



AN OBSERVATIONAL STUDY ON VARIATIONS OF THE BACTERIAL ISOLATES OBTAINED IN OTOLOGICAL INFECTIONS IN DIABETIC AND NON DIABETIC POPULATION

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ABSTRACT

Otitis externa and Chronic otitis media mucosal type are common ear infections in developing countries especially in diabetic population as they are comparatively immunocompromised. Focusing more on bacterial diversity among diabetic versus non-diabetic population and antibiotic resistance pattern will help to get insight on epidemiology and understand disease pathology to suggest effective treatment strategy. **Methodology**-A prospective observational study in 152 patients (>35 years) diagnosed with chronic otitis media mucosal type and otitis externa from June 2023 to December 2023. The patients were categorized in two groups of 76 (Group A-diabetic and Group B-non diabetic). Diabetic profile checked with blood investigations and ear discharge were taken for gram stain and culture sensitivity, were analysed. **Result**- In both groups most common side of ear discharge is right with mean duration of symptoms 6 to 8 months. Diabetic duration is 1-5 years (63.2%) and two drug therapy of oral hypoglycemic agents is followed in 77.6% of cases. In both groups most common organism isolated is Staphylococcus aureus, Group A (34.2%) and group B (36.8%) prevalence for which Group A sensitive to gentamicin, cotrimoxazole and resistant to ciprofloxacin, vancomycin and Group B sensitive to cotrimoxazole, gentamicin, and resistant to ciprofloxacin, vancomycin. Staphylococcus aureus, Pseudomonas aeruginosa, coagulase negative staphylococcus aureus shows statistical significance for presence and absence of recurrence. ($p=0.010, 0.011, 0.038$) respectively. **Conclusion**-In common ear infections like otitis externa, chronic otitis media mucosal type it is mandatory to do ear swab culture sensitivity especially in diabetic population before start of antibiotics and strict glycemic control in diabetic population are considerations to reduce morbidity and recurrence.

KEYWORDS

bacterial isolate, ear discharge, sensitivity, resistance, chronic otitis media, Otitis externa

INTRODUCTION

Otitis externa and Chronic otitis media-mucosal type are the most commonly encountered otological infections in the ENT outpatient department of any medical institution. Otitis externa was initially described by Mayer in 1844 and was thought to be a fungal infection until World War 2 [1]. Otitis externa is a common inflammatory condition usually associated with bacterial and fungal infections of the skin and the subcutaneous tissue of the external ear. Localized OE (furuncle) presents with severe pain and tenderness which is out of proportion to the size of furuncle. Diffuse OE presents with persistent, severe ear pain and ear discharge. COM-mucosal type is an inflammatory disease of the mucosal lining of the middle ear with duration of the symptoms more than 2 weeks according to the WHO guidelines COM is an important cause of preventable hearing loss especially in developing countries.

In diabetic macroangiopathy, microangiopathy compromise tissue perfusion which contributes to the pre-existing immune dysfunction and incomplete healing. Microangiopathy is often aggravated by infection with pseudomonas aeruginosa, the most common pathogen in these infections.

Prevalence of OE is 45.1% and COM-mucous type is 41.2% documented [3]. Indiscriminate use of antibiotics and poor follow up of patients has resulted in treatment failure, emergence of resistant strains, super infection, intra-cranial and extra-cranial complications.

This study is all about microbiological profile in OE and COM-mucosal type focusing more on their diversity among diabetic versus non-diabetic population.

METHODOLOGY

A prospective observational study was conducted on 152 patients who presented to the Department of ENT our tertiary care centre with ear complaints and those who were diagnosed with otitis externa and chronic otitis media mucosal type were taken up for the study. Stratified random sampling was done and categorized as:

Group A - Diabetic patients - 76 cases

Group B - Non Diabetic patients - 76 cases

Study was done over a period of 6 months (June 2023 to November 2023). Patients with acute otitis media, chronic otitis media-squamous type, previous ear surgeries / ear malignancies, patients with other immune compromised diseases other than diabetes mellitus were excluded from study.

