Research Article

Micro-organisms and their sensitivity pattern in acute otitis media from a developing country

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Abstract

Objective: Acute otitis media (AOM) has been associated with much morbidity including economic burden. Many bacterial organisms were identified to be the causative agents and several risk factors have been identified to increase the incidence of AOM. Considering the differences in the etiological agents and their susceptibility pattern, it becomes necessary to have up-to-date information on microbial resistance to guide the rational use of the existing antimicrobials. Hence, the present study has been envisaged to evaluate the spectrum of micro-organisms causing AOM and their antimicrobial susceptibility pattern in a tertiary care hospital. **Methods:** The present study was a cross-sectional study and was initiated following approval from the institutional ethics committee and written informed consent was obtained from all the study participants. Patients who have been diagnosed to have AOM by clinical symptoms and signs were enrolled in the study. Demographic details (age, sex), history associated with risk factors (unhygienic mopping, past history of antibiotic use/ear infection/surgery in the ear or head) were collected from each study participant. Three cotton swabs were used to collect the discharge and were subjected to Gram stain; aerobic culture and direct examination (KOH Preparation) for fungal elements and fungal culture were done. **Results:** A total of 106 consecutive AOM patients were identified of which, 76 (71.7%) were males and 30 (28.3%) were females. Majority [94/106 (88.7%)] had unilateral and one-third of the individuals (32%) were less than 10 years old. Majority of the study participants [79/106 (77.5%)] had purulent discharge and a total of 84/106 (82.4%) had history of unhygienic mopping of the ear discharge with sticks and 51/106 (50%) reported of having applied oil or hot water in the ears. Culture was positive in 102/106 (96.2%) patients. A total of 118 organisms have been grown in the culture, of which 117 were bacterial isolates and the remaining one was *Candida albicans*. Of the 117 bacterial isolates, 51 (43.6%) was *Staphylococcus aureus* and 42 (35.9%) was *Klebsiella pneumoniae.* Many of the isolated organisms [80/117(68.4%)] were sensitive to ciprofloxacin, 69/117 (59%) were sensitive to Amikacin, 63/117 (53.9%) to Piperacillin and 60/117 (51.3%) to Gentamicin. **Conclusion:** We found that majority of the patients of AOM had clinical presentation similar to other parts of the world. Even the growth and sensitivity of the isolated micro-organisms were similar to previous studies.

Keywords: acute suppurative otitis media, risk factors for otitis media, Gram stain, culture, antibiotic sensitivity.

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INTRODUCTION

Acute otitis media (AOM), characterized by inflammatory symptoms and signs in the middle ear occurring less than three weeks in duration has been found to be the most common condition necessitating medical management in children less than 5 years of age.[1] Worldwide, the prevalence of AOM ranges between 2.3-20%.[2] Otitis media is caused by multiple factors includes viral or bacterial, mechanical or functional Eustachian tube dysfunction, allergy, barotraumas or a combination of these factors. AOM may lead to complications such as labyrinthitis, mastoiditis, facial palsy, meningitis, intracranial abscess. AOM also causes an enormous economic burden to the society in terms of physician visits, medications, surgical procedures, and absences from work, school, or day care.[3,4] Bacteria are the responsible agents in majority, namely *Streptococcus pneumoniae*, *Haemophilus influenzae* and *Moraxella catarrhalis* account for around 4/5th of the AOM cases. Other micro-organisms causing AOM are *Staphylococcus*

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aureus, *Streptococcus pyogenes*, *Chlamydia pneumoniae* and recently, viruses have also been associated in some instances.[5] Antibiotics have been shown to be the only group of drugs effective in AOM.[6] The antibiotics have to be empirical enough to cover the suspected micro-organisms causing infection. Indiscriminate use of antibiotics has lead to a widespread antimicrobial resistance in the current scenario.[7] There may be difference in the etiologies of AOM between different geographical regions. Moreover, the resistance profile of micro-organisms may vary due to the difference in geography, local antimicrobial prescribing practices and prevalence of resistant bacterial strains. Thus, it becomes necessary to have up-to-date information on microbial resistance to guide the rational use of the existing antimicrobials. Without knowing the sensitivity pattern of the micro-organisms causing AOM, empirical antibiotic therapy of AOM is not justifiable.[8] Hence the present study has been envisaged to evaluate the spectrum of micro-organisms causing AOM and their antimicrobial susceptibility pattern in a tertiary care hospital.

