BACTERIOLOGY AND ANTIBIOGRAMS OF CHRONIC OTITIS MEDIA AMONG CHILDREN IN HYDERABAD

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ABSTRACT

BACKGROUND

Suppurative otitis media is a very common disease in ENT practice in all age groups, but in children it represents an important cause of preventable hearing loss. Physicians attending such patients tend to use antibiotics in the first instance empirically. Even though many studies are available on the susceptibility profiles of the bacteria isolated from the ear discharge, the susceptibility of these organisms varies from time to time and from place to place. Hence, such studies are required periodically to evaluate the changing trends in bacterial susceptibility following isolation.

Objective of this study is to isolate and identify the bacteria and study their antibiotic susceptibility profiles in children attending the Government ENT Hospital in Hyderabad.

MATERIALS AND METHODS

Between December 2008 and November 2012, a cross-sectional study was conducted at Government ENT Hospital, Koti, Hyderabad on 320 ear discharge samples collected from children attending with complaints of suppurative otitis media. Standard microbiological procedures adopted in collection, isolation and culture sensitivity of the samples.

RESULTS

Bacterial isolates encountered were Staphylococcus aureus (42.46%), E. coli (22.14%), Pseudomonas aeruginosa (16.02%), Proteus species (11.76%) and Streptococcus species (7.62%). The gram positive bacteria showed higher sensitivity to Ceftriaxone sodium (~ 90 - 100%), Cefotaxime (~ 90%) and Cefaclor (~ 85 - 90%). The Gram negative bacteria showed sensitivity to Amikacin (~ 100%), Gentamicin (~ 90 - 100%) and Ceftriaxone sodium (~ 80 - 95%). Pseudomonas aeruginosa showed resistance to many of the antibiotics used for testing sensitivity and termed as MDR (Multidrug Resistant Bacteria).

CONCLUSION

Among the clinical isolates, low levels of resistance was found in general to the commonly used antibiotics in the community. An increased frequency of (Methicillin-Resistant Staph aureus) MRSA was found. Awareness among the public and treating physicians should be created to reduce the risks of developing complications of suppurative otitis media and empirical treatment protocols that should be followed.

KEYWORDS

Otitis Media; Drug Resistance; Bacteria; Isolation; Bacteriology and MRSA.

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BACKGROUND

Suppurative inflammation of the middle ear cleft involving both the mucosal lining and bone is the standard definition of Suppurative Otitis Media. It presents clinically as acute and chronic forms.[1] It also includes a variety of clinical stages with different symptoms and signs.[2] The virulence of the bacteria plays an important role in its pathology.[3] Otitis media is more common in children, as their Eustachian tube is shorter and more horizontal than adults and is made up of more flaccid cartilage, which can impair its opening.[4] The principal route through which the infection reaches the middle ear cleft is the Eustachian tube.[5,6]

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The main source of infection is adenoids, tonsils, nose and paranasal sinuses. There is frequent change in the bacterial agents causing recurrent upper respiratory tract infections in children which in turn contaminates the adenoids, tonsils and nose and paranasal sinuses.[7,8] The bacteria commonly involved are Haemophilus influenza, Streptococcus pneumoniae, Streptococcus pyogenes, Staphylococcus-aureus, Moraxella-catarrhalis[9] and Pseudomonas-aeruginosa.[10] Shift of organism to Gram negative in dangerous type of CSOM and their virulence adds up to the pathology like facial nerve weakness, meningitis and lateral sinus thrombophlebitis.

The common Gram negative bacteria are Ps. aeruginosa, Proteus and E. coli.[11] Microbial drug resistance is a growing global problem bacteria like E. coli, Klebsiella spp. and P. aeruginosa and increasing trends are observed for all major anti-Gram negative agents (beta-lactams, fluoroquinolones and aminoglycosides).[12] MRSA infections are also increasingly difficult to treat, so as penicillin-resistant Strep. pneumonia.[13] In this situation, the objective of this study is to determine bacterial aetiologic agents of otitis media infections and their antibiotic resistance patterns among child patients who visited ENT Hospital.

