IJMA

International Journal of Medical Arts

Volume 6, Issue 4, April 2024

P- ISSN: 2636-4174
E- ISSN: 2682-3780

Available online at Journal Website
https://ijma.journals.ekb.eg/
Main Subject [Otorhinolaryngology]

Original Article

Current Microbiological Profile and Antibiotic Sensitivity Pattern in Chronic Suppurative Otitis Media in the Post- Antibiotic Era

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ABSTRACT

Article information

Received: 14-11-2023

Accepted: 18-12-2023

DOI: 10.21608/IJMA.2023.248591.1866.

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Citation: Agwa MAM, Mohamed SS, Abd El Galil AS, Abou Shuqqa HM. Current Microbiological Profile and Antibiotic Sensitivity Pattern in Chronic Suppurative Otitis Media in the Post- Antibiotic Era. IJMA 2024 April; 6 [4]: 4287-4292. doi: 10.21608/IJMA.2023.248591.1866.

Background: Whatever the cause or pathophysiology, middle ear inflammation is known as chronic suppurative otitis media [CSOM]. Because CSOM is resistant to local medicines, culture tests are regarded as the gold standard for identifying the causative agents.

The aim of the work: This study aims to detect microbiological profile [Bacteria and fungi] and antibiotic sensitivity pattern [For bacterial isolates] in CSOM.

Patients and Methods: This was a prospective study conducted on 100 patients with chronic suppurative otitis media who attended in the outpatient department at Al-Azhar university Hospitals from May 2022 to Feb 2023. Microbiological cultures and antibiotic susceptibility testing were performed on ear discharge samples collected from the study participants.

Results: The most predominant organism causing CSOM among aerobic bacteria was S. aureus, followed by Pseudomonas Aeruginosa, E. coli and Klebsiella Pneumoniae respectively. The fungal isolate was Candida species. Ciprofloxacin and Colistin were the best medications for treating Pseudomonas aeruginosa. Ciprofloxacin and Vancomycin were effective antibiotics for S. aureus. Amikacin and colistin were the most effective antibiotics for Klebsiella Pneumoniae. Colistin and Imipenem were the most effective antibiotics for E. coli.

Conclusion: Understanding the microorganisms and drug sensitivity pattern that cause CSOM and selecting appropriate antibiotics based on susceptibility testing can direct the course of therapy and minimize intracranial and extracranial problems associated with the illness.

Keywords: Microbiological Profile; Suppurative Otitis Media; Antibiotic Sensitivity.

INTRODUCTION

Whatever the cause or pathophysiology, middle ear inflammation is known as chronic suppurative otitis media [CSOM]. Multiple etiologies may cause CSOM, a condition that is well recognized for persisting and reoccurring despite therapy. Multiple factors contribute to the development and causation of CSOM. Acute otitis media generally precedes chronic sinusitis. In developing nations, CSOM is a frequent cause of hearing loss [1].

The infection of the middle ear may be preceded with viral diseases of the upper respiratory tract. The main microorganism causing middle ear infection is the bacteria. The pathophysiology of CSOM involves both Gram-negative [Pseudomonas aeruginosa, Escherichia coli, Proteus species, Klebsiella species] and Gram-positive [Staphylococcus aureus, Coagulase negative Staphylococcus species [CoNS], Streptococcus pneumoniae] bacteria [2].

Because of variations in location, local antibiotic prescription patterns, and the prevalence of resistant bacterial strains, the type, frequency, and antimicrobial resistance pattern of bacterial causes of ear infection differ across communities. Drug resistance arises when patients with suspected otitis media are given antibiotics without first undergoing a culture and antibiotic susceptibility test. Therefore, in order to ensure the prudent use of currently available antimicrobials, current information on microbial resistance must be accessible at both the national and local levels [3].

If local antibiotics are ineffective in treating CSOM patients, a superimposed fungal infection should be considered. The most reliable method for identifying the causative agents is culture research. Fungal isolates, particularly Aspergillus spp. and Candida spp., are the most often isolated species [4].

