ORIGINAL ARTICLE

Prevalence of Pathogenic Bacterial Isolates from Ear, Nose and Throat: in a Clinical Setup

Ghulam Saqulain[1], Israr Ahmed[2], Zeba Ahmed[3], Mohammad Faizan Lodhi[4]

Author`s Affiliation

[1]Head of Department, Department of Otorhinolaryngology and Head & Neck Surgery, Capital Hospital, Islamabad
[2]Assistant Professor, General Surgery, Islamabad
[3]Assistant Professor, ENT Department, Civil Hospital. Karachi
[4]Department of Otorhinolaryngology, Capital Hospital, Islamabad

Author`s Contribution

[1]Conception, Synthesis and Planning of the research
[2]Interpretation, analysis and discussion
[3,4]Active participation in active methodology

Address of Correspondence
Dr. Ghulam Saqulain
ghulam_saqulain@yahoo.com

ABSTRACT

Objective: To determine the Prevalence of pathogenic bacterial isolates in swabs obtained from patients with Ear, Nose and Throat Infections.

Methodology: This Cross sectional hospital based study was conducted at Otolaryngology outpatient's department of Capital Hospital, Islamabad, Pakistan from August 2014 to July, 2016. Swabs for microbial culture from a representative infected area were obtained i.e. ear, nose or throat. These included patients of either gender or age, who presented in the Otolaryngology outpatients with suspected bacterial ear, nose or throat infections on the basis of history and clinical examination. Patients on steroids, those with co-morbidities, immune deficient cases and those who took antibiotics in last one week were excluded. Samples (swabs) were taken throat swabs, processed by routine microbiological culture techniques for microbiological isolation. Data collected included gender, age, area of infection (ear, nose or throat) and pathogenic bacteria isolated. Data was recorded, cross-tabulated and analyzed using Microsoft Excel Worksheet.

Results: Of the study sample of 1439, 737(51.22%) were males and 702(48.78%) females with mean age of 29.12+19.24 years. These included 811(56.36%) cases of aural, 221(15.35%) cases of nasal and 407 (28.29%) cases of throat infections. 800(55.59%) were culture negative for pathogenic bacteria, while pathogens were isolated in 639(44.41%) cases. Staphylococcus aureus was isolated in majority i e., 434(30.16%), followed by pseudomonas in 167(11.61%) swabs.

Conclusion: Staph aureus was the commonest isolate from aural and nasal swabs while the majority of throat swabs were negative and, in a few streptococcus, pneumoniae was isolated, indirectly indicating the prevalence of viral infections in the cases with throat infections. This indicates the importance of culture and sensitivity in these cases before starting antibiotics.

Keywords: Ear Nose & Throat, Microbiological culture, Prevalence, Pathogenic bacteria.

Introduction

Ear, nose, and throat (ENT) infections are a common occurrence and have a high prevalence with a rate of 87.55.[1] These areas are too close to the brain and eyes and can result in complications with resultant morbidity and death. [2] Also, ear, nose, and throat are interconnected and interdependent both anatomically and physiologically. As they are exposed to the external environment, their mucosa is more easily accessible to pathogens. Therefore, organisms both pathogens and nonpathogens colonize these

areas.[3, 4] Nonpathogens are common in the upper respiratory tract and are responsible for respiratory health.[5] Staphylococcus, Corynebacterium, and Dolosigranulum colonize the URT soon after birth followed by Moraxella and Streptococcus.[5,6] Organisms gain access to the middle ear in younger age group due to a shorter and horizontally placed Eustachian tube and may result in disease due to lower immunity. [2]

Infections involving ear, nose and throat can cause emotional stress, hearing loss, learning disabilities

[3, 7], affecting speech-language development and progress in school.[8] It also significantly affect the patient's daily routine [9], and in critically ill, it is also a leading cause of death.[9] A variety of organisms colonize the ear, nose and throat with some being harmless under normal environmental conditions in these areas.[3] Nasopharyngeal colonization is a complex phenomenon with Staphylococcus being the main colonizer[10], while streptococcus pyogenes being a common pathogen in pharyngitis.[11] Dechen TC et al. in an Indian study reported staphylococcus aureus to be the commonest pathogenic organism involved in ENT infections. The other organisms incriminated were mainly Streptococcus pyogenes, Klebsiella, and Haemophilus with Pseudomonas isolated from aural and nasal samples [12]. While a study revealed that Staphylococus aureus isolated culprit in the majority of cases of chronic suppurative otitis media.[13]

Knowledge of local prevalence of pathogenic bacteria involved in ear, nose and throat infections is important to avoid development of drug resistance and enable efficient and cost effective treatment. Therefore, the present study was designed to determine the prevalence of pathogenic bacterial isolates involved in ear, nose and throat infections in out setup. This may help in making policy for rational use of antimicrobials and avoiding development of drug resistance.

