases of otitis media



Table/Fig-3- Antibiotic Sensitivity patterns of Gram positive isolates of otitis media

Antibiotic	*Staphylococcus aureus(34)*	*Enterococcus spp(2)*	*Streptococcus pneumoniae(1)*	Total n=37
P	15(44.11)	1(50)	1(100)	45.94
CX	25(73.52)	0	1(100)	70.27
E	25(73.52)	1(50)	1(100)	72.97
CD	25(73.52)	0	1(100)	70.27
GEN	24(70.58)	0	0	64.86
AK	24(70.58)	0	0	64.86
CIP	25(73.52)	1(50)	1(100)	72.97
HLG	0	2(100)	0	5.40
VAN	34(100)	2(100)	1(100)	100
LZ	34(100)	2(100)	1(100)	100
DOX	25(73.52)	1(50)	1(100)	72.97

Table/Fig-4: Antibiotic Sensitivity patterns of Gram negative isolates of otitis media

Antibiotic	*Pseudomonas aeruginosa (26)*	*E.coli (13)*	*Klebsiella spp(2)*	*Proteus spp(2)*	TOTAL n=43
AMP	0	1(7.69)	0	0	2.32
CZ	0	9(69.23)	0	0	20.93
CU	0	9(69.23)	0	0	20.93
CAZ	11(42.30%)	10(76.92)	1(50)	0	51.16
CTR	0	11(84.61)	1(50)	0	27.90
CPM	20(76.92)	11(84.61)	1(50)	0	74.41
AMC	0	12(92.30)	2(100)	0	32.55
PIT	21(80.76)	11(84.61)	2(100)	2(100)	83.72
IPM	24(92.30)	12(92.30)	2(100)	2(100)	93.02
GEN	20(76.92)	11(84.61)	1(50)	1(50)	76.74
AK	20(76.92)	9(69.23)	1(50)	1(50)	72.09
CIP	20(76.92)	9(69.23)	1(50)	1(50)	72.09
DOXY	0	8(61.53))	1(50)	0	20.93
AT	24(92.30)	12(92.30)	1(50)	1(50)	88.37
CL	26(100)	13(100)	2(100)	0	95.34

DISCUSSION:

Ear infections are commonly encountered infection in routine clinical practice. Ear infections mainly arise from the external auditory meatus as in otitis externa (OE) or in middle ear causing acute/chronic suppurative otitis media (ASOM/ CSOM). Chronic suppurative otitis media is one of the most common chronic diseases of ear and one of the major causes of deafness in India (11).

In this study, majority of patients belong to age below 15 yr(45.83%) which is comparable with Seid et al.(12). The pathogenic bacteria colonizes in middle ear and upper respiratory tract due to the short, wide and straight Eustachian tube in infants and which makes children's more vulranable to frequent ear infection (6,13).While, Loy et al. showed high prevalence of otitis media in age group of 31-41yr(23.3%)(14) .For age group below 10 yr, prevalence is 1.1% which is very low as compared to our study(14). Age is an important factor associated with risk of acquiring middle ear infection which is explained by other study (12).

In our study, 68.75% were females and 31.25% were males. Thus females were affected more in our study than male which is comparable with Raakhee T et al. and Loys et al.(11,14). This gender predisposition is incidental and may be due to variability of the study cohort as there are no anatomical factors responsible for OM development in either of the gender. One of the reason may be due to the there were difference in ear cleaning habit of the males and females. Generally, females clean their ears with cotton swabs which leads to the introduction of microorganisms from the external surface of ear to the middle ear(15). But, in Harshika et al, males are more predominant than females, which differs from our study (13).

In the present study ,*Staphylococcus aureus* (42.5%) was the most common isolate followed by *Pseudomonas aeruginosa* (32.5%) which is similar to Prakash M et al(16).

