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Study of Aerobic Bacterial Profile in Chronic Suppurative Otitis Media and their Antibiotic Susceptibility Pattern

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A B S T R A C T

Chronic suppurative otitis media (CSOM) is defined as chronic inflammation of the middle ear and mastoid cavity, which presents with recurrent ear discharges or otorrhoea through a tympanic perforation. The prevalence rate of CSOM in India is 7.8%. Inadequate antibiotic treatment, frequent upper respiratory tract infections with poor access to medical care are related to the development of CSOM.1 The bacteriological profile of CSOM keeps changing from place to place over the period of time, so this study was taken up to evaluate the scenario in our hospital. 120 clinically diagnosed cases of CSOM were studied for a period of 18 months in Dept of Microbiology, HIMS. History collected and swabs were collected aseptically. Identification of aerobic bacteria done as per standard operative procedures. Antibiotic susceptibility testing was done by Kirby-Bauer disc diffusion method. 98 cases yielded positive culture and 22 negative cultures. Bacterial isolates showed predominance of *Staphylococcus aureus* (34.23%) followed by *Pseudomonas* spp. (19.81%), *Klebsiella* spp. (14.41%) *Proteus* spp.(7.20%) Gram positive organisms were more sensitive to Linezolid, Vancomycin and Gram negative organism more sensitive to Colistin, Imipenem, and Amikacin.

Introduction

Ear is considered as an important sensory organ of human beings. Ear infections are a commonly encountered entity in routine clinical practice. Those infections arise from the external auditory canal as in otitis externa or in middle ear causing a Chronic Suppurative Otitis Media (CSOM). Chronic suppurative otitis media is one of the most common chronic diseases of childhood and one of the major causes of deafness in India.[1]

Hippocrates stated that acute pain of the ear, with the continued fever, is to be dreaded, for there is danger that the man may become delirious and die.[2] Suppurative otitis media along with its unpleasant symptoms and

complications may be a catastrophe for the marvellous organ, the ear, on which much of our appreciation of life and human activity depends. It is a privilege for an otorhinolaryngologist to preserve, repair and take utmost care of the structure and function of this organ, in whatever condition it is presented. It is a challenge to prevent the progress of acute suppurative otitis media to a chronic disease especially in children.[3] Aerobes bacteria, anaerobic bacteria, and fungi are all known potential pathogens in CSOM. Understanding of the microbiology of chronic otitis media is important for efficient and effective treatment, and prevention of complications and antibiotic resistance.[4]

Indiscriminate and inappropriate use of antibiotics has led to the disease Chronicity and to the development of bacterial resistance which in turn can lead to the development of complications of CSOM, increasing the morbidity of the patient. Therefore it is very important to treat the persistent ear discharge appropriately according to the antibiotic sensitivity pattern of the causative organisms.[5]

Chronic Suppurative Otitis Media (CSOM) has received considerable attention, because of its high incidence and because of issues such as antibiotic resistance and ototoxicity with both topical and systemic antibiotics. Changes in the bacteriological flora following the advent of antibiotics and antihistamines increases the relevance of study of modern day flora in CSOM.[6] The aim of the study was to re-evaluate the current bacteriological profile of CSOM and the sensitivity pattern to most of the currently available antibiotics in our environment.

Materials and Methods

The present study was conducted in Sri Chamarajendra Hospital, Department of Microbiology, Hassan institute of medical sciences, Hassan from January 2018 to June 2019. One hundred and twenty patients with CSOM of all age groups and both sexes attending outpatient department and those admitted in ENT wards were selected randomly for the study based on below mentioned inclusion and exclusion criteria's.

Inclusion criteria

Patients with active purulent discharge in the ear for more than 2 weeks [7]

Patients of all age groups of both sexes attending ENT OPD and admitted in ENT wards

Exclusion criteria

Patients on antibiotic or antifungal treatment (ear drops or systemic) within the previous two weeks

Patients with draining ears of less than two weeks duration

Traumatic tympanic membrane perforation

Non co-operative patients

Study Subjects

Informed consent was taken from all the study participants. Institutional Ethical committee clearance was taken before start of the study.

