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Original Research Article

Antibacterial susceptible pattern of ear, nose and throat in paediatric patient infections

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ABSTRACT

Background: To study the bacterial pathogens of ear, nose and throat (ENT) to determine the frequency and sensitivity pattern of ENT infections in paediatric patients.
Methods: The study was conducted during the period of June 2016 to May 2017 in Kerala Medical College Hospital. A total 225 samples were collected and evaluated for microbiological investigations. Antimicrobial susceptibility profile was determined by modified Kirby Bauer disc diffusion method.
Results: Out of 225 samples, 140 (62.22%) were found positive growth and 85 (37.77%) of samples were found negative culture. The frequency of different organisms isolated was as follows: *Pseudomonas* 43 (30.71%), *Staphylococcus aureus* 32 (22.85%), *Proteus spp.* 18 (12.85%) *Klebsiella spp.* 17 (12.14%) etc., Antibiotic susceptibility pattern gram positive bacteria were vancomycin (100%) followed by amikacin (97.14%), and in gram negative bacteria; sulbactam/ cefoperazone (97.14%), piperacillin/tazobactam (95.23%) and meropenem (94.28%) were the most effective drugs.
Conclusions: *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Proteus spp.* and *Klebsiella spp.* are the leading ENT pathogens in paediatric patients. Most of the isolates showed high resistance to cephalosporins. Showed high effectiveness to sulbactam/ cefoperazone, piperacillin/tazobactam.

Keywords: Antibiotics, Paediatric ENT infections, Susceptibility

INTRODUCTION

Many infectious diseases have been controlled in 20th century, the public health measures that the use of antimicrobial agents (AMAs).[1] The limited use of antimicrobials prevents insurgence of resistant microbes. Rational prescribing pattern is used to increase the therapeutic benefit and reduce the adverse effects of the patient.[2] Inflammation of the middle ear affects the tympanic membrane.[3] Sources of infection reaches the middle ear through eustachian tube.[4,5] The infections may be in the nose, paranasal sinuses, or in the oropharynx.[6] Nasopharyngeal colonization probably involves in host characteristics, host immune responses and direct competitive interactions with bacterial species.[7] *Staphylococcus aureus* is the main colonizer in nose; *Streptococcus pyogenes* throat infections are very common in Pharyngitis.[8,9] Detachment of cells increases the production of endotoxin, decrease the immune system that could initiate the infection process.[10] In order to avoid serious complications an active and prompt management of ENT infections is mandatory.[11] The present study fulfils the determination of the etiological

agents and their antibiotic susceptibility pattern in paediatric patients.

METHODS

The study was conducted in the Kerala Medical College Hospital, Mangode, Palakkad, Kerala. A total 225 sample culture was done on the time period of June 2016 to May 2017.

Swabs were collected from Ear, nose and throat in ENT department and Mac Conkey agar plates. Bacteria were identified by using Gram staining. Antimicrobial sensitivity testing was done on Mueller Hinton agar using Modified Kirby Bauer disc diffusion technique. 0.5 McFarland turbidity test inoculums used as a standards were for comparison. The suitable antimicrobial discs used for Gram negative bacteria and gram positive bacteria.

After keeping the appropriate antibiotics, the plates were incubated at 37ºC for the time of 16-18 hours. The zone of inhibition considered as antibacterial activity against each organism and it was measured in mm as sensitive, resistant using interpretation chart of zone sizes.

RESULTS

Table 1: distribution of bacterial pathogen isolates from ENT paediatric patients.

organisms	No. of patients	Ear swab	Nasal Swab	Throat swab
Pseudomonas spp.	43 (30.71%)	39	3	4
Staphylococcus aureus	32 (22.85%)	25	1	0
Proteus spp.	18 (12.85%)	15	0	0
Klebsiella spp.	17 (12.14%)	9	2	8
Escherichia coli	9(6.42%)	8	0	2
Enterobacter spp.	6(4.28%)	6	0	0
Citrobacter spp.	4(2.85%)	3	0	1
Acinetobacter spp.	3(2.14%)	3	0	0
Haemophilus parainfluenzae	3(2.14%)	1	0	4
Streptococcus pyogenes	2(1.42%)	2	0	1
Streptococcus pneumoniae	2(1.42%)	2	0	0
Stenotrophomonas maltophilia	1(0.71%)	1	0	0
Total	140 (100%)	114	6	20

Out of 225 samples, 140 (62.22%) were found positive growth while 85 (37.77%) samples were culture negative. Among 140 positive samples, single bacterial growth was present in 126 samples and 14 samples double bacterial growth. The frequency of different organisms isolated was as follows: *Pseudomonas* 43 (30.71%), *Staphylococcus aureus* 32 (22.85%), *Proteus spp.* 18 (12.85%) *Klebsiella spp.* 17 (12.14%), E. coli 9 (6.42%), *Enterobacter spp.* 6 (4.28%), *Acinetobacter spp.* 3 (2.14%), *Haemophilus parainfluenzae* 3 (2.14%), *Citrobacter spp.* 4 (2.85%), *Streptococcus pyogenes* 2 (1.42%), *Streptococcus pneumoniae* 2 (1.42%), and *Stenotrophomonas maltophilia* 1 (0.71%).

114 (81.42 %) cultured and found positive from ear samples; those are: *Pseudomonas spp.* (39), *Staphylococcus aureus* (25), *Proteus spp.* (15) and *Klebsiella spp*. (17) were the most frequent organisms. While positive nasal samples are only 6 (4.28%); *Pseudomonas spp*. (3), *Klebsiella spp*. (2) and *Staphylococcus aureus* (1) were isolated. From positive throat samples are 20 (14.28%); *Klebsiella spp*. (8), *Pseudomonas spp*. (4), *Haemophilus parainfluenzae* (4), *Streptococcus*, *E. coli* (2) and *Citrobacter spp*. (1) were isolated (Table 1).