The aim of the investigation was to identify the pattern of antibiotic susceptibility [for bacterial isolates] and the microbiological profile [fungi and bacteria] of chronic suppurative otitis media.

PATIENTS AND METHODS

This was a prospective investigation conducted on 100 patients with chronic suppurative otitis media who attended in the outpatient department at Al-Azhar university Hospitals from May 2022 to Feb 2023.

Inclusion Criteria: Patients belonging to both sexes with ages ranging from 10 to 60 years and patients who had signs of CSOM: [unilateral or bilateral otorrhea for more than 6 weeks].

Exclusion Criteria: Patients administering corticosteroid or immunosuppressive drugs, cases with cholesteatoma, immunocompromised and diabetes.

Methods

Every patient in this investigation underwent a thorough history-taking process included the following: personal history, complaints, previous medical and surgical histories, and family histories.

Under stringent aseptic measures, two sterile cotton swabs were used to collect samples from individuals with ear exudates. The samples were transported promptly to the microbiology laboratory. Using Gram's stain and KOH mount, the first swab was utilized for a direct smear inspection. The second swab was inoculated onto Sabouraud's Dextrose Agar for the isolation of fungal pathogens and onto Mac Conkey, Blood, and Chocolate agars for the isolation of aerobic bacteria. For 24 to 48 hours, the injected aerobic bacterial cultures were incubated at 37 °C. Using normal procedures, the morphology, cultural traits, and biochemical responses of the cultivated bacterial isolates were used to identify them. Following Clinical Laboratory and Standard Institute recommendations, antimicrobial sensitivity testing for bacterial isolates was performed on Muller Hinton Agar using the Kirby Bauer disc diffusion technique [5]. The specimens were incubated at room temperature after being inoculated into Sabouraud Dextrose Agar [SDA] plates. Based on morphological, cultural, and microscopic analysis utilizing the lactophenol cotton blue staining method, fungal growth was observed. Every data was examined, recorded, and contrasted.

Sample Size: This investigation was based on a **Sah *et al.*** [6]'s research. The following presumptions were taken into account while calculating the sample size using Epi Info STATCALC: A two-sided confidence level of - 95%, an 80% power, and a 5% error in the odds ratio were arrived at 1.115. Ninety-five was the ultimate maximum sample size obtained from the Epi-Info output. The sample size was therefore raised to 100 cases in order to account for any instances that may be dropped during follow-up.

Ethical considerations: The protocol was submitted to the Research Ethics Committee for approval. Prior to their inclusion in the trial, the patients gave their informed permission. Every participant was had the choice to resign from the research without compromising their management, and all data were kept private.

RESULTS

The included patients had an average age of 40.19 years with a standard deviation of 15.11. The median age of 42 years, along with the range of 10 to 60 years, suggested that the majority of patients fall within the middle range of ages. Regarding sex, 58% were male [58 patients] and 42% were female [42 patients]. This indicated a slightly higher representation of males in the study. The sample was evenly divided, with 40% of the patients were residing in urban areas and the remaining 60% in rural areas. Unilateral sample was taken from 48 patients and bilateral from 52 patients [Table 1].

In case of the nutrient agar, blood agar and chocolate agar out of the total samples tested with all agar plates, 94% exhibited positive growth of the targeted organism, from all samples 6% exhibited no growth. However, In the case of Sabouraud agar culture, 16% exhibited positive growth, while 84% showed negative results and in case of Macc. agar culture, 52% exhibited positive growth, while 48% showed negative results [Table 2].

Out of the total 100 samples, 6% showed no growth. Candida, E. coli, S. Aureus, Pseudomonas Aeruginosa and Klebsiella Pneumoniae were detected in [16%], [18%], [26%], [22%] and [12%] cases respectively [Table 3].