Sample collection

Collection of ear swab

Ear discharge was collected under strict aseptic precautions using sterile cotton swabs with the assist of aural speculum and processed immediately in the microbiology laboratory. Two swabs were collected, one for gram staining and one for aerobic culture. [8]

Direct smear examination

With one swab a thin smear was made on a clean glass slide and heat fixed and allowed to dry. Gram staining was done for the smears so made and was examined under oil immersion objective to note the various morphological types of bacteria, presence or absence of inflammatory cells and also to note the numbers of squamous epithelial cells in the sample.[8]

Aerobic culture

The second swab was used for inoculation on blood agar, nutrient agar and MacConkey agar plates. Chocolate agar plate with hemin (X factor) and nicotinamide-adenine-dinucleotide (NAD / V factor) inoculated for H.influenzae. All plates were incubated aerobically at 37°C in presence of carbon-dioxide (candle jar) and evaluated at 24 hours, 48 hours and 72 hours and discarded if there was no growth after 72 hours.

After 24hrs, 48hrs and 72 hrs of incubation the culture plates were inspected for growth and identified initially by colony characters, haemolysis on blood agar, lactose fermentation on MacConkey agar, morphology in gram staining, Catalase test, Oxidase test and motility (hanging drop) test.

The preliminary identification of potential pathogens, later confirmed up to species level by standard biochemical tests.[8]

Antibiotic sensitivity test is done by using Kirby-Bauer disc diffusion method on Mueller Hinton agar plate as per CLSI (2019).

Inoculum preparation; 3-4 similar colonies were touched with loop for gram negative bacteria's and 6-8 similar colonies for gram positive bacteria's and inoculated into nutrient broth and incubated for 4-6 hours. Inoculum preparation for fastidious is done using suspension of bacterial growth in saline.

The turbidity of the broth with inoculums is adjusted to 0.5 McFarland standards. Lawn culture was done on Mueller Hinton agar plate using sterile swabs. Sensitivity for *H.influenzae* was done on 5% blood agar with factor V (NAD) and for *S.pneumoniae* on 5% sheep blood agar. After drying the plate at 37^0c for 30 minutes, antibiotic discs (6 per 90mm plate) are applied with sterile forceps. After 16-18 hours of incubation(24hours for *H.influenzae*) in presence of 5% CO2, the degree of sensitivity determined by measuring the zones of inhibition of growth around the discs. Growth is inhibited around discs containing antimicrobials to which the bacterium is susceptible but not around those to which it is resistant.[9]

S. aureus ATCC 25923, E. coli ATCC 25922 and *P. aeruginosa* 25873 were used for internal quality control of antibiotic susceptibility testing.

Detection of MRSA

Cefoxitin disc diffusion method

All strains were tested with 30 µg Cefoxitin discs (Hi-Media) on Mueller–Hinton agar plates. For each strain, a bacterial suspension adjusted to 0.5 McFarland was used as Inoculum. The zone of inhibition was determined after 16–18 h incubation at 35 ^{0}C. Zone size was interpreted according to CLSI (2018) criteria: Strains of *S. aureus* having zone of inhibition of ≤21 mm was considered MRSA.[9]

Detection of HLAR

All strains were tested with High content Gentamicin (120µg) discs (Hi-Media) on Mueller–Hinton agar plates. For each strain, a

bacterial suspension adjusted to 0.5 McFarland was used. The zone of inhibition was determined after 16–18 h incubation at 37 ^{0}C. Zone size was interpreted according to CLSI (2018) criteria: Strains of Enterococcus having zone of inhibition of≤10 mm was considered HLAR.[9]

Detection of ESBL

ESBL detection by double disc synergy test

Screening test done using Ceftazidime 30µg. If found resistant with zone size <22mm, confirmatory test was done by placing Ceftazidime disc and Ceftazidime/ Clavulanic acid 30µg/10µg at a distance of 15mm.A 5mm enhanced zone with CAC disc compared to CAZ was confirmatory of ESBL producer.[9]

Detection AmpC beta-lactamase

Isolates with zone diameters less than 18 mm with 30-µg Cefoxitin disk were selected for confirmation of AmpC production.

