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Bacteriological Patterns In Safe And Unsafe Chronic Suppurative Otitis-Media.

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ABSTRACT

Chronic suppurative OM is a condition characterized by inflammation of the middle ear. If left untreated it may lead to serious complications both intra-cranial and extra-cranial, seen in developing countries. Aims of the study is to identify the pathological agent in safe and unsafe CSOM, to differentiate between aerobic and anaerobic bacteria causing CSOM, and identification of antibiotic resistant bacteria. Out of 50 clinical cases, Samples are collected before the administration of antibiotics and sent for culture and sensitivity and antibiotic susceptibility testing (AST). The reports obtained are analysed and subjected to study. In 50 patients of CSOM, highest age incidence is 31-40 years (26%). Out of 50, 29(58%) were males and 21(42%) were females. Out of the 50 samples, 45(90%) yielded culture positive and 5(10%) showed no growth. Out of the 50 diagnosed cases of CSOM, 39(78%) were tubotympanic and 11(22%) were atticoantral type of CSOM. *Pseudomonas aeruginosa* was the main isolate (26%) after which *Staphylococcus aureus* (24%). *Pseudomonas aeruginosa* was resistant to ciprofloxacin (53.8%) and levofloxacin(53.8%). *Staphylococcus aureus* (24%)was resistant to ciprofloxacin (91.6%) and levofloxacin (91.6%) and *Aspergillus niger*(4%) resistant to none. Predominance of gram-negative organisms were seen. Tubotympanic type is prevalent compared to atticoantral type associated with cholesteatoma formation. *Pseudomonas aeruginosa* was the most common organism isolated. Based on antibiotic sensitivity and resistance, proper antibiotics were selected and administered to avoid emergence of resistant bacteria and prevent progression of the disease.

Keywords: Antibiotic sensitivity, chronic suppurative otitis media, *Pseudomonas aeruginosa,* nosocomial infections, cholesteatoma.

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INTRODUCTION

Chronic suppurative otitis media by definition is the inflammation of the middle ear mucosa and the mastoid cavity predominantly. There is presentation of recurrent ear discharge also called otorrhoea which is followed by a tympanic membrane perforation in most scenarios. Most prone to this disease are those in highly developing countries. The low socio-economic society because of malnutrition, overcrowding, poor hygiene, inadequate health care, and recurrent upper respiratory tract infections are the victims of this disease specifically [1]. Chronic suppurative otitis media (CSOM) is prevalent since prehistoric times due to the inadequacy of health education [2]. It can either affect the pars tensa or pars flaccidadepending on the extent, the types of CSOM are classified into safe or tubotympanic typeand unsafe or atticoantral type. Conductive deafness (66.3%) and hearing disorders are predominant here which is the main manifestation [3]. the type of hearing loss in CSOM is conductive in nature, but some studies show additional sensorineural component to their conductive hearing loss (mixed hearing loss) [4]. Usually acute otitis media (AOM) or secretory otitis media if left untreated progresses to CSOM. The Infection can progress from middle-ear to vital structures such as labyrinth,mastoid,facial nerve, lateral sinus, meninges and brain leading to mastoid abscess, facial nerve paralysis, deafness, lateral sinus thrombosis, abscess in the cranium and meningitis.(5,6)In the pre-antibiotic era, emergence of these are widespread, however the introduction of antibiotics proves to be a boon to clinicians as it is used as a tool even without precise etiological diagnosis. Wrong use of antibiotics led to the emergence of multi-drug resistant bacterial strains which pose further complications [7].

Incidence / Prevalence

CSOM is highly prevalent worldwide around 65 to 330 million, and about 60% show clinical hearing impairment [8]. The prevalence of urban to rural ratio is 1:2 and the low socio- economic communities have the highest prevalence [1]. The risk factors lead to frequent upper respiratory tract infections and recurrent episodes of ear infections.