The sensitivity of antibiotics was 60% for Amikacin, 34% for Azithromycin, 52% for Colistin, 38% for Ceftriaxone, 22% for Cefotaxime, 54% for Gentamicin, 74% for Imipenem, 24% for Vancomycin, 71% for Ciprofloxacin and 54% for Amoxicillin-clavulanic acid [Table 4]

Colistin and Imipenem showed 100% sensitivity with all 18 E. coli samples being sensitive to them. However, none of the E. coli samples showed sensitivity to Vancomycin. Vancomycin showed [92.31%] sensitivity to S. aureus samples which was the most sensitive one while Azithromycin and Colistin showed no sensitivity. Colistin showed 100% sensitivity with all 22 Pseudomonas Aeruginosa samples being sensitive to it. However, none of the Pseudomonas Aeruginosa samples showed sensitivity to Vancomycin. Imipenem, Amikacin and Colistin showed 100% sensitivity, with all 12 Klebsiella pneumoniae samples being sensitive to them. However, none of the samples showed sensitivity to Vancomycin [Table 5].

Table [1]: Demographic data and laterality of sample of included patients

Parameter		Value [n = 100]
Age [Years]	Median [Range]	42 [10-60]
	Mean ± SD	40.19 ± 15.11
Sex	Male	58 [58%]
	Female	42 [42%]
Residence	Urban	40 [40%]
	Rural	60 [60%]
Laterality	Unilateral	48 [48%]
	Bilateral	52 [52%]

Table [2]: Culture used and organism outcome data

Culture	Positive	Negative
Nutrient agar	94 [94%]	6 [6%]
Blood agar	94 [94%]	6 [6%]
Macc. Agar	52 [52%]	48 [48%]
Sabouraud agar	16 [16%]	84 [84%]
Chocolate agar	94 [94%]	6 [6%]

Table [3]: Organisms detected among included patients

Organism	Value [n = 100]
No Growth	6 [6%]
Candida Species	16 [16%]
E. coli	18 [18%]
S. aureus	26 [26%]
Pseudomonas Aeruginosa	22 [22%]
Klebsiella Pneumoniae	12 [12%]

Table [4]: Antibiotics sensitivity among included bacterial isolates

Sensitivity test	Value [n = 100]
Amikacin	60 [60%]
Azithromycin	34 [34%]
Colistin	52[52%]
Ceftriaxone	38 [38%]
Cefotaxime	22 [22%]
Gentamicin	54 [54%]
Imipenem	74 [74%]
Vancomycin	24 [24%]
Ciprofloxacin	71 [71%]
Amoxicillin-clavulanic acid	54 [54%]

Table [5]: Sensitivity of each organism to every antibiotic

	E. coli [n= 18]	S. aureus [n= 26]	Pseudomonas Aeruginosa [n= 22]	Klebsiella Pneumoniae [n= 12]
Amikacin [n=60]	12 [66.67%]	18 [69.23%]	18 [81.82%]	12 [100%]
Azithromycin [n=34]	14 [77.78%]	0 [0%]	10 [45.45%]	10 [83.33%]
Colistin [n=52]	18 [100%]	0 [0%]	22 [100%]	12 [100%]
Ceftriaxone [n=38]	10 [55.56%]	16 [61.54%]	2 [9.09%]	10 [83.33%]
Cefotaxime [n=22]	8 [44.44%]	6 [23.08%]	6 [27.27%]	2 [16.67%]
Gentamicin [n=54]	11 [61.11%]	16 [61.54%]	16 [72.73%]	11 [91.67%]
Imipenem [n=71]	18 [100%]	23 [90%]	18 [81.82%]	12 [100%]
Vancomycin [n=24]	0 [0%]	24 [92.31%]	0 [0%]	0 [0%]
Ciprofloxacin [n=71]	17 [94.44%]	22 [83.33%]	20 [90.91%]	10 [83.33%]
Amoxicillin-clavulanic acid [n=54]	14 [77.78%]	17 [66.67%]	17 [77.27%]	7 [57.67%]

DISCUSSION

The aim of this study was to identify the pattern of antibiotic susceptibility [for bacterial isolates] and the microbiological profile [fungi and bacteria] of chronic suppurative otitis media.