Patients fulfilling the criteria were subjected to blood investigations related to confirmation of diabetic status like Fasting blood sugars (FBS), Postprandial blood sugars (PPBS) and Glycated hemoglobin levels (HbA1c).

The ear discharge collected with a thin sterile cotton swab (HiMedia, Mumbai, India) after cleaning with normal saline. The specimens were transported immediately to the microbiology laboratory for further processing. The swabs were inoculated in blood agar, chocolate agar and MacConkey agar for aerobic culture and the inoculated plates were incubated at 37°C for 24-48 hours with 5% carbon dioxide given to blood agar and chocolate agar plates. Antimicrobial susceptibility testing for aerobic bacterial isolates was done by Kirby-Bauer disc diffusion method on Mueller Hinton agar (HiMedia, India) as per Clinical Laboratory Standards Institute (CLSI) guidelines.

The following antibiotics with specific concentrations were used:

Trimethoprim-sulfamethoxazole/cotrimoxazole (25 µg), gentamicin (10 µg), amikacin (30 µg), ciprofloxacin (5 µg), levofloxacin (5 µg), ceftazidime (30 µg), piperacillin (10 Units), tazobactam (100/10 µg), colistin sulphate (10 µg), erythromycin (15 µg), clindamycin (2 µg), imipenem (10 µg), vancomycin (30 µg), linezolid (30 µg), clindamycin (2 µg), erythromycin (15 µg), high-level gentamicin (120 µg) from HiMedia Laboratories. Methicillin resistance among *Staphylococcus aureus* strains was detected by cefoxitin disc diffusion test. Patients were followed up for 6 months and recurrence noted.

ETHICAL ISSUES

Ethical clearance was obtained from the Institutional ethical committee. Informed consent was obtained from each study participant, after explaining the risks and benefits involved in the study and voluntary nature of the participation, in a language participant can understand. Confidentiality of the study participants was maintained throughout study and dissemination of the study results.

Statistics:

The collected data were analysed with IBM SPSS Statistics for Windows, Version 23.0.(Armonk, NY: IBM Corp).To describe about the data descriptive statistics frequency analysis, percentage analysis were used for categorical variables and the mean & S.D were used for continuous variables. To find the association of significance in categorical data the Chi-Square test or Fisher's exact test used. In all the above statistical tools the probability value 0.05 will be considered as significant level. Strong association and statistical significance was calculated based Chi-Square test and parameters with individual variation on bacteriological profile were summed up.

RESULT

Table1: Ear Manifestations Among Two Groups

Ear Manifestation variables	Group A Diabetic group (n=76)		Group B Non-diabetic group (n=76)	
	f	%	f	%
1.Common symptom:				
Ear discharge right side	53	69.7	43	56.6
Ear discharge left side	13	17.1	17	22.4
Hard of hearing right	10	13.2	16	21.0
Hard of hearing left	0	0	0	0
2. Duration of symptom:				
6-8 months	39	51.3	54	71.1
8-12 months	14	18.4	14	18.4
>12 months	23	30.3	8	10.5
3.Diagnosis:				
COM-mucosal	51	67.1	57	75.0
OE	20	26.3	10	13.2
Others	5	6.6	9	11.8

In both groups most common side of ear discharge is right group A-69.7%, group B-56.6% with mean duration of symptoms 6 to 8 months.(50-70%)

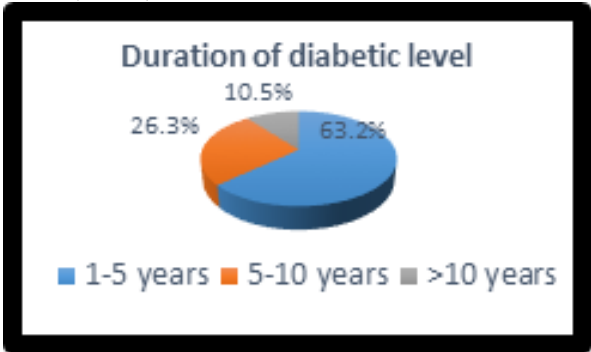


Figure 1: Duration Of Diabetes

Table 2- Prevalence Of Bacterial Isolates

Organism variables	Group A Diabetic group (Total)	Group B Non-diabetic group (n=76)
	f(%)	f(%)
<i>Pseudomonas aeruginosa</i>	21(27.6)	19(25)