Confirmation done by AmpC disk test: MHA plate was inoculated with ATCC E.coli strain, later AmpC disk was rehydrated with 20 µl of saline, and test organism applied to it. A 30 µg Cefoxitin disk is placed on MHA plate.

Next AmpC disk is placed almost touching the Cefoxitin disk and incubated overnight at 35°C. Plate with an indentation or a flattening of the zone of inhibition is considered AmpC positive.

Detection of Metallo-beta-lactamase

If the zone of Imipenem was reduced to 16-20 mm or less or heaping occurred, we tested the isolate for MBL production. Double Disc synergy test using EDTA were used for detection of MBL. An enhanced zone with EDTA disc was considered MBL.[9]

Results and Discussion

Staphylococcus aureus was the predominant organism in ear discharge followed by *Pseudomonas aeruginosa, Klebsiella pneumoniae, Proteus* spp, and *Moraxella catarrhalis.*

All the *Streptococcus* spp. isolates were 100 % sensitive to all the drugs tested as per the guidelines. *S. aureus* were sensitive Linezolid, Vancomycin and Clindamycin.

Resistance was highest with Ampicillin followed by Cefoxitin and Cotrimoxazole. Gram negative isolates were highly sensitive to Colistin followed by Imipenem, amikacin, and Levofloxacin.

In the present study an attempt is made to know the aerobic bacteriological profile of CSOM, with antimicrobial susceptibility testing of the bacterial isolates.

Age wise distribution

In the present study maximum number of patients were in the age group of 0-10 years, i.e. 44 (36.6%) followed by 22.5% in second decade and 12.5% in third decade.

These findings are in correlation with studies done by Majumder *et al.,* (2019)[10] and Serry *et al.,* (2016). [11]However Deb T *et al.,*. (2011)[3], Chirwa M *et al.,* (2011)[4] have reported maximum number of patients in second decade. Vineetha Gupta *et al.,* (1998) [12], Maradesha P *et al.,* (2016) [13] and Loy A.H.C *et al.,* (2002)[14] have reported maximum number of patients in third decade.

Higher incidence of otitis media during first decade in our study may be due to

Abundance of lymphoid tissue in children which may obstruct the Eustachian tube

Increased risk of upper respiratory infection

Immunocompetence not attained completely in children

Short and straight eustachian tube in infants and young children which allows ready access of bacteria to middle ear[15].

Sex wise distribution

Males were slightly more affected 63(52.5%), than the females 57 (47.5%) in the present study. Khanna *et al.,* (2015) and Nagraj *et al.,* (2018) [17] also got similar findings. But Nahata V *et al.,*[18] and Surya *et al.,* (2016) [19] differed in their study, where they found a female preponderance, which could be due to difference in literacy levels in different geographical locations where women visit hospitals less frequently. The male predominance may be because of their more exposed way of life style.

Culture results of cases studied

In the present study 98(81.667%) specimens were positive and 22(18.333%) were negative for the culture. Similar observations was seen in studies done by Chauhan J *et al.,* (2019)[20] and Khatoon *et al.,* (2015)[21]. But the culture results are variable with other workers. Prakash M *et al.,* (2013) got 93.75% positive cultures and 6.25% negative cultures. This could be due to the difference in the patient population studied and geographical variations.

Negative cultures can be attributed to CSOM because of fungal and anaerobic bacterial etiology.

Incidence of pure and mixed cultures

In the present study monomicrobial etiology was found in 79.591% and polymicrobial etiology in 20.409% of cases. My study is correlated with Majumder *et al.,* (2019)[10] and Gopi *et al.,* (2016)[01]. But Yousuf A *et al.,* (2012)[22] and Chirwa M *et al.,* (2015)[4] found equal incidence of mixed and pure culture.

Availability and use of topical and systemic broad spectrum antibiotics in the period before consultation was probably responsible for the lower incidence of mixed infection in our study.

Aerobic bacteriological profile in CSOM cases.

In present study among 120 cases of CSOM, *Staphylococcus aureus* was the predominant organism 32 (34.23%) followed by *Pseudomonas aeruginosa* 22 (19.81%), *Klebsiella pneumoniae* 16 (14.41%), *Proteus* spp. 08(7.20%), Moraxella catarrhalis 08(7.20%), *Hemophilus influenzae* 06 (05.40%), *Enterococcus faecalis* 8 (5.48%), E. coli 06 (5.40%), *Streptococcus pneumoniae* 05(4.50%), *Acinetobacter baumanii* 4 (3.60%).