MATERIALS AND METHOD

The present study was a cross-sectional study conducted between June 2007 and December 2008 in the ENT clinic, Krishna Institute of Medical Sciences and Dr. Kantak ENT Hospital, Karad. The study was initiated following approval from the institutional ethics committee and written informed consent was obtained from all the study participants. Patients who have been diagnosed to have AOM by clinical symptoms and signs were enrolled in the study. Demographic details (age, sex), history associated with risk factors (unhygienic mopping, past history of antibiotic use/ear infection/surgery in the ear or head) were collected from each study participant. The external ear was cleaned with sterile wet cotton swab and at same time, type of discharge observed. Auditory speculum was introduced in the ear and thin sterile cotton swab (manually made and autoclaved) was passed through the ear and pus was collected from adjacent of the tympanic membrane and placed into sterile culture tubes. Three cotton swabs were used to collect the discharge. One swab was used for Gram staining and aerobic culture. The culture was carried out on plain blood agar, MacConkey's agar and chocolate agar and incubated aerobically at 37^0C overnight. The aerobic organisms were identified according to standard methods (Mackie and McCartney). Isolated organisms were tested for their sensitivity against antibiotics according to the Kirby-Bauer method as per CLSI standards. The control organism strains that were used include *Escherichia coli* ATCC 25922, *Staphylococcus aureus* ATCC 25923, *Pseudomonas aeruginosa* ATCC 27853 and *Klebsiella pneumoniae* ATCC 13883. The second swab was processed for direct examination of fungal elements by KOH Preparation and third swab for fungal culture. Two sets of Sabouraud's dextrose agar with and without actidione were inoculated with the specimen, and incubated at 25^0C and 37^0C respectively. These were examined everyday in the first week and then twice a week for the next three weeks for the growth of any yeast or mycelial fungus. Lacto phenol cotton blue preparation, slide culture and germ tube test (in case of *Candida albicans*) were also performed to identify the species. Descriptive statistics were used for representing the demographic details of the study participants. Age was categorized into five categories (in years) (0-10, 11-20, 21-30, 31-40 and above 40).

Demographic Details

A total of 106 consecutive AOM patients were identified of which, 76 (71.7%) were males and 30 (28.3%) were females. Majority [94/106 (88.7%)] had unilateral while the remaining [12/106 (11.3%)] had bilateral involvement of the ears. Median (range) of age (years) of the study participants was 11.5 (1-40). One-third of the individuals (32%) were less than 10 years old.

Clinical features of the study Participants

Majority of the study participants [79/106 (77.5%)] had purulent discharge while mucopurulent [21/106 (20.6%)], mucoid [4/106 (3.8%)] and blood mixed [2/106 (2%)] were seen in the rest. A total of 26/106 (25.5%) reported deafness, 32/106 (31.4%) had blocking sensation in the ear, 86/106 (84.3%) had ear ache and 52/106 (51%) had pulsatile ear discharge. Forty eight individuals (47.1%) had fever as a systemic symptom.

Predisposing risk Factors

A total of 84/106 (82.4%) had history of unhygienic mopping of the ear discharge with sticks, 51/106 (50%) reported of having applied oil or hot water in the ears, 62/106 (60.8%) had history of common cold, 22/106 (21.6%) had used a topical antibiotic, 3/106 (2.9 %) had history of allergic rhinitis, 12/106 (11.76%) had history of tonsillitis, 2/106 (1.96%) had chronic illness and 2/106 (1.96%) had bottle feeding.

Spectrum of micro-organisms

Culture was positive in 102/106 (96.2%) patients. A total of 89 individuals had shown growth of one micro-organism, 16 had two and one had three organisms. So, a total of 118 organisms have been grown in the culture, of which 117 were bacterial isolates and the remaining one was *Candida albicans*. Of the 117 bacterial isolates, 51 (43.6%) was *Staphylococcus aureus*, 42 (35.9%) was *Klebsiella pneumoniae*, 11 (9.4%) was *Pseudomonas aeruginosa*, 7 (6%) was *Escherichia coli*, 3 (2.6%) was *Streptococcus pyogenes*, 2 (1.8%) was *Streptococcus pneumoniae*, 1 (0.1%) was *Citrobacter koseri*. A total of

10 individuals had grown *Klebsiella pneumoniae* and *Staphylococcus aureus*, 3 had grown *Staphylococcus aureus* and *Pseudomonas aeruginosa*, 2 had growth of *Staphylococcus aureus* and *Escherichia coli*, 1 had *Staphylococcus aureus* with *Streptococcus pyogenes* and 1 had growth of *Staphylococcus aureus* with *Klebsiella pneumoniae* and *Candida albicans*.

Antimicrobial sensitivity Pattern

Many of the isolated organisms [80/117(68.4%)] were sensitive to ciprofloxacin, 69/117 (59%) were sensitive to Amikacin, 63/117 (53.9%) to Piperacillin and 60/117 (51.3%) to Gentamicin. Details of the antimicrobial sensitive and resistance pattern of the isolated micro-organisms are depicted in Table 1.