Methodology

This cross sectional hospital based study was conducted at Otolaryngology outpatients of Capital Hospital Islamabad, Pakistan from August 2014 to July, 2016. Samples were randomly collected by taking swabs from the representative infected ear, nose and throats of patients. These included cases of both genders, having an infection involving ear, nose or throat on the basis of history and clinical examination. However, patients taking steroids or suffering from co-morbidities like chronic renal failure, diabetes mellitus or any disease which may affect the immune system were excluded from the study. Also, cases who had taken any antibiotic

local or systemic for the last one week prior to presenting in our outpatients were excluded from the study. A doctor of ENT department collected the swabs aseptically in sterile swab pack including sterile swab sticks and submitted to microbiology laboratory without delay in the same hospital after properly labeled with patient's PMR number, date, and site of sample collection. Specimens were cultured on Blood and MacConkey agar plates. Plates were incubated at 37°C for 24 hours and in case no growth, incubation was further extended for another 24 hours. This was followed by Gram staining, biochemical tests and by using API system and organism identification by culture characteristics, morphological features, production of pigments and mobility etc.

Data was collected, and analyzed descriptively using Microsoft Excel Worksheet and expressed in percentages and cross tabulated. Gender was presented by frequency and percentage and age of presentation, presented by Mean + SD. Data were then compared with the national and international literature and deductions observed were then discussed.

Results

Of a total number of 1439 samples (swabs), acquired for the study from representative area from patients with ear, nose and throat infections, 737(51.22%) were males and 702(48.78%) females with mean age of 29.12 ± 19.07 years and included 811(56.36%) aural samples, 221(15.35%) nasal and 407 (28.29%) samples from the throat (Table-I). Following routine bacterial culture and microbiological assessment techniques, 800(55.59%) samples were found to be culture negative for pathogenic bacteria, while pathogens were isolated in 639(44.41%) cases. Pathogenic bacterial organisms were isolated in 315(49.30%) males and 324(50.70%) females (Figure I).

| TABLE -I: FREQUENCY DISTRIBUTION OF BACTERIAL ISOLATES* SITE OF ISOLATION (AREA). CROSS TABULATION (N=1439)								
		Aural (n= 811, %=56.36)		Nasal (n= 221,%=15.35)		Throat (n=407, %=28.29)		Total (n=1439)	
BACTERIAL ISOLATES		No	%	No	%	No	%	No	%
NON PATHOGENIC (N=800, 55.59 %)		275	33.91	124	56.10	401	98.53	800	55.59
PATHOGENIC (N=639, 44.41%)	Staph aureus	339	41.80	95	42.98	0	0	434	30.16
	Strep pneumoniae	0	0	1	0.46	6	1.47	7	0.48
	Haemophilus strptococci	0	0	0	0	0	0	0	
	E.coli	5	0.61	0	0	0	0	5	0.35
	Klebsiella pneumoniae	0	0	0	0	0	0	0	
	Proteus spp	25	3.08	1	0.46	0	0	26	1.81
	Pseudomonas spp	167	20.60	0	0	0	0	167	11.61
TOTAL		811	56.36	221	15.35	407	28.29	1439	100
(NOTE: NO = ABSOLUTE FREQUENCIES, % - RELATIVE FREQUENCIES)									
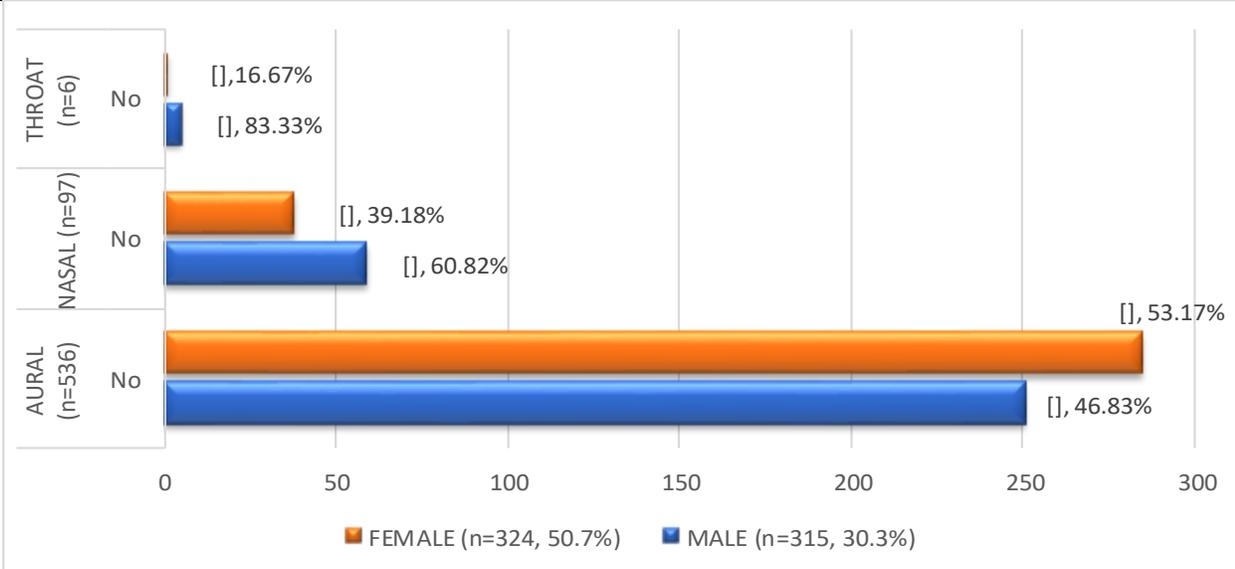
Figure I: Gender Distribution of Study Population according to Site of Isolation. (n = 639)