MATERIALS AND METHODS

A cross-sectional prospective study was conducted during the period of December 2008 and November 2012. A total of 320 children attending the Government ENT Hospital, Hyderabad with discharge from the ear were clinically diagnosed to have chronic suppurative otitis media. Ethical clearance certificate was obtained from the institute and an informed consent was obtained for each patient to collect an ear discharge swab by the attending physician and filled a short questionnaire. The patient's age ranged from 2 years to 15 years. Ear swab/discharge specimens were aseptically collected. Rubber tipped micro aural suction tips was used connected to a sterile trap to minimise the trauma and contamination. Collected specimens were kept in Stuart's Transport Media to maintain the viability of microorganisms until the specimen is processed. The specimens were transported within 1 hour in an ice box to the Microbiology Department of the Osmania Medical College, Hyderabad. All ear specimens were directly inoculated onto Blood, Chocolate and MacConkey agar (HiMedia, India). The Blood and MacConkey agar plates were incubated aerobically, while chocolate agar was incubated under 5% CO_2 atmosphere at 37°C for 24 - 48 h. All positive cultures were identified by their characteristic appearance on their respective media, Gram-staining reaction and confirmed by the pattern of biochemical reactions using the standard method.[14] Members of the family enterobacteriaceae were identified by indole production, H_2S production, citrate utilisation, motility test, urease test, oxidase, carbohydrate utilisation tests and other tests using API 20E identification kits (BioMerieux, France). For Gram-positive bacteria coagulase, DNase, catalase, bacitracin and optochin susceptibility tests and other tests were used (Oxoid, Ltd). Antimicrobial susceptibility testing was performed for all isolates according to the criteria of the (CLSI) Clinical and Laboratory Standards Institute.[15] Bacterial suspension was prepared and was adjusted to a McFarland solution 0.5 and inoculated onto Mueller Hinton agar (HiMedia, India). The appropriate set of antibiotics was applied to the corresponding isolate (Oxoid, Ltd). P. aeruginosa (ATCC - 27853), S. aureus (ATCC - 25923) and E. coli (ATCC - 25922) were used as a quality control throughout the study for culture and antimicrobial susceptibility testing and IdBact© v1.1 Identification Software was used to assist in isolate identification. Data entry and analysis were done using SPSS version 18 software. Cross tabulation and Chi-square test were performed. A p-value of < 0.05 was considered indicative of a statistically significant difference.

RESULTS

320 children were included in the study for collection of pus from the ears at Government ENT Hospital, Hyderabad and among them 198 (61.87%) were males and 122 (38.12%) were females ($p > 0.05$) resulting in an overall male-to-female ratio of 1.62:1. The average age of the children was 9.3 years (age range 2–15 years), 200 (62.5%) of the children were younger than 10 years; 268 children (83.75%) of the children had previous history of ear discharge and for the remaining 16.25% of them it was their first complaint of ear discharge. The parents of the children gave history of using antibiotics in 165 (51.56%) prescribed by primary physicians and in spite of which the specimens showed a positive culture. The frequently used antibiotics Ceftriaxone followed were Erythromycin, cephalexin, amoxicillin and ciprofloxacin. The commonest symptom among the 320 children was discharge from the ear in 100%, pain in the ear in 86.87%, loss of hearing in 58%, fever in 43.3% and itching in and around the ears in 39% (Table 1).

Clinical/Signs and Symptoms	Yes	No
Ear discharge	320 (100%)	0 (0.0%)
Ear pain	278 (86.87%)	42 (14.13%)
Hearing problems	185 (57.81%)	135 (42.18%)
Itching	157 (49.06%)	163 (51.95%)
Fever	138 (43.12%)	182 (56.78%)

Table 1: Showing the Clinical Findings among the Children, (n = 320)

Unilateral involvement of the ear was found in (right = 187, left = 133) 244 children (76.25%) and bilateral in 76 (33.75%). Copious amounts of discharge purulent in appearance was observed in 231 (72.18%) children, blood stained in 11.2% and foul-smelling scanty discharge in 78 children (24.37%). Out of 320 specimens collected, 291 specimens (90.93%) showed positive culture. The remaining 9.07% specimens reported as negative for bacterial culture. Gram positive bacteria were isolated in 190 specimens (59.37%) and the remaining 130 (40.62%) were Gram negative bacteria. Among the Gram positive bacteria S. aureus isolates showed that 91% were sensitive to Ceftriaxone, 72% sensitive to Methicillin and 67.8% sensitive to cefaclor. Among the Streptococcus spp., all isolates were sensitive to amoxicillin-clavulanic acid and about 90.9% were sensitive to amoxicillin, cefaclor, ceftriaxone, penicillin and azithromycin. For Bacillus spp., all isolates were sensitive to clarithromycin, cefadroxil, streptomycin, gentamycin, rifampicin and ampicillin. Staph. aureus was of the highest incidence 143 (44.68%), Ps. aeruginosa 76 (23.75%), Proteus spp. 24 (Proteus mirabilis and Proteus vulgaris) (7.50%), Streptococcus spp. 20 (6.25%), Bacillus spp. 17 (5.31%), Moraxella spp. 15 (4.68%), Candida spp. 13 (4.06%) and Klebsiella spp. 12 (3.75%).