Table 1: Antimicrobial sensitivity and resistance pattern of the isolated micro-organisms

	Total number of isolated strains	Number of strains that are resistant to all the tested antimicrobials	AK	AZK	AG	AM	CN	CX	PG	GM	PC	PR	RP	RC	CF
Staphylococcus aureus	51	4	30	7	24	8	22	6	1	31	28	6	21	42	18
Klebsiella pneumonia	42	2	21	31	13	3	4	9	6	9	22	32	6	21	22
Pseudomonas aeruginosa	11	6	8	1	1	3	4	5	2	11	8	7	9	10	11
E.coli	7	-	6	2	2	1	4	2	0	5	4	2	3	5	3
Citrobacter koseri	1	-	1	0	1	1	1	1	1	1	1	1	1	1	1
Streptococcus Pneumoniae	2	-	1	1	1	0	0	1	0	1	0	1	1	1	1
Streptococcus pyogenes	3	-	2	2	2	0	0	2	1	2	0	2	0	0	2
Total	117	-	69	44	44	16	35	26	11	60	63	51	41	80	58
Percentage	-	-	58.97	37.61	37.61	13.68	29.91	22.22	9.40	51.28	53.85	43.59	35.04	68.38	49.57

AK- Amikacin; AZK- Azithromycin; AG- Augmentin; AM-Ampicillin ; CN- Carbencillin ; CX - Cloxacillin ; PG - Penicillin ; GM - Gentamicin ; PC - Piperacillin ; PR - Ceftriaxone ; RP - Cefotaxin ; RC - Ciprofloxacin ; CF - Cephalexin ;

DISCUSSION

The present study has been done over a period of 1.5 years to evaluate the type of micro-organisms and their antimicrobial susceptibility pattern in acute otitis media patients. We found that majority of the study participants belonged to either paediatric or adolescent age group, had unilateral purulent discharge and reported ear ache as the major complaint. More than three-fourths of the study participants had unhygienic mopping of the ear with sticks. *Staphylococcus aureus* followed by *Klebsiella pneumoniae* were the most common isolated organisms in our patients that were majorly sensitive to Ciprofloxacin, Gentamicin and Piperacillin. AOM is one of the most common infections in children less than 15 years of age. Alho *et al* reported that the incidence of AOM was 0.93 incidents per child-year during the first two years of life.[9] Another study from the western world had estimated a prevalence of AOM to be about 25% during the first 5 years of life.[10] A prospective cohort study on children had reported that nearly 2/3rds of the children had at least one episode of AOM before they celebrated their first birthday with the peak incidence occurred during the first 6 months of life. [11] Our data were generally comparable with these previous studies. A shorter, wider and more horizontal location of eustachian tube predisposing to the drainage of middle ear secretion into the nasopharynx is the reason for transmitting infection when from nasopharynx to middle ear through pharyngotympanic tube. A recent study has also shown that recurrence of AOM is common and previous studies have reported it to range between 20-27% in 6 months to 60% in 4 months.[12] Presentation of patients with acute otitis media depends on the stage of pathogenesis. Four stages have been noted namely, the first stage of tubal occlusion, second stage of pre suppuration followed by the stage of suppuration and lastly resolution.[13] Patients on the first stage mostly will present with the complaints of deafness while in the next stage marked earache which is throbbing in nature may be present in association with high grade fever, deafness and tinnitus. Hearing loss is also a constant symptom in cases of otitis media where fluid get accumulate in middle ear. However in early stage of middle ear infection hearing loss is almost absent because of the stage of inflammation without any pouring of secretion. But when fluid begins

to accumulate, hearing becomes impaired. In the present study, otalgia is the prominent symptom (84.3%) followed by pulsatile discharge (51%), fever (47%), fullness of ear (31.4%), deafness (25.5%) and tonsillitis (11.8%). Many individuals had claimed unhygienic mopping of the ear or application of hot oil or water that predisposed for the development of AOM. Unhygienic mopping of the ear may transmit the infection from an external environment to the middle ear and is more commonly seen amongst the patients from rural areas.[14] A systematic review has found that craniofacial abnormalities, gastroesophageal reflux, presence of adenoids, upper airway infections, day care center attendance, presence of siblings/family size, passive smoking, breastfeeding and use of pacifiers as factors associated with increased risk of AOM.[15] Due to limited sampling, we found that breastfeeding and family history contributed to only around two and four percentage respectively. Culture negativity has been reported to be around 12-35% in various studies in patients with AOM.[16] In the present study, micro-organisms were isolated in around 96% of the cases. Slightly less than half of the study population showed growth of *Staphylococcus aureus* followed by *Klebsiella pneumoniae* corroborating with other studies.[17] The organisms were found to be susceptible to Ciprofloxacin followed by Gentamicin and Piperacillin, the spectrum similar to other reports.[18] Vijaya *et al* in 2004 reported that around 60% of the isolated organisms were sensitive to fluroquniolones and aminoglycosides.[18] Only one patient was found to have been infected with *Candida albicans*. Fungal organism being the etiological agent for AOM has been rarely reported in the literature.[18] Recent studies have also found out viruses being the offending agents in AOM.[19] But we have not attempted to isolate any virus in the present study due to technique constraints. The strengths of the study are that we have collected microbiological reports from slightly more than 100 consecutive patients of AOM and assessed the presence of various risk factors from each of the study participants. However, the study is limited by the fact that no long-term follow up of the study participants was done, data on recurrence of AOM was not collected and isolation of virus has not been looked into. In conclusion, we found that majority of the patients of AOM had clinical presentation similar to other parts of the world. Even the growth and sensitivity of the isolated micro-organisms were similar to previous studies.

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