Demographic characteristics of the studied patients showed that the mean age was 40.19 ± 15.11 years ranged between 10 to 60 years. Regarding sex, 58% were male [58 patients] and [42%] were female [42 patients]. This indicated a slightly higher representation of males in the study. The sample was evenly divided with [40%] of the patients residing in urban areas and the remaining [60%] in rural areas. Unilateral Sample was taken from 48 patients and bilateral from 52 patients. In agreements with our study, **Priscilla *et al.*** [7] studied the microbiological profile, susceptibility pattern, and risk factors for ear discharge in patients with CSOM in order to provide recommendations for empirical therapy. A total of 135 samples, including 55 aspirates and 80 ear swabs, were taken from patients with clinically confirmed CSOM. The patients' ages varied from 10 to 60 years, and the male to female ratio was 1.5:1. Of these, 57.03% of the samples were male and 42.96% were female. Male patients had a greater growth positive rate [97.4%] than female patients [81.03%], and this variation was statistically meaningful [P=0.04]. Of the patients in this research, 53.33% were from rural and 46.66% from urban regions. Patients from rural regions had a greater growth positive rate [98.57%] than patients from urban areas [81.53%], and this variation was statistically relevant [P=0.02]. In contrast, majority of the patients who suffered from CSOM were females in another studies [8, 9].

Ninety-four percent showed positive growth, while 6% of all samples exhibited no growth. However, in the case of the Sabouraud agar culture, 16% exhibited positive growth, while 84% showed negative results. In the case of the MacConkey agar culture, 52% exhibited positive growth, while 48% showed negative results. These findings were in agreement with those of **Harshika *et al.*** [10].

Out of the total 100 samples, 6 samples [6%] showed no growth. Candida, E. coli, S. aureus, Pseudomonas aeruginosa, and Klebsiella pneumoniae were detected in 16% [16], 18% [18], 26% [26], 22% [22], and 12% [12] of cases, respectively. In agreement**, Sah *et al.*** [6] noted that, it was found that Staphylococcus aureus [42.24%] was the most common bacterium isolated in the research, followed by Pseudomonas aeruginosa [28.44%], Klebsiella pneumoniae

[10.34%], Acinetobacter anitratus [6.9%], and Proteus mirabilis [5.17%].

Sensitivity to amikacin was observed in 60% of the included patients. Azithromycin sensitivity was found in 34% of patients. Colistin sensitivity was detected in 52% of patients. Ceftriaxone sensitivity was observed in 38% of patients. Cefotaxime sensitivity was found in 22% of patients. Gentamicin sensitivity was detected in 54% of patients. Imipenem sensitivity was observed in 74% of the included patients. Vancomycin sensitivity was found in 24% of patients. Ciprofloxacin sensitivity was observed in 71% of patients, and amoxicillin-clavulanic acid sensitivity was found in 54% of patients. Several studies [11-13] all observed a similar sensitivity pattern. Ciprofloxacin has been determined to be the most successful medication.

Among 18 E. coli samples, the sensitivity percentages to different antibiotics were as follows: [66.67%] for Amikacin, [77.78%] for Azithromycin, [55.56%] for Ceftriaxone, [44.44%] for Cefotaxime, and [61.11%] for Gentamicin. Colistin and Imipenem showed 100% sensitivity, with all 18 E. coli samples being sensitive to them. However, none of the E. coli samples showed sensitivity to Vancomycin. Ciprofloxacin and Amoxicillin-clavulanic acid also exhibited good sensitivity, with [94.44%] and [77.78%] inhibition rates, respectively. In similar study, **Rathi *et al.*** [14] reported that, [60%] of the E. coli isolates showed sensitivity to Ciprofloxacin and [50%] to Gentamicin.