Staphylococcus aureus and Pseudomonas aeruginosa are commonly known organisms to cause otitis media. While study in Nanded and Bangalore reported *Pseudomonas aeruginosa* was the most common bacterial isolate followed by *Staphylococcus aureus* which causes the middle ear infection (17,13) .*E.coli*(16.25%) , *Klebsiella spp.*(2.5%) are the other organisms found in our study which is comparable to Argaw-Denboba A et al. (18).The etiology and prevalence of ear infection differs with geographical areas and climate conditions(6).

In our study, all gram positive isolates were sensitive to

vancomycin (100%) and linezolid(100%) which is similar with Sandhu et al. and Harshika et al (19,13). Ciprofloxacin (72.97%), erythromycin(72.97%) , clindamycin (70.27%) and doxycycline(72.97%) showed sensitivity which is comparable with study in Punjab and Northern Ethopia (19,5). While Harshika et al. shown less sensitivity to erythromycin (50%), ciprofloxacin (37.5%) and clindamycin (37.5%)as compared to our study (13).This variability may be due to easy availability and inadvertent use of antibiotics and local clinical practice. Highest resistance was shown by the penicillin (45.94%) (19,13,14,5) in our study. Clinical resistance to penicillin and other antimicrobial agents by Gram positive cocci is now a known problem throughout the world due to overuse of this drug and production of resistant beta lactamases enzyme excessively.

In our study Gram negative organisms had highest sensitivity to colistin(95.34%), followed by imipenam(93.02%) which is similar to Agrawal et al and Harshika et al. (20,13). Sensitivity of gentamicin(76.74%), amikacin(72.09%), and ciprofloxacin(72.09%) were found in our study which is similar to Rathod et al and Wasihun et al(17,5) .Less sensitivity wasshownby ampicillin (2.32%), tetracycline (20.93%), cefazoline(20.93%),cefuroxime(20.93%) and ceftriaxone (27.90%) in our study which is in accordance with Mehtab et al. and Dilshad et al. (21,22).Most of the isolate in our study were resistant to commonly used antibiotics for otological infections. The reason behind this might be prescription of antibiotics without microbiological guidance, sell of drugs without prescription i.e self medications, indiscriminate use of antibiotics as well as negligence on patient's part like stop taking antibiotics before the completion of therapy and this will lead to the partly resistant organisms to flourish . Therefore, a more rational use of antibiotics is needed to be implied in treatment of patients suffering from a chronically discharging ear to obtain maximal effect.

CONCLUSION:

Many otorhinological infections are not notifiable infections and hence ignored and usually diagnosined lately.Therefore early diagnosis of these infections is very important for early treatment so as to prevent progression of the disease like hearing impairment. Hence , microbiological assessment is essential to confirm the diagnosis. Continuous and periodic evaluation of the etiological agent and their antibiotic sensitivity is necessary to decrease the potential risk of complications .

REFERENCES:

(1) Gorems K, Beyene G, Berhane M, Mekonnen Z. Antimicrobial susceptibility patterns of bacteria isolated from patients with ear discharge in Jimma Town, Southwest, Ethiopia. BMC Ear Nose Throat Disord. 2018; 18:17
(2) Cripps AW, Kyd J. Bacterial otitis media: current vaccine development strategies. Immunol Cell Biol. 2003; 81:46–51
(3) Winn W, Allen S, Janda W. Koneman's Color Atlas and Textbook of Diagnostic Microbiology, 6th edn. Lippincott's Williams and Wilkins, Philadelphia. 2006; 439–440 and 211–302
(4) Abera B, Kibret M. Bacteriology and antimicrobial susceptibility of otitis media at dessie regional health research laboratory, Ethiopia. Ethiopian J Health Develop.2011; 25(2):161–167
(5) Wasihun AG, Zemene Y. Bacterial profile and antimicrobial susceptibility patterns of otitis media in Ayder teaching and referral hospital, Mekelle University. Northern Ethiopia Springerplus. 2015;4(1):701
(6) Muluye D, Wondimeneh Y, Ferede G, Moges F, Nega T. Bacterial isolates and drug susceptibility patterns of ear discharge from patients with ear infection at Gondar University Hospital, Northwest Ethiopia. BMC Ear Nose and Throat Disord. 2013; 13(1):10
(7) Noh KT, Kim CS. The changing pattern of otitis media in Korea. Int J Pediatr Otorhinolaryngol .1985;9:77-87.
(8) Collee, J.G., Dugaid, J.P., Fraser, A.G., Marmion, B.P., Simmons, A. Laboratory strategy in the diagnosis of infective syndromes. In: Collee JG, Fraser AG, Marmion BP, Simmons A eds. Mackie and McCartney practical medical microbiology. 14th ed, Churchill Livingstone. 2006; 53-94.
(9) Bauer, A.W., Kirby, W.M.M., Sherris, J.C., Turck, M. Antibiotic susceptibility testing by a standardized single disk method. Am J Clin Pathol .1966; 45: 493-6.
(10) CLSI. M100 Performance Standards for Antimicrobial Susceptibility Testing .30th ed.2020
(11) Raakhee T,Sreenivasa Rao Unguturu . Bacteriological study of discharging ear in patients attending a tertiary care hospital. Int J Res Med Sci. 2014;2(2):602–60.
(12) A. Seid, F. Deribe, K. Ali, and G. Kibru. Bacterial otitis media in all age group of patients seen at Dessie referral hospital, North East Ethiopia. Egyptian Journal of Ear, Nose, Throat and Allied Sciences. 2013; 14(2):73–78
(13) Y. K. Harshika, S. Sangeetha and R. Prakash .Microbiological Profile of CSOM and their Antibiotic Sensitivity Pattern in a Tertiary Care Hospital .Int.J.Curr.Microbiol.App.Sci. 2015; 4(12): 735-743
(14) Loy AH, Tan AL, Lu PK. Microbiology of chronic suppurative otitis media in Singapore. Singapore Med J 2002; 43:296-9.
(15) Sanjan Sanju, Manish Kumar, R. S. Prasad, Debarshi Jana. Bacterial isolates and drug susceptibility patterns of ear discharge from patients with ear infections at Darbhanga Medical college, Laheriasarai ,Bihar.ijsr International Journal of Scientific Research. 2020; 9(12) : 48-49
(16) Prakash, M., Lakshmi, K., Anuradha, S., Swathi, G.N. Bacteriological Profile and their Antibiotic Susceptibility Pattern of cases of CSOM. Asian J Pharm Clin Res. 2013; 6 (3): 210- 212.
(17) Vimal S. Rathod VS, Shrikhande SN, More SR . Study of bacteriological profile and its antibiotic susceptibility in patients of chronic suppurative otitis media in Nanded, Maharashtra. Int J Health Sci Res. 2016; 6(3):68-72.
(18) Argaw-Denboba A, Abejew AA, Mekonnen AG. Antibiotic-resistant bacteria are major threats of otitis media in Wollo area, northeastern Ethiopia: a ten year retrospective analysis. Int J Microbiol. 2016;2016:8724671
(19) Sandhu D, Gupta V, Chhina D, Munjal M. Clinical characterisation & microbiological profile of otological infections. IP Int J Med Microbiol Trop Dis 2020;6(2):96-102.
(20) Agrawal A, Kumar D, Goyal A, Goyal S, Singh N, Khandelwal G. Microbiological le and their antimicrobial sensitivity pattern in patients of otitis media with ear pro discharge. Indian J Otol .2013; 19:5-8
(21) Mehtab Alam, Asfia Sultan, Kamlesh Chandra. Microbiological Assessment of Chronic Otitis Media: Aerobic Culture Isolates and Their Antimicrobial Susceptibility Patterns .Indian J Otolaryngol Head Neck Surg.2021 https://doi.org/10.1007/s12070-021-02496-x
(22) Dilshad arif, Mukhia, R.K., Goud, S.K.T., Nissar, J., Prasad, R.S., Singh, S. Bacteriological Profile of Ear Infections and Its Antibiotic Susceptibility Pattern in Tertiary Care Hospital Navi Mumbai. IOSR Journal of Dental and Medical Sciences. 2014; 13 (5): 58 62.