The frequency of *Staphylococcus aureus* in the middle ear infections can be attributed to their ubiquitous nature and high carriage of resistant strains in the external auditory canal and upper respiratory tract.

However workers like Sudhindra *et al.,* (2014)[6], Chauhan *et al.,* (2019)[98], Nagraj M.*et al.,* (2018) [17], Serry *et al.,* (2017)[11], Khatoon *et al.,* (2015)[21]have found Staphylococcus aureus as the second most common organism causing CSOM. The next predominant organism in the present study was *Pseudomonas aeruginosa* 22 (19.81%). My study is correlated with Chauhan *et al.,* (2019)[98] and Nagraj M.*et al.,* (2018)[55]. However some workers like Sudhindra *et al.,* (2014)[6] and Yousuf A *et al.,*. (2012)[22] have found Pseudomonas spp. as the predominant organism causing CSOM.

The other organisms isolated in the present study are *Moraxella catarrhalis* 08(7.20%) *Hemophilus influenza* 06(05.40%), *Enterococcus faecalis* 8(5.48%), *Acinetobacter baumanii* 4(3.60%) and *Streptococcus pneumoniae* 05(4.50%), These findings are correlated with Nia *et al.,* (2011) and Khatoon *et al.,* (2015).

The organisms like Pseudomonas, *Proteus* spp, E. coli, *Acinetobacter* spp and *Klebsiella* spp, are considered mostly as secondary invaders from external auditory canal which gains access to the middle ear via a defect in tympanic membrane resulting from an acute episode of otitis media. Presence of organisms like Pseudomonas and Acinetobacter and presence of Multidrug resistant Gram negative bacilli in CSOM cases indicates that, those patients would be frequent visitors of hospital.

Susceptibility of Gram-positive bacterial isolates to selected antimicrobial agents

Antibiotic sensitivity was carried out for all the isolates by Kirby-Bauer disc diffusion method. In the present study *S.aureus* showed maximum susceptibility to Vancomycin (100%), Linezolid (84.3%), Ceftriaxone (84.3%) and least susceptibility to Amoxicillin (12.5%) and Erythromycin (21.8%). Ciprofloxacin was 54.2% susceptible and Doxycycline was 56.2% susceptible. Cefoxitin showed 78.9% susceptibility, hence MRSA isolates were 21.9%.Similar observations was seen in studies done by Khatoon *et al.,* (2015)[36] and Serry *et al.,* (2017)[80]. But higher rates of MRSA was found in Majumder *et al.,* (2019)[95]. It is also observed that the most commonly used drug ciprofloxacin is exhibiting increasing resistance. In a study done by Dhirendra *et al.,* (2016) [23], Clindamycin showed 85% susceptibility to *S. aureus*, but in our study more resistance was observed.

Streptococcus pneumoniae showed maximum susceptibility to Penicillin (100%), Vancomycin (100%) and least susceptibility to Cotrimoxazole. Kazeem *et al.,* (2017)[10] reported 50% resistance to tetracycline's. Enterococci showed 100% sensitivity to Vancomycin, Linezolid,

High level Gentamycin and Levofloxacin. Amoxicillin was the least susceptible antibiotic. Similar results were observed in studies done by Kazeem *et al.,* (2017)[10] and Devi *et al.,* (2015).[16]

Susceptibility of Gram-negative bacterial isolates to selected antimicrobial agents

Among Gram negative organisms, highest susceptibility was shown by Colistin (100%) and Imipenem (91.9%)followed by Amikacin (68.7%), Ciprofloxacin (58.2%) and least susceptibility to Amoxicillin (12.5%) and Amoxiclav(18.2%).This was correlated with Gopi *et al.,*[1], Prakash *et al.,* (2013) and Khatoon *et al.,* (2015)[36]. In *pseudomonas aeruginosa* showed maximum sensitivity to Colistin (100%), Imipenem (91.6%), Tobramycin (83.3%) and least was shown to Gentamycin (45.8%) and Amoxicillin (4.1%). In a study done by Sharma *et al.,* Pseudomonas showed maximum sensitivity to Amikacin (82.3%) and Ciprofloxacin (76.5%).