The study revealed a total of 7 genera of pathogenic bacteria with an overall prevalence of the bacterial pathogens isolated shown in table-I, which showed that staphylococcus aureus was isolated in majority i.e. 434(30.16%), followed by pseudomonas species in 167(11.61%) swabs. Staphylococcus aureus was also prevalent in aural infections (339, 41.80%) followed by Pseudomonas (167, 20.60%) with 275 (33.91%) swabs being culture negative. While in case of nasal infections also staphylococcus aureus was most prevalent i.e., 95 (42.98%) followed by Streptococcus pneumoniae and Proteus in single case each (0.46%), with 124 (56.10%) being culture negative. While the majority of the throat swabs were culture negative i.e., 401 (98.53%) and only 6 (1.47%) cases of Streptococcus pneumoniae isolated, indirectly indicating prevalence of viral infections.

In this study the prevalence of pathogenic bacterial isolates was high below 40 years age groups with

maximum prevalence noted in 31-40 years age group and lower prevalence in higher age groups above 40 years (Table-II).

Discussion

This Study revealed that both genders are almost equally susceptible to pathogenic organisms with negligible difference gender-wise. Similarly, no statistical difference in gender was noted by Obiajuru et al in their study.[8] Age related prevalence of pathogenic organisms was high below 40 years with a peak in 31-40 years age group and lower prevalence above 40 years. In contrast to our study, Obiajuru et al, showed the highest prevalence in 41 – 50 years group.[7]

Site wise aural infections showed a slight predominance in females with a male to female ratio of 1:1.14. While, Abdullah et al [14], found an almost equal male female ratio. In contrast Hailu D et al, reported a predominance of aural infection in males (92.7%).[15] In our study, nasal and throat infections showed a more predominance with M: F ratio of 1.55:1 and 2.5:1 in nose and throat cases respectively.

The present study showed that bacterial infections involving Ear, Nose, and Throat are highly prevalent in Islamabad. 639 (44.41%) swabs were culture positive for bacterial pathogens while 800(55.59%) swabs cultured were negative, while

in a study by Tahiri Z et al [16], majority (88%) samples revealed normal bacterial flora. The pathogenic bacteria in the present study were isolated predominantly in aural swabs (536) compared to nose (97) and throat (6). Similarly, Obiajuru et al, reported that aural swabs presented with maximum organisms but in contrast to our study, second commonest were throat swabs and least common in nasal swabs .[7]

