

ORIGINAL RESEARCH

Clinico Microbiological study of Bacterial Isolates from Ear, Nose and Throat (ENT) Among Patients Attending in a tertiary care hospital in Panipat district

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ABSTRACT

Background: Ear, nose and throat (ENT) infections are common and have a high incidence. These areas are too close to the brain and eyes and can lead to complications that lead to illness or even death. In addition, the ear, nose, and throat are interrelated and interdependent both anatomically and physiologically. Because they are exposed to the outside environment, their mucous membranes are more easily accessible to pathogens. Thus, pathogenic and non-pathogenic organisms colonize these areas. Nonpathogenic agents are common in the upper respiratory tract and are responsible for respiratory health. **Materials and methods:** Samples from patients presenting for ENT OPD at N.C. Hospital and Medical College, Israna, Panipat, Haryana, India were isolated for further microbiological evaluation. 100 samples from male and female patients, including 55 ear specimens, 30 and 15 throat swabs and nasal secretions, were examined between April and June 2022 and the samples were analyzed by culturing, direct microscopy and identification of bacteria. **Result:** Research results have identified 7 bacterial genera, namely *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Proteus vulgaris*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Streptococcus pneumoniae*. **Conclusion:** *Staphylococcus aureus* was the most common isolate from ear and nasal swabs, while the majority of throat swabs were negative and, in a small number of *Streptococcus pneumoniae* was isolated, indirectly showing viral infection rates in cases of throat infections. This demonstrates the importance of culture and sensitivity in these cases before starting antibiotics.

Keywords: Prevalence, Bacteria, Ear, Nose and Throat, Isolates

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INTRODUCTION

Ear (Anural), Nose (Nasal), and Throat (ENT) infection are among the most widespread and serious infections that compel an individual to seek medical attention. It represents some of the most common bacterial disease encountered affecting people of all ages. These infections are one of the leading causes of morbidity and mortality in critically ill patients.[1] The ear, nose, and throat are the frequent sites of infection, because they come in direct contact with the physical environment and are exposed to air borne microorganisms.

Disease of ear, nose and throat (ENT) affect the functioning of adults as well as children, often with significant impairment of the daily life of affected patients.[1] It has been envisaged that with increase in global population, infection remain the most

important causes of disease with upper respiratory infections causing hearing loss and learning disability particularly in children. [2-4] Ear infection such as chronic otitis (tinnitus), have serious consequences in developing countries such as retarded language development and progress in school among children.[5] ENT infection which is now known to be the most common childhood infections [6] in other cases nasal condition may be distressing, as in the case of nasal myiasis.[7]

Bacterial species such as *Staphylococcus aureus*, *Streptococcus* species, *Proteus* species, *Haemophilus* and *Escherichia coli* forms were found to be responsible for most cases of ENT infections. Elsewhere, *Actinomyces israeli*, *Mycoplasma pneumoniae*, *Mycobacterium tuberculosis* and *Corynebacterium diphtheriae* have been found to be

responsible for varying rates of infection and ENT disease.[8,9]

Colonization in the nasopharynx may involve a complex combination of factors including host characteristics, host immune responses, and direct competitive interactions between bacterial species. [10] Staphylococcus yellow is the main bacteria that invade the nose. [11] Pharyngitis is a common throat infection and is mainly caused by Streptococcus pyogenes. [12] The rapid development of microbial resistance to available antibiotics has increased the risk of infectious diseases to human health. [13] Biofilm formation and chronic antibiotic-resistant ENT infections are also a common threat. Cell separation, endotoxin production, increased resistance to the host immune system, and growth of the organism are all biofilm processes that can initiate infection.[14] To avoid serious complications, aggressive and prompt management of ENT infections is imperative.[15]

Chronic suppurative otitis media (CSOM) is a common cause of hearing loss, disability and poor school performance among children in poor and developing countries. It is the main cause of disease in the world. The worldwide prevalence of CSOM is between 65 and 330 million people and 39 to 200 million (60%) have clinically significant hearing loss. The overall incidence is estimated to be around 9 per 100,000 people. CSOM is persistent inflammation of the middle ear or mastoid cavity and is characterized by recurrent or persistent ear discharge (watery ears) within 2 to 6 weeks of perforation of the tympanic membrane. Frequent upper respiratory infections and poor socioeconomic conditions (overcrowded housing, poor sanitation and nutrition) are often associated with the development of CSOM. Deafness due to CSOM of the certain type is often considered a purely conductive type. In the dangerous types of CSOM, neural deafness is most often caused by labyrinthitis and cholesteatoma. Occasionally, in a life-threatening condition, CSOM can lead to fatal intracranial infection and acute mastoiditis.[16-18]

MATERIALS AND METHODS

Site and patient selection

This prospective study was conducted at the Department of Otolaryngology and Microbiology, N.C. Medical College and Hospital, Israna, Panipat, Haryana, India, over a period of 3 months from April 2022 to June 2022. One hundred patients presenting to the otolaryngology outpatient department of this hospital with various signs and symptoms of infection and related ENT diseases were randomized for this

work. Detailed patient history was collected at ENT OPD.