Table.1 Age distribution

AGE IN YEARS	FREQUENCY	PERCENTAGE (%)	p value
0-10	44	36.6%	<0.001
10-20	27	22.5%	
20-30	15	12.5%	
30-40	05	4.16%	
40-60	15	12.5%	
>60	14	11.66%	

Table.2 sex distribution

SEX	FREQUENCY	PERCENTAGE (%)	p
Male	63	52.5%	0.855
Female	57	47.5%	
Total	120	100%	

Table.3 Results of culture positivity of CSOM cases studied

Details of isolation	Total number of swabs studied	
	Ear swabs	(%)
Positive cultures	98	81.66%
Negative cultures	22	18.34%
Total	120	100%

Table.4 Incidence of pure and mixed cultures

Organisms	Total number of strains and Percentage excluding known commensals	
	Ear	(%)
Monomicrobial	78	79.59 %
Polymicrobial	20	20.40%
Total	98	100%

Note: Monomicrobial etiology was found to be 78 (79.51%) in ear. Polymicrobial was 20 (20.49%)

Table.5 Distribution of isolates

Organisms	Frequency in Ear	%
Staphylococcous aureus	32	28.82
Pseudomonas aeruginosa	22	19.81
Klebsiella pnemoniae	16	14.41
Proteus vulgaris	05	4.5
Proteus mirabilis	03	2.7
Moraxella catarrhalis	08	7.20
Haemophilus influenzae	06	5.4
Escherichia coli	06	5.4
Streptococcus pneumoniae	05	4.5
Acinetobacter baumanii	04	3.6
Enterococci faecalis	02	1.8
Citrobacter freundii	02	1.8

Table.6 Antibiotic sensitivity pattern of gram positive organisms isolated in ear discharge

Antibiotics	*S.aureus* (32)	%	*Enterococci* (02)	%	*S. pneumoniae* (05)	%
P	01	3.1	01	50	05	100
CX	25	78.12	02	100	05	100
E	07	21.87	01	50	04	80
CD	20	62.5	02	100	04	80
COT	20	62.5	02	100	02	40
GEN	28	87.5	01	50	04	80
CIP	16	50	01	50	03	66.6
VA	32	100	02	100	05	100
DOX	18	56.2	02	100	05	100
LZ	27	84.3	02	100	05	100
LE	28	87.5	02	100	04	80
PTZ	17	53.12	01	50	05	100
AMX	04	12.5	00	00	05	100
AMC	06	18.75	00	00	05	100
CTR	27	84.3	01	50	05	100
AK	28	87.5	02	100	05	100

Table.7 Antibiotic sensitivity pattern of gram negative organisms isolated in ear discharge

Antibiotic	*Klebsiella* (16)		*Proteus* (08)		*Acinetobacter* (04)		*Citrobacter* (02)		*H.influenzae* (06)		*E.coli* (06)		*Moraxella* (08)	
AMX	01	6.2	04	50	00	00	00	00	05	83.3	02	33.3	03	37.5
AMC	04	25	06	75	00	00	00	00	05	83.3	02	33.3	04	50
AK	11	68.7	03	37.5	02	50	01	50	04	66.6	05	83.3	06	75
GEN	09	56.2	03	37.5	03	75	01	50	02	33.3	03	50	05	62.5
CIP	07	43.75	05	62.5	00	00	01	50	05	83.3	04	66.6	04	50
CTR	04	25	07	87.5	00	00	00	00	04	66.6	04	66.6	03	37.5
CAZ	04	25	05	62.5	01	25	01	50	04	66.6	01	16.6	04	50
CAC	11	68.7	08	100	01	25	01	50	05	83.3	05	83.3	06	75
CX	09	56.2	07	87.5	02	50	02	100	05	83.3	05	83.3	06	75
PTZ	07	43.7	05	62.5	02	50	01	50	05	83.3	04	66.6	05	62.5
COT	08	50	03	37.5	02	50	01	50	06	100	04	66.6	05	62.5
CL	16	100	NT	00	04	100	02	100	NT	00	06	100	08	100
IPM	14	87.5	07	87.5	03	75	02	100	06	100	05	83.3	08	100
LE	13	81.25	07	87.5	03	75	01	50	05	83.3	05	83.3	07	87.5