<i>Staphylococcus aureus</i>	26(34.2)	28(36.8)
<i>Proteus mirabilis</i>	3(3.9)	4(5.3)
<i>Ecoli</i>	4(5.3)	5(6.6)
Coagulase neg staph aureus	5(6.6)	5(6.6)
<i>Hemophilus influenza</i>	8(10.5)	6(7.9)
MRSA	2(2.6)	1(1.3)
No growth	1(1.3)	0
TOTAL	76(100)	76(100)

In both groups *Staphylococcus aureus* is the most common isolate followed by *Pseudomonas aeruginosa*

Table 3: Antibiotic Sensitivity And Resistance

Antibiotic sensitivity and resistance among Diabetic and Non diabetic population

Organism	DM/NDM	Gentamicin		Ciprofloxacin		Ofloxacin		Imipenem		Vancomycin		Cotrimoxazole		Ampicillin	
		S	R	S	R	S	R	S	R	S	R	S	R	S	R
<i>Pseudomonas aeruginosa</i>	DM(21)	12	1	1	16	2	2	6	2	-	-	-	-	-	-
	NDM(19)	13	2	2	9	3	5	1	3	-	-	-	-	-	-
<i>Staphylococcus aureus</i>	DM(26)	14	6	5	11	-	-	-	-	3	5	4	4	-	-
	NDM(28)	16	4	6	14	-	-	-	-	2	6	4	4	-	-
<i>Proteus mirabilis</i>	DM(3)	1	0	0	1	0	0	1	-	-	0	2	1	0	-
	NDM(4)	1	0	0	1	1	0	0	1	-	-	1	2	1	0
<i>Ecoli</i>	DM(4)	2	0	0	2	1	-	-	-	-	-	-	-	1	2
	NDM(5)	2	1	1	0	1	2	-	-	-	-	-	-	1	2
Coagulase negative staphylococcus aureus	DM(5)	2	0	1	1	-	-	-	-	2	1	0	3	-	-
	NDM(5)	3	0	0	2	-	-	-	-	2	1	0	2	-	-
<i>Hemophilus influenza</i>	DM(3)	5	1	1	6	2	1	-	-	-	-	-	-	-	-
	NDM(4)	4	0	2	5	0	1	-	-	-	-	-	-	-	-
MRSA	DM(2)	1	0	0	1	1	1	-	-	-	-	-	-	-	-
	NDM(1)	1	0	1	0	0	-	-	-	-	-	-	-	-	-
No growth	DM(1)														
	NDM(0)														

In *Staphylococcus aureus* Group A sensitive to gentamicin, cotrimoxazole and resistant to ciprofloxacin, vancomycin and Group B sensitive to cotrimoxazole, gentamicin, and resistant to ciprofloxacin, vancomycin.

No organism could be isolated in one diabetic patient.

In *Pseudomonas aeruginosa* both groups were sensitive to gentamycin and ofloxacin and resistant to ciprofloxacin and imipenam.

