Understanding the Microbiology of Chronic Otitis Media

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OBJECTIVE: To describe the microbiology of Chronic Otitis Media (COM), its susceptibility and resistance patterns.

STUDY DESIGN: Clinical chart review

SETTING: Secondary care center.

SUBJECTS AND METHODS: Patients with COM who attended the clinic between October 2021 and July 2023 were included. Clinical data, along with results from bacterial and fungal cultures, were collected. Antibiotic susceptibility testing was performed on the bacterial isolates. A descriptive analysis was conducted.

RESULTS: Twenty-one patients diagnosed with COM were included, fourteen female patients, with a mean age of 50.65 years. Fifty-two percent (n=11) of cases had cholesteatoma. The most frequently isolated microorganisms were *Corynebacterium amycolatum* (23%, n=8), *coagulase-negative Staphylococcus* (17%, n=6), *Pseudomonas aeruginosa* (15%, n=5) and *Staphylococcus aureus* (9%, n=3). Isolated fungi were *Candida albicans* (12.5%, n=2), *Candida parapsilosis* (37.5 %, n=6), and *Aspergillus terreus* (18.7%, n=3).
A high resistance was observed to lincosamides at 75%, macrolides 58.3%, penicillins 45.8%, and quinolones 44.1%. In terms of sensitivity, 100% susceptibility was observed to carbapenems, oxazolidinones, and 72.9% to cephalosporins.

CONCLUSION: The evolution of new microorganisms in chronic otitis media, such as the appearance of *Corynebacterium*, has led to a change in the pharmacological susceptibility, showing a higher percentage of resistance to lincosamides, macrolides, quinolones, penicillins.

Key words: Chronic otitis media, microbiology, antibiogram, resistance.

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INTRODUCTION

Chronic otitis media (COM) is a persistent inflammatory disease of the middle ear, lasting more than three months, characterized by gradual onset and structural involvement, particularly of the tympanic membrane. Its pathophysiology is linked to impaired mucociliary clearance and altered middle ear ventilation.

The most frequently isolated microorganisms in chronic otitis media are *Staphylococcus aureus, Pseudomonas aeruginosa, Proteus mirabilis*, and species of *Klebsiella*, along with various anaerobic bacteria and fungi. Bacteria are identified in approximately 50% of cases..[1,2]

Additionally, cholesteatoma is associated with biofilms in 60% of cases. The microorganisms most commonly associated are *Pseudomonas aeruginosa* in immunocompromised patients and *Candida albicans*.[3,4]

Fungi can also be involved in chronic otitis media. Some of the species most frequently identified are *Candida parapsilosis, Candida albicans* and species of *Aspergillus*.[1,5-7]

METHODS

Clinical chart review, this study included patients with diagnosis of OMC, treated at the Otolaryngology-Head and Neck Surgery department, in HCC Autonomous University of Sinaloa, from October 2021 to July 2023.

Inclusion criteria:
- Both genders.
- Patients older than 18 years with diagnosis of chronic otitis media with active infection.
- Culture of ear secretion.

Exclusion criteria:
- Samples with incomplete data or errors in patient identification or culture traceability.
- Patients lost to follow-up.

The follow-up in patients with COM (**Figure 1**) was set at every week for 1 month.