MATERIALS AND METHODS

A prospective study of sample size 50 carried out in a span of 3 months (27/1/23 to 27/4/23) in the ENT department of MVJMC&RH. Inclusion criteria are patients diagnosed with CSOM belonging to all age groups. Exclusion criteria are for those with (a) Prior administration of antibiotics for any systemic illness (b) Patients with history of recent medication for any ear disease.

Methodology

Based on the inclusion and exclusion criteria a study of 50 patients who presented to the ENT department with persistent ear discharge and a tympanic membrane perforation were selected. These patients were subjected to general ENT examination and otoscopy and then clinically diagnosed with CSOM. During the span of three months those patients were selected who did not take any antimicrobial therapy (local / systemic) prior to the clinical diagnosis which is the sole criteria here.

Sample Collection and Transport

Sterile aural cotton swabs were taken from the discharging ear and enclosed in an airtight glass tube. Aseptic precautionary measures were followed. An aural speculum was used to collect the same, labelled and was sent to the microbiology lab.

Culture And Sensitivity

- Gram staining done for identification of pus cells and organisms.
- Specimen inoculated onto 5% sheep blood agar, MacConkey agar, thioglycolate broth.
- Blood agar was kept in a candle jar with 5-10% of CO2 at 37°C for 24-48hours.
- MacConkey agar at 37°C for 24-48 hours.
- Thioglycolate broth was kept at 37°C for 48-72 hours.

The growth which was seen was classified based on the physical characters mostly of morphology

and cultural characteristics. The biochemical reactions according to standard techniques were observed under here. The growth was identified and antibiotic sensitivity was done by automated method (VITEK). Standard procedures were employed to identify the same [9,10]. After a meticulous review the results were interpreted. Central laboratory standards institute guidelines were used to interpret the same [11].

Statistical Analysis

The data is analysed and calculated in percentage and recorded in Microsoft XL. Theprevalence of the organisms would be determined and expressed in percentage.

OBSERVATION AND RESULTS

Out of 50 patients of CSOM those who were included in this study are who presented with ear discharge and tympanic membrane perforation aged 7 to 63 years, highest incidence in age groups of 31-40 years (26%) followed by 41-50 years (24%) and the least incidence was in age groups greater than 60 years of age (6%).Out of 50 samples, 29(58%) were males and 21(42%) were females, owing to male predominance. Unilateral infection is more common than bilateral infection.

Out of the 50 samples collected, 45(90%) yielded culture positive results and 5(10%) showed no growth and were sterile, out of the 10 organisms isolated, 1 was a fungi (*Aspergillus niger*) and the rest were bacterial isolates.

Table 1: Age distribution of patients with chronic suppurative otitis media (CSOM)

Age group (in years)	Number of patients	Percentage
<20	7	14
21-30	8	16
31-40	13	26
41-50	12	24
51-60	7	14
>60	3	6

Table 2: Sex distribution of patients with CSOM

Sex	Frequency	Percentage
M	29	58
F	21	42
Total	50	100

Table 3: Distribution according to type of CSOM

Safe/unsafe	Frequency	Percentage
Safe	39	78
Unsafe	11	22
Total	50	100

Out of the 50 clinically diagnosed cases of CSOM, 39(78%) were tubotympanic type which is also called safe type of CSOM and 11(22%) were atticoantral type of CSOM which is unsafe in nature.

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Table 4: Type of growth of organisms isolated in CSOM

Type of growth	No of patients	Percentage
Aerobic	5	10
Anaerobic	12	24
Facultative aerobe	11	22
Facultative anaerobe	17	34
No growth	5	10

Out of the 50 swabs taken, 5(10%) showed no growth and 45(90%) showed growth, out of which 5(10%) were aerobic, 12(24%) were anaerobic, 11(22%) were facultative aerobes and 17(34%) were facultative anaerobes. According to gram staining, gram negative organisms 31(62%) were seen and 19(38%) of gram-positive organisms were seen.