S-sensitivity: R-resistance: DM-Diabetic: NDM-Non diabetic

Table 5: Recurrence Rate And Significance

Recurrence	Diabetic group (Total)	Non-diabetic group (n=76)	p-value
	f	f	
<i>Pseudomonas aeruginosa</i>			
Present	4	11	0.011
No recurrence	17	8	S
<i>Staph aureus</i>			
Present	3	12	0.010*
No recurrence	23	16	S
<i>Proteus mirabilis</i>			
Present	1	0	0.212
No recurrence	2	4	NS
<i>Ecoli</i>			
Present	1	3	0.294
No recurrence	3	2	NS

Coagulase negative staph aureus			0.038*
Present	0	3	S
No recurrence	5	2	
Hemophilus influenza			NA
Present	0	0	
No recurrence	8	6	
MRSA			NA
Present	1	1	
No recurrence	0	0	
No growth	1	0	NA

Staphylococcus aureus, Pseudomonas aeruginosa, coagulase negative staphylococcus aureus shows statistical significance in terms of recurrence rate ($p=0.010$, 0.011 , 0.038) respectively with 37.5%, 27.7%, 30% recurrence in both groups indicating the virulence and extent of antibiotic resistance observed.

DISCUSSION:

COM is a major public health problem in poor and developing countries like India. According to a report by WHO, India belongs to the highest (>4%) COM-prevalent countries. Hence, early diagnosis, knowledge of regional etiological agents and an effective antibiotic policy can curtail the development of COM in fatal cases.

Otitis externa is defined as an infection of the cutis and subcutis of the external auditory canal, possibly involving the tympanic membrane and the pinna as well.[2] Its different forms include acute diffuse otitis externa, circumscribed otitis externa, chronic otitis externa, and malignant (i.e., necrotizing) otitis externa.

In our study patients diagnosed with Chronic otitis media mucosal type and otitis externa had ear discharge as predominant symptom which is in cordance with previous study of otitis media by Orji FT et. Al [6]. Most common isolate in both group A(diabetic) and group B (non diabetic) is Staphylococcus aureus (35.5%) which is in disagreement with the report of Perveen et al[7]. where Pseudomonas aeruginosa was predominant organism.

Topical quinolones are the treatment of choice for chronic otitis media; they are equally or more effective as aminoglycosides and lack the risk of ototoxicity. Quinolones are effective in resolving otorrhea and eliminating the microorganism proved on study by Harris AS et al [5]. In our study in Gram positive bacteria, fluoroquinolones had low sensitivity as compared to aminoglycosides. Based on best-practice recommendations, quinolones should be used in the treatment of otitis media [4] Fluoroquinolone drops are typically used for empirical therapy of COM; It is believed that the widespread and incorrect use of empirical ear drops caused this shift in the microbial dynamics.

This finding that aminoglycosides are a reserve medication for ear and skull base infections is concerning, and it emphasizes for a shift in COM treatment from empirical therapy to culture-guided therapy in order to address the challenging issue of increasing antibiotic resistance.[8] Recurrence rate of COM recorded as 6.38%[9].In our study recurrence in diabetic(13.1%) and non diabetic(39.4%) which needs detailed workup in future studies

This study highlights on need of common otologic infections diagnosis and treatment protocol based on topographic environment, occupation, age and comorbidities, long term surveillance in developing countries with temperate climate for predominant organism, insisting of culture sensitivity, role of systemic antibiotics , focus on diabetic control rates in ear infection cure rates.

CONCLUSION:

Staphylococcus aureus followed by *pseudomonas aeruginosa* were observed as the principle causes of otological infection in this study. Knowledge of the spectrum of microorganisms causing ear discharge is important for the treatment of patients which decides whether to start antibacterial agents which helps to reduce treatment cost. Aminoglycoside had high susceptibility compared to fluoroquinolones in both Gram positive and Gram negative isolates due to over-the-counter and high use of fluoroquinolones. Also recurrence rates in Staphylococcus aureus, Pseudomonas aeruginosa and Coagulase negative staphylococcus aureus in both groups were significant indicating multidrug resistance. This study can help to formulate local antibiotic policy and will guide the clinician on appropriate management of COM infection in this area.

RECOMMENDATIONS:

This study provides insight and opens up further researches in bacterial biofilm causing antibiotic resistance, role of diabetic status-glycemic levels in pathogenesis and severity of disease in common otological infections insisting on interdisciplinary approach.

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