Antibiotic susceptibility pattern of vancomycin (100%) followed by amikacin (97.14%) showed in gram positive organisms sensitivity in all the isolates of *Staphylococcus aureus* but resistant to penicillin and ampicillin in *Streptococcus spp*. (*Streptococcus pyogenes* and *Streptococcus pneumoniae*) showed 60% susceptibility to these drugs. The isolates were also susceptible to ciprofloxacin (91.42%), amoxicillin/clavulanic acid (80.00%), cefuroxime (77.14%), ceftriaxone (82.85%), oxacillin (74.28%), piperacillin\tazobactam (74.28%), cefotaxime (71.42%) and cefradine (74.28%) (Table 2).

Table 2: Antibiotic sensitive and resistant pattern of gram positive organisms (n=35).

Antibiotics	Sensitive	Resistant
Vancomycin	35(100%)	0(0%)
Amikacin	34(97.14%)	1(2.85%)
Ciprofloxacin	32(91.42%)	3(8.57%)
Ceftriaxone	29(82.85%)	6(17.14%)
Amoxicillin/Clavulanic acid	28(80.00%)	7(20.00%)
Cefuroxime	27(77.14%)	8(22.85%)
Oxacillin	26(74.28%)	9(25.71%)
Piperacillin/Tazobactam	26(74.28%)	9(25.71%)
Cefradine	26(74.28%)	9(25.71%)
Cefotaxime	25(71.42%)	10(28.57%)
Pencillin	2(5.71%)	33(94.28%)
Ampicillin	2(5.71%)	33(94.28%)

In Gram negative bacteria sulbactam/ cefoperazone (97.14%), piperacillin/tazobactam (95.23%) and meropenem (94.28%) were the most effective drugs. The sensitivity of the isolates to other drugs included amikacin (85.71%), ceftazidime (76.19%) and ciprofloxacin (80.95%). The isolates were less

susceptible to ceftriaxone (47.61%), chloramphenicol (40.95%), cefotaxime (33.33%), amoxicillin/clavulanic acid (33.33%) and cefuroxime (24.76%) (Table 3).

Table 3: Antibiotic sensitive and resistant pattern of gram negative organisms (n=105).

Antibiotics	Sensitive	Resistant
Sulbactam/Cefoperazone	102(97.14%)	3(2.85%)
Meropenem	99(94.28%)	6(5.71%)
Tazobactam/Piperacillin	100(95.23%)	5(4.76%)
Amikacin	90(85.71%)	15(14.28%)
Ceftazidime	80(76.19%)	25(23.80%)
Ciprofloxacin	85(80.95%)	20(19.04%)
Ceftriaxone	50(47.61%)	55(52.38%)
Chloramphenicol	43(40.95%)	62(59.04%)
Cefotaxime	35(33.33%)	70(66.66%)
Amoxicillin/Clavulanic acid	35(33.33%)	70(66.66%)
Cefuroxime	26(24.76%)	79(75.23%)

DISCUSSION

The present study analyzes the general trends of use of antibiotics in paediatric patients in ENT departments. The antibiotic resistance can be solved by making the practitioners aware of the treatment for paediatric infection. There are several studies related to antibiotic use in hospitals regarding constructive approach in solving problems arising from multiple antibiotic use. The antibiotic resistance has become a major threat to the medical practitioners. Irrational and inappropriate use of antibiotics has been a major contributor to this ever-growing problem.[12]

Present study demonstrated that the ear, nose and throat swabs to analyze the frequency and antimicrobial sensitivity pattern of pathogenic bacteria of ear, nose and throat. According to the present study a total number of samples 140 (62.22%) pathogenic organisms were isolated from 225 (37.77%) samples. These analysis are comparable with a study conducted in Benin city in which 272 samples, single bacterial growth was obtained in 165 (60.66%) samples and 69 (25.36%) showed growth of two isolates.[13] The present study frequency of different organisms were isolated are *Pseudomonas* 43 (30.71%), *Staphylococcus aureus* 32 (22.85%), *Proteus spp.* 18 (12.85%) *Klebsiella spp.* 17 (12.14%), similar frequency in earlier study of pathogens of ENT specimens.[14] But other previous studies conducted in various regions also isolated the same microorganisms (*Staphylococcus aureus, Streptococcus pyogenes, Klebsiella spp., Haemophilus influenzae, Pseudomonas aeruginosa, Proteus and E. coli*) with different frequencies.[15,16] The reason for such a wide number and frequency of pathogens might be poor hygienic conditions.

In the present study Gram positive organisms showed sensitivity to vancomycin (100%) amikacin (97.14%) and ciprofloxacin (91.42%) in the present study. An Indian earlier studied reported sensitivity of Staphylococcus aureus to ciprofloxacin as 89% and gentamicin 76.5%.[17] and Gram negative organisms were most sensitive to sulbactam/ cefoperazone (97.14%), piperacillin/ tazobactam (95.23%). This is quite similar to a research work reported 100% sensitivity against *Pseudomonas*.[18] The rational use of antibiotics should be considered for the better treatment and to avoid the burden of multi-drug resistance in ENT patients.

CONCLUSION

Present study identified that, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Proteus spp.* and *Klebsiella spp*. are the leading ENT pathogens in paediatric patients. Most of the isolates showed high resistance to cephalosporins. However, they showed high effectiveness to sulbactam/ cefoperazone, piperacillin/tazobactam.

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