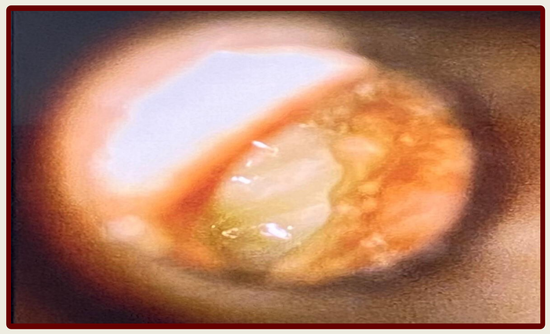

Figure 1. Ear with chronic otitis media

REFERENCES

1. Campos L, Barrón M, Fajardo G. Otitis media aguda y crónica: una enfermedad frecuente y evitable. Rev Fac Med UNAM. 2014 Jan;57:5-14.
2. Bluestone CD. Management of chronic otitis media with effusion. Acta Otorhinolaryngol Belg. 1983;37(1):44-56. PMID: 6684382.
3. Saunders J, Murray M, Alleman A. Biofilms in chronic suppurative otitis media and cholesteatoma: scanning electron microscopy findings. Am J Otolaryngol. 2011 Jan-Feb;32(1):32-7. doi: 10.1016/j.amjoto.2009.09.010. Epub 2009 Dec 24. PMID: 20036033.
4. Macassey E, Dawes P. Biofilms and their role in otorhinolaryngological disease. J Laryngol Otol. 2008 Dec;122(12):1273-8. doi: 10.1017/S0022215108002193. Epub 2008 Apr 11. PMID: 18405407.
5. Pérez L, Alvarez F, García O, Hernández A. Comportamiento bacteriológico de la otitis media crónica en pacientes diagnosticados en el Servicio de Otorrinolaringología. Mediciego. 2015;21(2).
6. Biju M, Philip AC, Pulimoottil DT, Joy SM, Kaipuzha RR, Jose S. Microbiology of Active Mucosal Chronic Otitis Media and Shifting Trends in Etiology in Idukki, Kerala: A Prospective Observational Study. Indian J Otolaryngol Head Neck Surg. 2023 Apr;75(Suppl 1):476-482. doi: 10.1007/s12070-023-03605-8. Epub 2023 Feb 24. PMID: 37206817; PMCID: PMC10188870.
7. Kaźmierczak W, Janiak-Kiszka J, Budzyńska A, Nowaczewska M, Kaźmierczak H, Gospodarek-Komkowska E. Analysis of pathogens and antimicrobial treatment in different groups of patients with chronic otitis media. J Laryngol Otol. 2022 Mar;136(3):219-222. doi: 10.1017/S0022215121003224. Epub 2021 Oct 27. PMID: 34702380.
8. De Miguel Martínez I, Vasallo Morillas JR, Ramos Macías A. Terapéutica antimicrobiana en otitis media crónica supurada [Antimicrobial therapy in chronic suppurative otitis media]. Acta Otorrinolaringol Esp. 1999 Jan-Feb;50(1):15-9. Spanish. PMID: 10091344.

RESULTS

Of the 21 patients included, 66.6% (n=14) were women and 33.3% (n=7) were men. Of the total, 52% (n=11) had cholesteatoma. The most affected ear was the right ear in 52% (n=11) of the cases, and 4 of them had a co-infection of fungi and bacteria throughout their culture history.

A total of 47 bacterial cultures were obtained, of which 25.5% (n=12) showed no bacterial growth. Among cultures with bacterial growth (n=35), 23% (n=8) isolated *Corynebacterium amycolatum*, 17% (n=6) isolated coagulase-negative *Staphylococcus*, 14% (n=5) isolated *Pseudomonas aeruginosa*, *Achromobacter xylosoxidans* was isolated in 11% (n=4), 8.5% (n=3) isolated *Staphylococcus aureus*, 6% (n=2) isolated *Enterobacter aerogenes*, and 6% (n=2) isolated *Staphylococcus epidermidis*. This distribution is shown in **Figure 2.**

A total of 44 mycological cultures were analyzed, of which 63.6% (n=28) showed no growth, while 36.4% (n=16) yielded pathogenic fungi. The most frequent isolates were Candida parapsilosis (38%, n=6), followed by Aspergillus terreus (19%, n=3) and Candida albicans (13%, n=2). See **Figure 3**.