The susceptibility pattern of Gram-positive bacteria (n = 209) isolated from otitis patients was determined (Table 2).

Antimicrobial Agent	S. aureus (n = 143)			Streptococcus spp. (n = 20)			Antimicrobial Agent	Bacillus spp. (n = 17)		
	Sens (%)	Inte (%)	Resi (%)	Sens (%)	Inter (%)	Res (%)		Sens (%)	Int (%)	Resi (%)
AMC	59.2	17.9	25	88.9	9.1	–	AMC	86.5	–	12.5
CLR	37.1	14.3	46.4	72.7	27.3	–	CLR	100	–	–
CDX	52	3.5	46.4	81.8	18.2	–	CDX	100	–	–
CX	61.4	7.1	28.6	81.8	8.6	9.1	S	100	–	–
CJ	65.8	14.3	17.9	8659	9.1	–	GM	100	–	–
CRO	88.6	10.7	–	87.6	9.1	–	R	100	–	–
P	45.7	–	62.3	86.5	–	9.1	P	12.5	–	57.5
E	79.2	25	35.7	87.6	–	9.1	E	87.5	12.5	–

Table 2: Showing the Susceptibility Pattern of the Gram Positive Organism, (n = 190)

*S = sensitive, *I = intermediate, *R = resistant.

AMP, ampicillin; AMC, amoxicillin-clavulanic acid; CRO, Ceftriaxone; E, erythromycin; GM, Gentamycin; R, rifampicin; MET, Methicillin; P, penicillin; S, streptomycin; CDX, cefadroxil; CLR, clarithromycin; CJ, cefaclor; CX, cloxacillin.

Among the Gram negative bacteria (n = 130) the susceptibility pattern of antibiotics was studied and it showed Ps. aeruginosa were sensitive to Amikacin in 109 (83.84%) of the isolates, 80.76% were sensitive to ceftazidime and 61.12% were sensitive to cefixime. Also it showed high frequency of resistance to clarithromycin (100%), cefadroxil (97.4%), streptomycin (89%) and ampicillin (86.6%). Regarding P. mirabilis isolates, 100% were sensitive to ciprofloxacin, Ceftriaxone and Ceftazidime, 87.5% sensitive to streptomycin, and 79.2% to cefixime. Other Gram-negative bacteria such as M. catarrhalis and Klebsiella spp. were sensitive (100%) to ciprofloxacin, cefixime, ceftriaxone, ceftazidime and gentamycin (Table 3).

Antimicrobial Agent	P. aeruginosa (n = 39)			Proteus spp. (n = 24)			M. catarrhalis (n = 5)			Klebsiella spp. (n = 2)		
AMC	21	–	77	50	45.8	80	80	–	20	100	–	–
AMP	13.2	–	65.4	16.7	62.5	60	60	40	–	–	–	100
CIP	49.8	–	5.2	100	–	100	100	–	–	100	–	–
CFM	57	17.8	25.2	79.2	20.8	100	100	–	–	100	–	–
CLR	–	–	100	–	81.2	–	–	–	100	50	50	–
CDX	2.6	–	89.4	–	79.2	20	20	–	80	50	50	–
CRO	52.4	28.5	19.1	100	–	100	100	–	–	100	–	–
CAZ	79.9	4.2	11.3	100	–	100	100	–	–	100	–	–
S	11	–	89	87.5	8.3	40	40	40	20	50	50	–
GM	48.7	7.7	43.6	84.3	12.5	100	100	–	–	100	–	–

Table 3: Showing the Susceptibility Patterns of Gram-Negative Bacteria Isolated from Ear Infections, (n = 130)

*S = sensitive, *I = intermediate, *R = resistant.