Table.8 Antibiotic sensitivity pattern of pseudomonas isolated in ear discharge

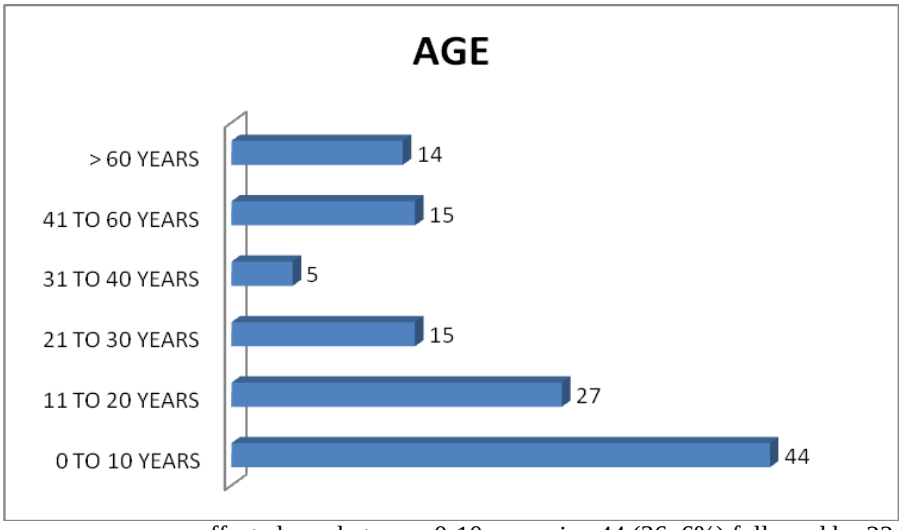
Antibiotics	*Pseudomonas* (24)	%
AMX	01	4.16
AMC	02	8.33
AK	17	17.83
GEN	11	45.83
CIP	18	75
CTR	13	54.16
CAZ	13	54.16
CAC	20	83.83
CX	22	91.66
PTZ	20	83.83
COT	15	62.5
CL	24	100
IPM	22	91.66
LE	20	83.83
TOB	20	83.83
AT	19	79.16

Table.9 Frequencies of resistance markers with percentage

Resistance markers	*S.aureus*	*Klebsiella*	*E.coli*	*Pseudomonas*
MRSA	07/32 (21.8%)	--	--	--
HLAR	01/02(50%)	--	--	--
ESBL	--	07(29.1%)	04(20.8%)	04(20.8%)
AmpC	--	02(18.2%)	01(15.4%)	02(18.2%)
Carbapenamase	--	02(33.3%)	01(16.6%)	02(33.3%)

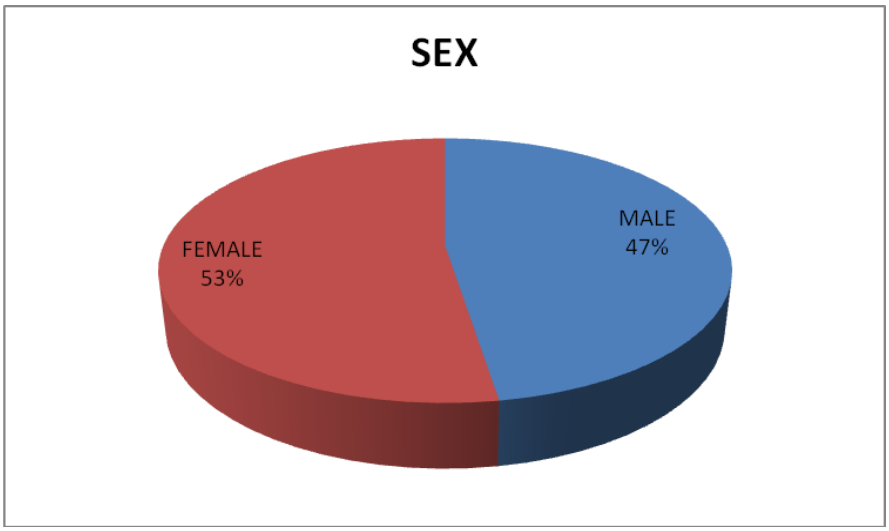
Overall ESBL rate was 24/74 (36.5%), AmpC rate was 15/74(20.2%), and Carbapenamase was 06/74(08.1%).