In this study aural infections with staph aureus was most prevalent (41.80%) followed by Pseudomonas (20.60%), Proteus (3.08%) and E.coli (0.6%) with no cases of Klebsiella pneumoniae and Enterobacter were isolated. Similarly, in other local studies by Mariam et al [10], and Abdullah FE et al [14], staph aureus was most prevalent followed by pseudomonas and prevalence of Klebsiella pneumoniae was (9.69%), Proteus (7.14%), E Coli (4.08%) and Enterobacter (7.14%). Also, in the study by Tahiri et al [16], Staphylococcus aureus topped the list followed by pseudomonas. In contrast, in a local study Fatima G et al, reported predominance of Pseudomonas (68.44%) and Staphylococcus aureus (25.72%) [17], and an Indian study reported predominance of Pseudomonas (38.64%) followed by Staphylococcus aureus (27.27%) [18] and an Ethiopian study by Hailu D et al, Pseudomonas (29.7%), Staphylococcus aureus (26.3%) and

Table-II: Age wise Prevalence: Age Groups * Negative and Positive Cultures Site Wise. Cross Tabulation (n= 1439)									
Age groups	Aural (n=811)		Nasal (n= 221)		Throat (n=407)		Total		Grand Total
	-ve	+ve	-ve	+ve	-ve	+ve	-ve	+ve	No
< 1	2	3	0	0	1	0	3	3	6
1-10	44	92	16	16	105	3	165	111	276
11-20	48	88	25	18	73	2	146	108	254
21-30	62	114	28	17	75	0	165	131	296
31-40	44	95	20	19	51	0	115	114	229
41-50	28	64	17	10	44	1	89	75	164
51-60	26	41	9	8	22	0	57	49	106
> 60	21	39	9	9	30	0	60	48	109
TOTAL	275	536	124	97	401	6	800	639	1439
(Note: - ve = Non Pathogenic Organisms, +ve = Pathogenic Organisms									

Proteus (21.9%).[15] In the present study Staphylococcus aureus was also the most prevalent nasal pathogen (95, 42.98%) followed by Streptococcus pneumoniae and Proteus (1, 0.46% each). Similarly, Tahiri et al[16] also reported Staphylococcus aureus in 52.4%, Streptococcus spp. in 16% nasal specimens however he also noted Branhamella in 13% of nasal specimens. Majority of the throat swabs in the study were negative for pathogenic bacteria indicating a prevalence of viral infections. Only 6 swabs were positive for pathogenic bacteria with Streptococcus pneumoniae detected in all. In contrast in study by Tahiri et al[16], isolates from the throat included staphylococcus aureus (48.7%), Enterococcus (13.3%), Streptococcus Group A (11.8%) and Streptococcus beta-haemolyticus Group B (8.4%). According to Martin JM et al. [11], Streptococcal pharyngitis was prevalent in throat specimens in 5 - 15 years group and those who were culture negative for bacteria most likely had viral infection.[11] We also presume that the 401 (98.53%) swabs out of a total of 407 swabs taken from cases with throat infection and were negative for pathogenic bacteria, the majority were most probably suffering from viral infection.

Findings of this study revealed that overall in ENT infections, the most prevalent pathogen was staph aureus (434) 30.16% followed by pseudomonas (167) 11.61%. This is in conformity to a study by Ahmad et al [19] and a Nigerian study by Obiajuru et al[7]. In contrast in a study by Kabeer et al, Pseudomonas was the most commonly isolated organism followed by staph aureus. [20] Tong et al [21], reviewed the infections caused by Staph aureus, being a major human pathogen, and highlighted that there was shortage of reliable evidence for many clinical settings.

Conclusion

Staphylococcus aureus was found to be most prevalent pathogen followed by pseudomonas in ear and nasal infections, while negative cultures in throat infections in this study point towards predominance of viral pathogens making culture and sensitivity an essential tool before considering prescribing antibiotics. However, when unavailable, before prescribing antibiotic in ear and nasal infections, these two bugs (staph and pseudomonas) must be kept in mind.

References

1. Ain MR, Shahzad N, Aqil M, Alam MS, Khanam R. Drug utilization pattern of anti bacterials used in ear, nose and throat outpatient and inpatient departments of a university hospital at New Delhi, India. J Pharm Bioallied Sci. 2010; 2(1): 8-12.

2. Al-Marzoqi AH, Al-Janabi HO, Hussein HJ, Al Taee ZM, Yheea SK. Otitis Media;Etiology and Antibiotic Susceptibility among Children under Ten Years in Hillah city,Iraq. Journal of Natural Sciences Research. 2013; 3(3):1-3

3. Chibuike I, Reginald AO, Solomon UC, Ifeanyi AO, Conrad J, Chinenyenwa JN et al.Prevalence and Antibiotic Susceptibility Patterns of Methicillin-ResistantStaphylococcus Aureus (MRSA) Isolated from Healthy Inhabitants of Uturu Rural Communities, Abia State, Nigeria. Journal of Natural Science Research.2013; 3(10): 85-91.