Table 5: Frequency of isolated bacterial species from ear swabs of patients with CSOM

Type of organism	Number of patients (n)	Percentage (%)
Acinetobacter baumannii	1	2
Escherichia coli	4	8
Methicillinresistant staphylococcusaureus (MRSA)	4	8
Staphylococcus aureus	12	24
Pseudomonas aeruginosa	13	26
Aspergillus niger	2	4
Proteus mirabilis	4	8
Staphylococcus epidermis	1	2
Staphylococcushaemolyticus	2	4
Klebsiella pneumoniae	2	4
no growth	5	10
TOTAL	50	100

Monomicrobial type growth was mostly seen. Among the gram negative bacteria, *P.aeruginosa* (26%) was most predominant, second was *Escherichia coli*(8%) and *Proteus mirabilis*(8%). Gram positive bacteria were seen of which *Staphylococcus aureus*(24%) was most predominant and solely isolated in about 12 cases, followed by (MRSA) *Methicillin* resistant *staphylococcus aureus*(8%).

Table 6: Antibiotic resistance pattern of the isolated bacterial species in CSOM.

Bacteria isolated	No.	CIP %(n)	LEV %(n)	SXT %(n)	GEN %(n)	CF %(n)	OXI %(n)	CM %(n)	TIC %(n)	AMC %(n)	CXM %(n)	MNO %(n)	P %(n)
Acinetobacter baumannii	1	100(1)	NIL	100(1)	100(1)	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
Escherichia coli	4	75(3)	75(3)	NIL	NIL	NIL	25(1)	NIL	NIL	NIL	NIL	NIL	25(1)
MRSA	4	100(4)	100(4)	50(2)	NIL	NIL	100(4)	25(1)	25(1)	NIL	NIL	NIL	100(4)
Staphylococcus aureus	12	91.6(11)	91.6(11)	41.6(5)	NIL	NIL	8.3(1)	8.3(1)	NIL	NIL	NIL	NIL	75(9)
Pseudomonas aeruginosa	13	53.8(7)	53.8(7)	NIL	30.7(4)	7.7(1)	NIL	NIL	NIL	NIL	NIL	NIL	NIL
Aspergillus niger	2	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
Proteus mirabilis	4	NIL	100(4)	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	100(4)	NIL
Staphylococcus epidermis	1	100(1)	100(1)	NIL	NIL	100(1)	100(1)	100(1)	100(1)	NIL	NIL	NIL	100(1)
Staphylococcus haemolyticus	2	100(2)	100(2)	NIL	NIL	NIL	100(2)	NIL	NIL	NIL	NIL	NIL	100(2)
Klebsiella pneumoniae	2	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	50(1)	50(1)	NIL	NIL
no growth	5	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL

CIP: Ciprofloxacin, LEV: Levofloxacin, SXT: Trimethoprim/Sulfamethoxazole, GEN: Gentamycin, CF: Cefalotin, OXI: Ofloxacin, CM: Clindamycin, TIC: Ticarcillin, AMC: Amoxicillin-clavulanic acid, CXM: Cefuroxime, MNO: Minocycline, P: Penicillin

P.aeruginosa was the most predominant organism isolated in this study(26%) which was resistant to Ciprofloxacin(53.8%) and Levofloxacin(53.8%) which are quinolone antibiotics followed by Gentamycin(30.7%) which is an aminoglycoside antibiotic. *Staphylococcusaureus*(24%) was the next most predominant organism which was highly resistant to Ciprofloxacin(91.6%) and Levofloxacin(91.6%) which belong to quinolones, followed by resistance to Penicillin(75%) and Trimethoprim/Sulfamethoxazole(41.6%). Among the fungal isolates, *Aspergillus niger*(4%) was resistant to none of the antibiotics.