Sample collection

Throat swabs, nasal (nose) swabs and ear (ear) swabs were obtained sterile with sterile Evepon swabs and the collected sample was clearly labeled with patient number, date, and side (i.e. nose, ear) and throat). The swabs were immediately transported in a sterile cotton swab to the microbiology laboratory for further analysis. Laboratory analysis of collected samples

Direct microscopy

Throat, ear, and nose (nose) swabs taken from the patient are microbiologically examined to determine the type and number of bacteria, as well as the cells and the relationship between bacteria and pus cells, using a thorough technique, culture and direct microscopy. [19-20]

Culture technique

Throat swabs were inoculated into chocolate agar plates, while nasal (nose) and ear swabs were inoculated into chocolate and MacConkey agar plates. All culture plates were incubated aerobically for 24 hours with the exception of the chocolate agar plate which was placed in a candle jar. Plates are examined for bacterial growth and pathogenic colonies are identified by conventional methods. Hemolysis was studied on a chocolate agar plate. Pure, discreet colonies of bacterial isolates are stored immediately in the refrigerator until identification testing is required. Bacterial isolates were identified by standard biochemical tests.[20] and antibiotic susceptibility testing was performed using the Kirby-Bauer disc diffusion method.[21]

Statistical analysis

Laboratory samples were statistically analyzed to check for significance using chi-squared.[22-23]

RESULTS

A total of 55 ear swabs, 15 nasal swabs, and 30 throat swabs were collected from patients attending the N.C. Hospital. In which, ear swabs were positive in 50 (56.17%), 13 (14.61%) in nasal swabs and 25 (28.08%) in throat swabs.

Ear swabs were positive in 26 (29.21%) men and 24 (26.96%) women, throat swabs were positive in 13 (14.60%) men, 12 (13.48%) women, while nasal swabs were positive 6 (6.74%) were positive in men and 8 (8.98%) in women (Table 1 & Fig.1).

Table 1: Sex Wise Distribution and Culture Result of Patients

Sample	Sex	Positive	Negative	Total examined
Ear Swabs	Male	26	3	28
	Female	24	2	27
Nasal Swabs	Male	6	1	7
	Female	8	0	8