Among the Klebsiella pneumoniae samples, the sensitivity percentages to different antibiotics were as follows: 100% for amikacin and colistin, 83.33% for azithromycin, 83.33% for ceftriaxone, 16.67% for cefotaxime, and 91.67% for gentamicin. Imipenem showed 100% sensitivity, with all 12 Klebsiella pneumoniae samples being sensitive to it. However, none of the samples showed sensitivity to vancomycin. While ciprofloxacin demonstrated a relatively high sensitivity rate at 83.33%, amoxicillin-clavulanic acid had a lower sensitivity rate of 57.67%. In a previous study, **Rathi *et al.*** [14] reported that 81.81% of Klebsiella isolates were found to be sensitive to ciprofloxacin. A smaller percentage of isolates showed susceptibility to amoxicillin clavulanic acid [18.18%], ceftazidime [36.36%], cotrimoxazole [45.45%], and gentamicin [63.63%]. In contrast, another study aimed to evaluate the bacteriological profile of CSOM and their sensitivity patterns, **Kazeem and Aiyeleso** [15], showed that Klebsiella species had a sensitivity of 70.6% and 67.7% to ceftazidime and ceftriaxone, respectively, followed by tetracycline [53.0%] and gentamicin [50.0%].

Out of the 22 Pseudomonas Aeruginosa samples tested, the sensitivity rates were as follows: Amikacin [81.82%], Azithromycin [45.4%], Colistin [100%], Ceftriaxone [9.09%], Cefotaxime [27.27%], Gentamicin [72.73%], Imipenem [81.82%], and Vancomycin [0%]. These results indicate that Amikacin, Gentamicin, and Imipenem had relatively higher sensitivity rates, while Ceftriaxone and Vancomycin showed low or no sensitivity. Ciprofloxacin displayed a substantial sensitivity rate of 90.91%, and Amoxicillin-clavulanic acid had a lower sensitivity rate of 77.27%. In agreement, **Soumya *et al.*** [16] revealed that for Pseudomonas aeruginosa, penicillin, piperacillin, and tazobactam were the most effective antibiotics. On the other hand, **Kombade *et al.*** [17] reported that Pseudomonas aeruginosa was reported to have excellent sensitivity for Amikacin [77.8%], Gentamicin [74.2%], and Imipenem [64.9%], and high sensitivity for Ceftazidime and Colistin [100%].

The sensitivity among S. aureus samples was as follows: Amikacin [69.23%], Azithromycin [0%], Colistin [0%], Ceftriaxone [61.54%], Cefotaxime [23.08%], Gentamicin [61.54%], Imipenem [90%], and Vancomycin [92.31%]. These findings suggest that Amikacin, Ceftriaxone, Gentamicin, Imipenem, and Vancomycin exhibited varying degrees of effectiveness against S. aureus strains, while Azithromycin and Colistin showed no sensitivity. Ciprofloxacin and Amoxicillin-clavulanic acid displayed good sensitivity, with rates of 83.33% and 66.67%, respectively. In agreement, **Sah *et al.*** [6] reported that Ciprofloxacin [81.63%] had the highest percentage of S. aureus sensitivity, followed by tobramycin [73.46%], gentamicin [63.26%], and chloramphenicol [53.06%]. Penicillin had the highest level of resistance at 79.60%.

Conclusion: The management of illness therapy and the reduction of intracranial and extracranial consequences associated with CSOM may be achieved by having knowledge of the microorganisms and antibiotic sensitivity pattern responsible for the condition, as well as by selecting appropriate antibiotics based on susceptibility testing. Based on our findings, the most prevalent isolated bacteria were, S. aureus, followed by Pseudomonas Aeruginosa, E. coli and Klebsiella Pneumoniae respectively. The isolated fungi were

Candida Species. Ciprofloxacin and Vancomycin were the most effective antibiotics for S. aureus. Ciprofloxacin and Colistin were the most effective antibiotics for Pseudomonas Aeruginosa. Amikacin and colistin were the most effective antibiotics for Klebsiella Pneumoniae. Colistin and Imipenem were the most effective antibiotics for E. coli.

Declarations: No conflict of interest or financial disclosure.

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IJMA

INTERNATIONAL JOURNAL OF MEDICAL ARTS

VOLUME 6, ISSUE 4, APRIL 2024

P- ISSN: 2636-4174
E- ISSN: 2682-3780