AMC, amoxicillin-clavulanic acid; AMP, ampicillin; CIP, ciprofloxacin; CLR, clarithromycin; CDX, cefadroxil; CRO, Ceftriaxone; CAZ, ceftazidime; GM, gentamicin; S, streptomycin.

DISCUSSION

The present study attempts to isolate the various bacteria causing suppurative middle ear disease in children attending the Government ENT Hospital, Hyderabad. It also analyses the sensitivity of these bacteria to various commonly used antibiotics used by physicians and ENT surgeons in the management of infections of middle ear. The antibiogram helps the consultants of the Hospital to choose the different antibiotics when the specific bacteria are isolated. Clinically, the most troublesome symptom of middle ear infections is ear discharge for which the children are brought to the Hospital followed by pain in the ear and lastly loss of hearing. This may be due to the fact that the children are unable to appreciate the fact of loss of hearing. Only when the parents notice delayed response at home and/or by teachers at school, this symptom goes unnoticed. The most common important symptoms of ear infections are ear discharge (otorrhoea), ear pain (otalgia), hearing loss, vertigo and tinnitus.[16] In the present study similar findings are observed; 86.87% of patients suffered from ear pain, while only 57.81% suffered from hearing problems. The incidence of peak-age of occurrence of suppurative otitis media in children younger than 10 years of age observed in the present study are similar to findings of previous studies done in Ethiopia[17,18] and other developing countries.[19,20,21,22,23] Unlike the study of few authors from Ethiopia,[17,18] Nigeria,[23,24] South Korea,[25] Greece,[26] Pakistan,[27] Turkey[28] and Eastern Nepal[11] who found Gram negative bacteria dominating the infection of middle ear, the present study showed prevalence of Gram positive bacteria in 190 specimens (59.37%) and the remaining 130 (40.62%) Gram negative. The most commonly isolated organism in this study was S. aureus 143 (44.68%) followed by Ps. aeruginosa 76 (23.75%), Proteus spp. 24 (Proteus mirabilis and Proteus vulgaris) (7.50%), Streptococcus spp. 20 (6.25%), Bacillus spp. 17 (5.31%), Moraxella spp. 15 (4.68%), Candida spp. 13

(4.06%) and Klebsiella spp. 12 (3.75%). This is again in contrary to the findings of authors from Ireland,[29] Pakistan[30] and Greece[26] who described P. aeruginosa as the most commonly isolated pathogen (32.5%) followed by Proteus spp. and Streptococcus spp. respectively. The overall percentage of positive cultures from patients who received antibiotics was 165 (51.56%) and from those that did not receive any antibiotics were 155 (48.43%). This observation was statistically significant and in agreement with a study from Ethiopia.[17,18] This study also provides insights into the susceptibility profile of bacteria isolated from ear infections. Our results have demonstrated that amoxicillin-clavulanic acid, ceftriaxone, ciprofloxacin, cefaclor, cloxacillin and gentamycin in general are effective against both Gram positive and negative bacteria isolated from ear infections. Gram-positive bacteria showed that there was high frequency of sensitivity to ceftriaxone, cefaclor and methicillin, while ciprofloxacin, ceftazidime, gentamicin, cefixime and ceftriaxone were perfect antimicrobial agents against Gram negative bacteria. This susceptibility profile of isolated bacteria provides an evidence for bacterial resistance to many antimicrobial agents by means of Multiple Drug Resistance (MDR); this can be noticed clearly from the susceptibility pattern of P. aeruginosa and S. aureus and increased frequency of Methicillin resistance S. aureus (MRSA) (5.8%) and this detection of multidrug resistant isolates may further limit therapeutic options. However, there are reports from different parts of the world with high resistance to these antimicrobial agents except for gentamicin.[21,23,24,28,31] This difference in the susceptibility profile might be due to frequency of usage of these agents for the treatment of ear infections in different geographic locations.

CONCLUSION

In the present study, ceftriaxone and ciprofloxacin were the most effective drugs when compared to other drugs tested against the Gram-positive and Gram-negative bacteria. This is comparable with other studies done elsewhere.[11,21,30,31,32] The in-vitro efficacy of gentamicin, ceftriaxone and ciprofloxacin against tested organisms in present study is the reflection of infrequent prescription of these drugs by ENT specialist in the community.

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