Throat Swabs	Male	13	4	17
	Female	12	1	13

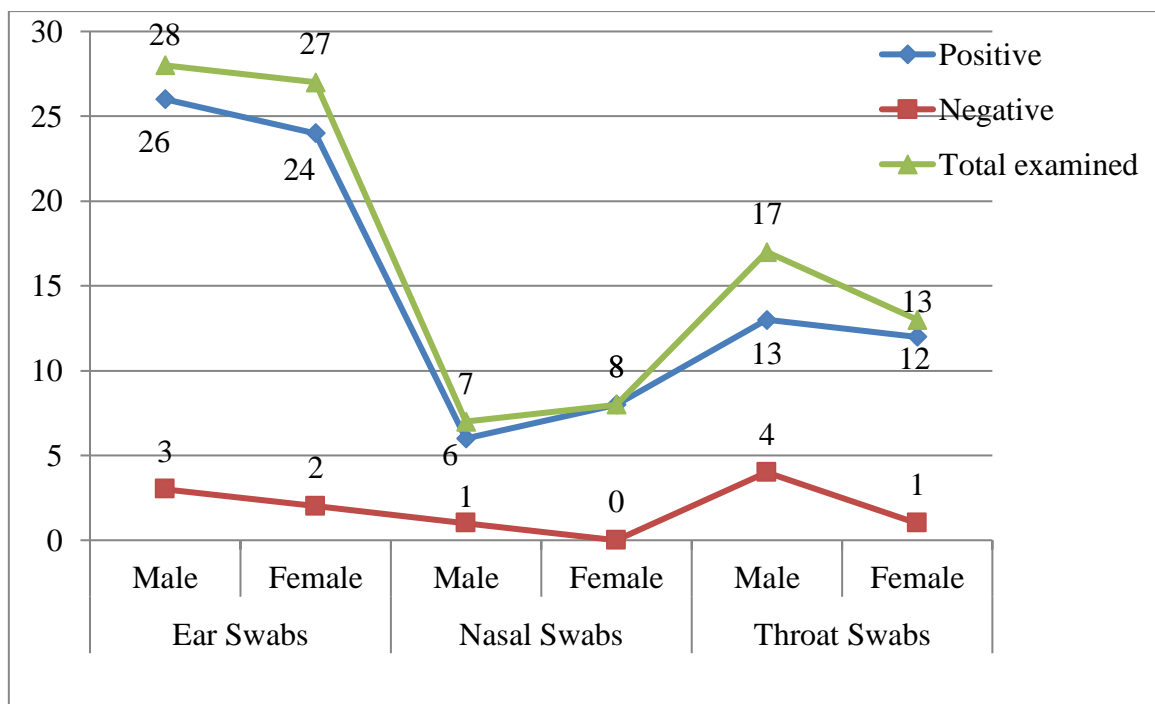


Fig. 1: Sex Wise Distribution and Culture Result of Patients

The results of this study show that seven bacterial strains are Escherichia coli, Klebsiella pneumoniae, Proteus mirabilis, Proteus vulgaris, Pseudomonas aeruginosa, Staphylococcus aureus and Streptococcus pneumoniae was associated with various ear, nose and throat diseases among the patients examined in the study area. Of all the organisms isolated, 49 (53.84%) occurred in ear smears, followed by 26 in the throat (28.57%), while at least 14 (15.38%) occurred. at the nose.

Overall, the most common organisms were Staphylococcus aureus (24.17%) while the least common were Klebsiella pneumoniae and Proteus vulgaris with (4.39%). Staphylococcus aureus and Streptococcus pneumoniae were isolated from ENT swabs, Escherichia coli isolated from ENT swabs, in nasal and throat swabs, Klebsiella pneumoniae and Proteus mirabilis were both isolated from ear and throat swabs, while Pseudomonas aeruginosa was isolated from ear swabs only (Table 2 & Fig.2).

Table 2: Bacteria Associated with ENT Infection

Bacterial isolates	Ear	Nose	Throat	Total	%
Escherichia coli	6	4	0	10	10.98
Klebsiella pneumoniae	2	0	2	4	4.39
Proteus mirabilis	4	0	0	4	4.39
Proteus vulgaris	9	0	1	10	10.98
Pseudomonas aeruginosa	18	0	0	18	19.98
Staphylococcus aureus	8	8	6	22	24.17
Streptococcus pneumoniae	2	2	15	19	20.87

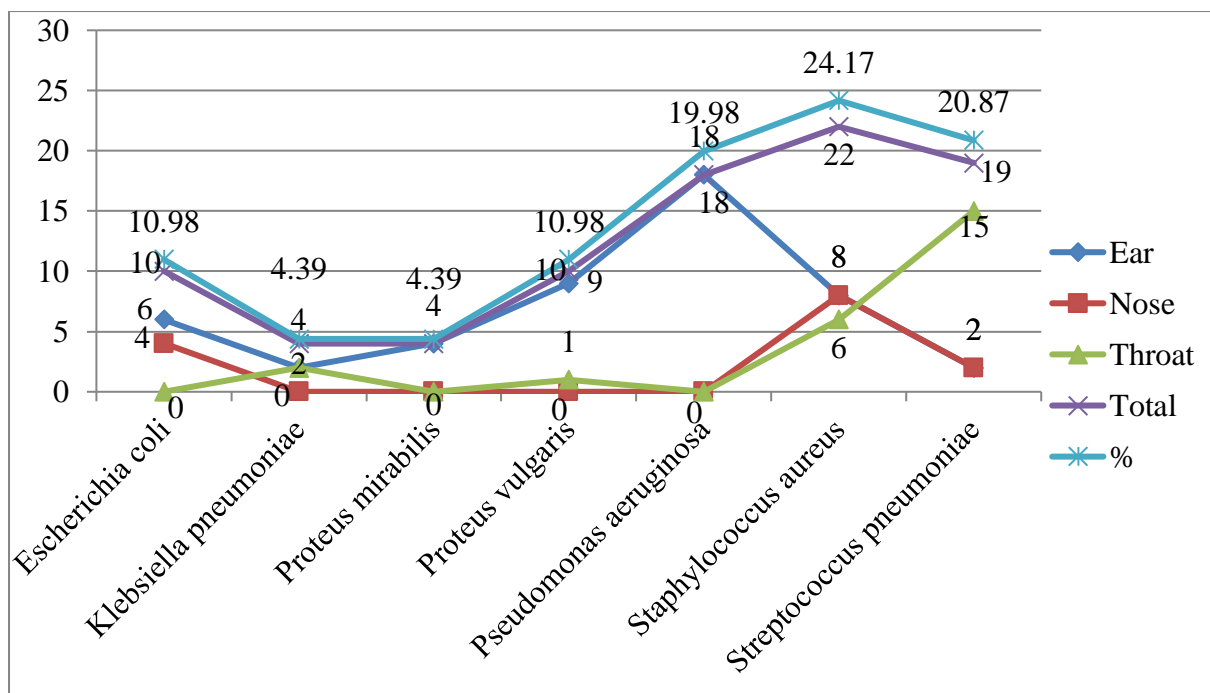


Fig. 2: Bacteria Associated with ENT Infection

The age related prevalence of the ENT infection in the study area showed that the highest prevalence of the bacterial infection (47.25%) is amongst those aged 1 – 10 years, (18.68%) was amongst the aged greater than 50 years, (9.89%) was amongst the aged 11 – 20 years (6.59%) was amongst neonate (i.e. less than 1 year) and 21 – 30 years while the least (5.49%) was amongst 31 – 40 years and 41 – 50 years. (Table 3).