4. Volks AV, Wheeler MF. Basic Microbiology. Philadelphia. J. B. Lippincott Company; 1990 pp. 592

5. Bosch AA, Levin E, van Houten MA, Hasrat R, Kalkman G, Biesbroek G, et al. Development of upper respiratory tract microbiota in infancy is affected by mode of delivery. E Bio Medicine. 2016; 9:336–45.

6. Vissers M, de Groot R, Ferwerda G. Severe viral respiratory infections: are bugs bugging? Mucosal Immunol. 2014; 7:227–38.

7. Obiajurn IOC, Chukuezi AB. Microbiological assessment of ENT Infections and disease: Case study at Orlu, Imo state, Nigeria. J. Res. Nurs. Midwifery. 2013;2(5): 72-76

8. Newton EV, Macharia J, Muswe P, Ototo B, Kan SW. The use of a questionnaire to detect hearing loss in Kenyan pre-school children. Int J Pediatr Otorhinolaryngol. 2001;18(3): 229 – 34.

9. Witsell DL, Dolor RJ, Bolte JM, Stinnett SS. Exploring health related quality of life in patients with diseases of the ear, nose and throat; A multicenter observation study.Otolaryngol Head Neck Surg. 2001; 125(4):288-98.

10. Ahmed MK, Mir A, Jan M, Imran R Shah, Farmanullah GS, Latif A. Prevalence of Bacteria in Chronic Suppurative Otitis Media Patients and Their Sensitivity Patterns Against Various Antibiotics in Human Population of Gilgit, Pakistan J Zool.2013;45(6):1647-53

11. Martin JM. The Mysteries of Streptococcal Pharyngitis. Current treatment options in pediatrics. 2015;1(2):180-89.

12. Dechen TC, Pal R, Kar S. Understanding the clinico-microbiological spectrum of common ear, nose and throat infections in Sikkim, India.J Global Infect Dis 2011;3:202-02.

13. Ghani S, Qasim Z, Mughal T, Haq EU, Husain S. Bacteriological Prevalence and Growth Pattern in Patients of Chronic Suppurative Otitis Media in Mirpur AJK. JIMDC. 2015:4(3):110-12.

14. Abdullah FE, Khatri PK, Alzadjali NA, Ali AD, Bhagia G. Ear infections in Karachi: The frequency and antibiotic resistance of bacterial isolates. Pak J Med Sci. 2011;27(1):77-81.

15. Hailu D, Mekonnen D, Derbie A, Mulu W, Abera B. Pathogenic bacteria profile and antimicrobial susceptibility patterns of ear infection at Bahir Dar Regional Health Research Laboratory Center, Ethiopia. Springerplus. 2016; 5:466.

16. Tahiri Z, Mustafa A. Pathogenic microbiological flora recovered from ear, nose and throat specimens in a regional hospital in Kosovo. Niger J Med. 2008; 17(3):275-9.

17. Fatima G, Shoaib M, Raza MZ, Bilal S. Antimicrobial Susceptibility Pattern of Bacterial and Fungal Isolates from Patients with Chronic Suppurative Otitis Media in Perspective of Emerging Resistance. Pak J Otolaryngol. 2013;29:49–53

18. Mane PM, Basawraju A. Clinical significance of microbial flora in middle ear infections and its implications. Trop J Med Res. 2016;19(2):128-30.

19. Ahmad MM, Kurawa ZM, Shu'aibu I, Yahya G. Microbiological Assessment of Bacterial Isolates from Ear, Nose And Throat (ENT) Among Patients Attending Aminu Kano Teaching Hospital. Nigerian Journal of Basic and Applied Science. 2016; 24(1):15-18

20. Kabeer S, Zafar A, Mehdi N, Zubair M, Javed H, Shaheen A et al. Isolation and Antimicrobial Susceptible Pattern of Bacterial Pathogens from Ear, Nose and Throat of Paediatric Patients. Pak J Med Health Sci. 2014;8(3): 644-47.

21. Tong SY, Davis JS, Eichenberger E, Holland TL, Fowler VG Jr. Staphylococcus aureus infections: epidemiology, pathophysiology, clinical manifestations, and management. Clin Microbiol Rev. 2015;28(3):603-61.