DISCUSSION

Otitis media is not just limited to a region but is a worldwide disease. It emerges as a menace particularly amongst lower socio-economic sections of the society [12]. Long term side effects are seen which include impairment in language development, effective communication, social and congnitive development. CSOM is one such disease which if cured can be an important cause for preventable hearing loss, particularly seen in the developing world [13]. Early diagnosis and prompt treatment is necessary to prevent emergence of antibiotic resistance bacteria. India is one such country where high -prevalence can be seen and the scope for urgent attention is needed [14].

In this study out of 50 isolates, 5 were sterile and showed no growth and 45 showed mostly monomicrobial type of growth. Males were more affected than the females which has similarities in one such study which was done by Falagas ME et al., [15] patients in the age group 31-40 years had higher prevalence followed by those in the age groups of 41-50 which shows similarity. Majority of gram-negative organisms (62%) were seen compared to gram positive organisms (38%). Depending on the type of CSOM, safe or tubotympanic type (78%) was more predominant owing to lesser complications compared to unsafe or atticoantral type (22%) which presented with wider complications. Facultative anaerobes (34%) were mostly predominant followed by anaerobes (22%). Among the organisms isolated, Pseudomonas aeruginosa (26%) which is a gram-negative organism was predominant followed by Staphylococcus aureus (24%)

Nosocomial infections can be seen where the sole predominance is of *P.aeruginosa* and has been difficult to cure and one disadvantage is of resistance to the most potent of antibiotics. Pseudomonas is known to be an extracellular pathogen, which needs warm damp external environment to survive and grow, like the auditory meatus. It is one such organism where eradication once emergence is almost nil. Bony necrosis and mucosal diseases are the primary manifestations here [16]. The tympanic membrane paves way for the infection to spread to the middle ear hence the disease is of progressive type [17,19].

Fungal species isolated here *is Aspergillus*. (4*%) Candida* species and *Aspergillus* species are the most common and the most found fungal isolates in CSOM.

Antibiotic resistance was done as follows, *Pseudomonas aeruginosa* was highly resistant to Ciprofloxacin (53.8%) and Levofloxacin (53.8%) followed by Gentamycin (30.7%). *Staphylococcus aureus* (24%) was the next most predominant organism which was highly resistant to Ciprofloxacin (91.6%) and Levofloxacin (91.6%) followed by resistance to Penicillin (75%) and Trimethoprim/sulfamethoxazole (41.6%). Among the fungal isolates, *Aspergillus niger* (4%) was resistant to none of the antibiotics.

In current scenario, geographical and environmental variations in study populations are subjected to constant change hence the pattern of cases and antimicrobial susceptibility change over time which becomes difficult to treat [20]. Change in microbial flora leads to hampered susceptibility to antibiotics which cause emergence of antibiotic resistant bacteria. The indiscriminate and haphazard use of antibiotics adds to the negligence which causes a delay in treatment. The due course of antibiotics must be completed to ensure adequate treatment completion to prevent emergence of antibiotic resistant bacteria. When the symptoms subside, due to negligence seen in most patients, they stop taking the course of thetherapy, and allow the partly resistant microbes to flourish which worsen the condition and affect treatment directly worsening the disease.

Therefore, once a patient is diagnosed with the disease, periodic evaluation is a must to ensure prompt treatment which is directly helpful in preventing emergence of resistant bacterial growth and helps with overall improvement of the patient's condition.

CONCLUSION

In the bacteriological patterns of safe and unsafe CSOM, gram negative organisms were predominant than gram positive organisms. Safe type of CSOM which is also called as Tubotympanic type is seen more in this study compared to unsafe/atticoantral type. Atticoantral type is usually associated with cholesteatoma formation. *Pseudomonas aeruginosa* is seen followed by *Staphylococcus aureus, Escherichia coli, MRSA, and Proteus mirabilis*. Antibiotic sensitivity was done and the antibiotics to which the organisms were resistant were found. Based on this, proper antibiotics were selected and administered to avoid emergence of resistant bacteria and ensure prompt treatment and prevent further progression of the disease.

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