Table 3: Age related prevalence of bacterial isolates in ENT infections

	< 1	1 – 10	11 – 20	21 – 30	31 – 40	41 – 50	> 50
E. coli	0	4	0	2	1	0	3
Klebsiella pneumoniae	0	3	0	0	0	1	0
Proteus mirabilis	1	2	2	0	0	0	0
Proteus vulgaris	2	6	0	0	0	0	2
P. aeruginosa	3	8	2	0	0	1	4
Staphy. aureus	0	8	3	3	1	1	6
Strep. pneumoniae	0	11	2	1	1	1	2
Total	6	43	9	6	5	5	17
%	6.59	47.25	9.89	6.59	5.49	5.49	18.68

Contrary to the above finding the age related prevalence of infection in this study showed that is no any significant difference in the prevalence of the bacteria isolated in different age group ($X^2 = 1.0689$, $p = 1.064$)

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.[4] 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.[4]

Obiajurn and Chukuezi (2013) reported that bacteria Staphylococcus aureus, Streptococcus pneumoniae, Proteus species, Haemophilus species were responsible for most cases of ENT infections,[4] Whereas Rakesh Kumar et al. (2013) find out that Pseudomonas species, Staphylococcus aureus, Proteus

species and Klebsiella species, are the common bacteria that cause ENT infection in Japur, India,[24] similarly Osazuwa et al. (2011) find out that Pseudomonas aeruginosa, Staphylococcus aureus, Klebsiella species, Streptococcus pneumoniae, Escherichia coli are the bacteria associated with ENT infection and Pseudomonas aeruginosa was the most prevalent aetiological agent of ENT infection in Benin city [25], El-Mohmood et al. (2010) reported that Streptococcus pneumoniae, Staphylococcus aureus, Klebsiella pneumoniae, Haemophilus species, Proteus mirabilis and Pseudomonas aeruginosa were the bacteria isolated in ENT infection. Based on their study Streptococcus pneumoniae was the most prevalent bacteria isolated in both ENT infections. These study collaborate the above findings Escherichia coli, Haemophilus species, Klebsiella

pneumoniae, *Proteus mirabilis*, *Proteus vulgaris*, *Pseudomonas aeruginosa*, *Streptococcus pneumoniae* and *Staphylococcus aureus* were found in both Ear, Nose and throat infection.[26]

But contrary to El-Mohmood et al. (2010) *Staphylococcus aureus* was the most prevalent bacteria isolated in ENT infection.[26] While the finding in these research that *Pseudomonas aeruginosa* was found in only Ear infection collaborate the finding of Osazuwa et al. (2011) that *Pseudomonas aeruginosa* was the most aetiological agent of ENT infection in Benin City.[25]

A study reported by Miorangthem and Angon (2012) find that the bacteria species isolated from ENT infection in Sikkim population in India children are *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Streptococcus pyogenes*, while in adult *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Klebsiella* species and *Escherichia coli* were isolated. [27]

Signs and symptoms of this infection include mild to severe pain, fever and headache (Azeez, 2000),[28] runny or stuffy nose, and ear fullness.[29] Other symptoms and complications include difficulty swallowing food, meningitis, runny nose, laryngospasm, laryngeal paralysis, hearing loss, ear infections, and more. Several factors are believed by former workers to be responsible for infections and ENT diseases. These include poor hygiene habits and forceful blowing of the nose as well as excessive inhalation of infected mucus into the middle ear, leading to otitis media in adults. [30] But Azeez (2000) suggested that otitis media is common in children due to narrowing of the Eustachian tube, which may not drain well. [28]

The human ear, nose and throat (ENT) are closely related and interconnected parts of the body. Therefore, infections, diseases and health problems related to ENT are studied and cared for just like most other parts of the human body. The ears, nose, and throat have been shown to host a wide variety of microorganisms, some of which are more or less harmless under normal conditions. [3]

CONCLUSION

Staphylococcus aureus was found to be the most common pathogen, followed by *pseudomonas* in ear and nose infections, while negative cultures in throat infections in this study showed a predominance of viral pathogens, making culture possible. Culture and susceptibility becomes an essential tool before considering antibiotic prescribing. However, when these are not available, before prescribing antibiotics for ear and nose infections, two types of bacteria (*staph* and *pseudomonas*) should be kept in mind.

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