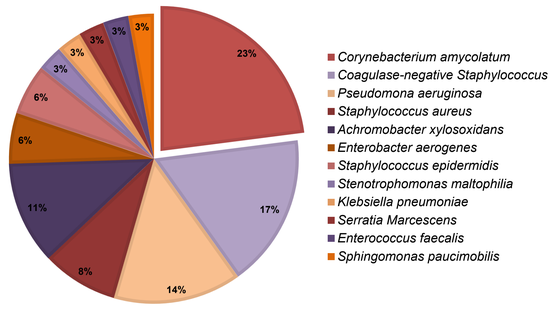

Figure 2. Total isolated bacteria

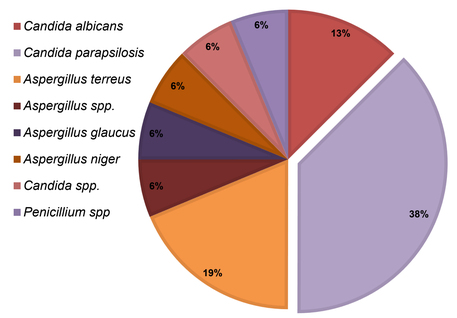

Figure 3. Total isolated fungi

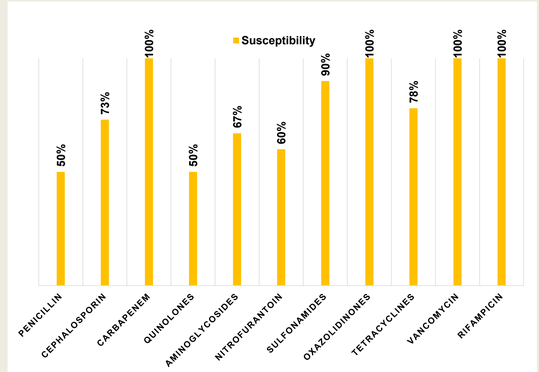

Table 1. Susceptibility of the most commonly used antibiotics in chronic otitis media.

High susceptibility to carbapenems, cephalosporins, sulfonamides, oxazolidinones, tetracyclines, vancomycin, and rifampicin was observed in the cultures isolated from patients with chronic otitis media **(Table 1).** Similarly, a high level of resistance to clindamycin, macrolides, fosfomycin, and quinolones was observed **(Table 2).**

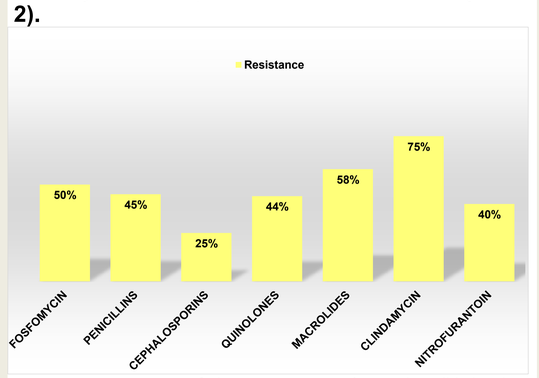

Table 2. Resistance of the most commonly used antibiotics in chronic otitis media.

Regarding the bacterial spectrum, *Corynebacterium amycolatum*, the most frequently isolated pathogen, showed 100% susceptibility to cefotaxime, tetracycline, and linezolid, with 83% resistance to levofloxacin. *Pseudomonas*, on the other hand, was 100% susceptible to gentamicin, amikacin, cefepime, ceftazidime, and meropenem, but resistant to cephalothin, ceftriaxone, and fosfomycin.

DISCUSSION

Findings of present study reveal a progressive shift in the microbiological spectrum of chronic otitis media (COM), as well as in antibiotic sensitivity patterns, which has critical therapeutic implications. Traditionally, pathogens such as *Pseudomonas aeruginosa* and *Staphylococcus aureus* have been the main etiological agents.[1,2] Our analysis reveals an increasing involvement of bacteria such as *Corynebacterium amycolatum* and *coagulase-negative Staphylococcus*, along with a higher incidence of fungi such as *Candida parapsilosis*. These results suggest a shift toward a more resistant and diverse microbiota, possibly influenced by the indiscriminate use of topical and systemic antibiotics.

Likewise, topical quinolones have been considered the treatment of choice for chronic suppurative otitis media in recent years.[8] However, the high resistance found to macrolides and quinolones highlights the therapeutic resistant of common empirical treatments. The susceptibility observed in this study to carbapenems, linezolid, and trimethoprim-sulfamethoxazole, although encouraging, should be approached with caution to avoid repeating the resistance patterns seen in other drug families.

CONCLUSION

The evolution of new microorganisms in chronic otitis media, such as the appearance of *Corynebacterium*, has led to a change in the pharmacological susceptibility, showing a higher percentage of resistance to lincosamides, macrolides, quinolones and penicillins.