Fig.1 Schematic distribution of age



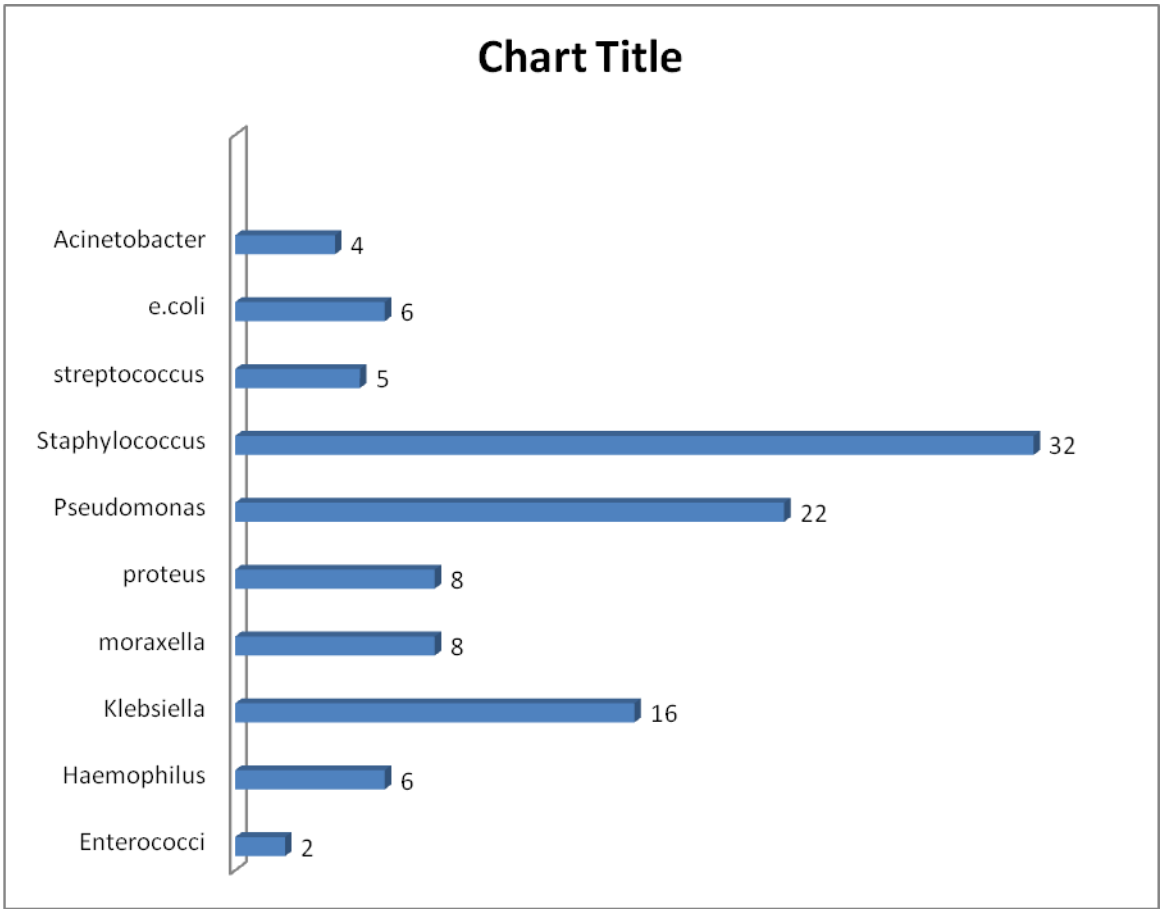
Note: Most common age group affected was between 0-10 years, i.e. 44 (36 .6%) followed by 22.5% in second decade which is statistically significant

Fig.2 Schematic distribution of sex



Note: Males were slightly more affected 63(52.5%), than the females 57 (47.5%) but the difference is not statistically significant.

Fig.3 Schematic distribution of isolates



Klebsiella showed maximum sensitivity to Colistin (100%) and Imipenem (92.4%) and least to Amoxicillin (12.5%). E.coli was highly susceptible to Colistin (100%) and Imipenem (83.4%) and least susceptible to Ceftazidime (20%). In Pseudomonas Colistin (100%), Imipenem (91.6%) and Tobramycin (83.3%) showed maximum sensitivity and least was shown by Gentamycin (45.8%) and Amoxicillin (4.1%). Study by Nia *et al.*,[24] showed high sensitivity to Ciprofloxacin (95%) and relative sensitivity to Gentamicin (85%). *H.influenzae* showed maximum sensitivity to Imipenem and Levofloxacin.

The results of culture and sensitivity pattern vary from place to place and time to time. This may be because of various reasons like changes in prevalence of particular organisms, environmental variations, changes in the antibiotic prescription pattern etc. Therefore culture and susceptibility testing for CSOM in a population/ geographical area is of paramount importance for appropriate antimicrobial therapy of CSOM.

In this study, most of the isolates were found to be resistant to regularly used cell wall inhibitors like penicillin group of drugs and cephalosporins. MRSA was detected in (29.1%) *S.aureus*. ESBL and AmpC were detected in 36.5% and 20.2% Gram negative bacteria respectively. MBL was detected in 8.1%.

However In study done by Khatoon *et al.*,[36], MRSA and HLAR were detected in 9(29%) S. aureus and 1(50%) *Enterococcus faecalis*.

ESBL and AmpC were detected in 11(18.3%) and 12(20%) Gram negative bacteria respectively. MBL producer was not detected in Gram negative bacteria.

Prevalence of ESBL, AmpC β-lactamase and MRSA were found to be 48.9 %, 20.4 %, and 27.5 % respectively in a study done by Sasirekha (2013).

Higher rates of resistance markers were seen in study done by Chellaiah *et al.,* (2014). They got 56.6 % MRSA. 67.3% of Enterobacteriaceae were ESBL producers, 6.1% were AmpC producers and 27.2% of *Pseudomonas aeruginosa* were MBL producers.

Ibrahim *et al.,* in 2019 found the frequency of ESBL and AmpC β-lactamase producers to be 27% and 101 32.5%, respectively.

This indicates that, the incidence of various resistance markers is increasing which reflects the increasing level of resistance in the community. Increased prevalence of the resistance markers like MRSA, ESBL etc may be because of ineffective implementation of Infection control and antibiotic policies. This could be also because of improved reporting of the resistance markers with routine testing.

In today's age, where there is increasing concern regarding antimicrobial resistance and the increasing rate of MRSA, HLAR, ESBL and AmpC is disheartening.

The early knowledge of bacterial isolates in CSOM cases aids in giving a probable chance of upcoming complications and better prognosis. Hence timely management of CSOM cases with proper culture and sensitivity report helps in getting better outcome in CSOM patients. The aerobic bacteriological study of CSOM showed *Staphylococcus aureus* as the most common causative agent followed by *Pseudomonas aeruginosa, Klebsiella pneumoniae* and *Proteus mirabilis*. The overall isolation rate of MDR gram positive and gram negative organisms were found to be high. This may be due to frequent visit of patients to hospital. Hence the rate can be reduced significantly if we could also focus on hospital infection control.

The antibiotic susceptibility testing to gram positive and gram negative isolates showed maximum sensitivity to expensive and higher class of drugs like to Vancomycin, Linezolid, Colistin and Imipenem. The high degree of resistance rate is observed to the most commonly used antibiotics like Ciprofloxacin, Gentamycin etc in present study. This may be due to the irrational use and over the counter availability of antibiotics. To prevent development of drug resistance, prescription of antibiotics should always be guided by culture and sensitivity reports and escalation or de-escalation of dosage following empirical therapy done accordingly based sensitivity report.

The early knowledge of bacterial isolates in CSOM cases aids in giving a probable chance of upcoming complications and better prognosis. Hence timely management of CSOM cases with proper culture and sensitivity report helps in getting better outcome in CSOM patients.

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