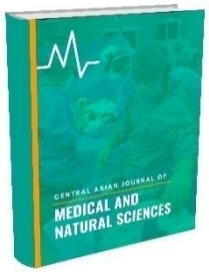
CENTRAL ASIAN JOURNAL OF MEDICAL AND NATURAL SCIENCES



Volume: 04 Issue: 04 | Jul-Aug 2023 ISSN: 2660-4159

http://cajmns.centralasianstudies.org

The Most Common Causes of Bacterial Ear Infections

1. **Gufran Kadhim Abdulkareem**
2. **Estabraq AbduIkareem Qahtan**

Received 2nd May 2023,
Accepted 3rd Jun 2023,
Online 20th Jul 2023

[1,2] Southern Technical University. Basra Technical Institute, Technique of pharmacy department, Basra, Iraq
gufran.kadhim@stu.edu.iq,
aestbrq679@gmail.com

Abstract: The purpose of this study was to determine the most prevalent bacteria in the ear secretion samples collected from probable otitis media patients in Basrah, Iraq. The results showed a significant relationship between age and the probability of middle ear infections. The most commonly isolated microbial species were seen to be Pseudomonas spp., Proteus spp., and Staphylococcus aureus. The results showed that S. aureus was the most common strain found in adults, while Pseudomonas spp. primarily affected the kids.

Introduction

Ear infections are the most common clinical problem that affects people across the globe and are the primary cause of preventable hearing loss in developing nations [1, 2]. Microbial infections affect the ear components like the skin covering the middle and outer parts of the ear, tympanic and mastoid canals, cartilage and periosteum, and the ear canal itself [3]. Hearing loss affects 32 million children, >328 million people, which constitute >5% of the global population [4]. Hearing loss may result from infectious disorders such as rubella, mumps, measles, or meningitis that can be prevented by vaccination [2, 5]. Ear infections are caused by viruses, bacteria, or fungi. However, ear infections are generally caused by a variety of strains, like mixed bacterial infections or infections with *Escherichia coli*, *Klebsiella* spp., *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and *Streptococcus pyogenes* [6]. Otitis media is a condition that affects the middle ear mucosa, located below the tympanic membrane (eardrum). The middle ear contains the posterior mastoid air cells along with the anterior eustachian tube, tympanic membrane, medial inner ear, posterior mastoid air cells, and ear ossicles (malleus, incus, and stapes).

The middle ear infection spreads to the adjoining tissues, including the brain and meninges superiorly, the sigmoid sinus posteriorly, and other significant structures, with harmful outcomes. The middle ear's modified respiratory epithelium, which comprises ciliated cells and goblet cells, produces mucins that are normally transferred along the Eustachian tube [7]. Various OM subtypes manifest themselves in different forms [8]. Children aged below 2 are commonly affected by acute OM (AOM), which appears as otalgia, acute onset symptoms, and fever in an unwell child. It is a severe type of inflammation caused by bacteria or viruses. Acute supportive OM, a subtype of AOM, is characterized by pus in the middle ear. Ear discharge is noted if the eardrum perforates, which occurs in ≈5% of cases, but higher rates have also been noted [9, 10], where the perforation can self-heal [9]. AOM is a

Copyright (c) 2023 Author (s). This is an open-access article distributed under the terms of Creative Commons Attribution License (CC BY).To view a copy of this license, visit https://creativecommons.org/licenses/by/4.0/

common infectious illness affecting children, and while it is frequently self-limiting [11], it does cause significant morbidity and has a low fatality rate [12, 13].

AOM frequently results in acute mastoiditis, also known as acute inflammation of mastoid periosteum and air cells, when the middle ear and the periosteum that surrounds the mastoid air cells are both infected. Children under the age of two are the most usually affected, with a frequency ranging from 1.2 to 6.0 per 100,000 [14]. Patients typically report mastoid pain and post-auricular oedema in addition to AOM symptoms. The condition is more dangerous than uncomplicated AOM and frequently calls for intravenous antibiotics, hospitalization, and surgery if there is an abscess or untreated mastoiditis [7]. OM with effusion (OME) refers to a chronic form of inflammation, compared to AOM and acute mastoiditis. People of all age groups are affected by the chronic form of this condition, which shows a lesser likelihood of recovery. This condition can occasionally cause life-threatening and severe complications, particularly in children and the elderly [2, 5], like brain abscesses, hearing loss, or meningitis. Children aged between 3 and 7 years are generally affected.

Hearing loss is the most commonly reported symptom since it is characterized by the absence of acute inflammation and is caused by effusion, which is a glue-like fluid beyond the intact tympanic membrane [15]. This disease may cause academic difficulty or speech delays. Histologically, it is described as a chronic inflammatory condition that involves the enlargement of middle ear mucosa, increased mucin synthesis, and altered viscous mucin. Mucin, the major element in middle ear effusion, is responsible for the glue's thick sticky viscosity. The middle ear effusion contains many bacterial strains [16]. The symptoms of OME that are noted during the screening of asymptomatic children disappear in 63% of the cases after 3 months and in 88% of the cases after almost a year [11]. Middle ear effusions typically disappear on their own [15], particularly if OME develops after an AOM episode. Also, OME-related hearing loss disappears rapidly. It is suggested to adopt a "watch and wait" strategy and to only administer treatment strategies to patients experiencing chronic effusions. Chronic OME can negatively impact academic success, speech development, and behaviour, especially if it is bilateral and is manifested during infancy. On the other hand, the extent to which the OME influences these qualities and quality of life is controversial [15]. OME is more common in children compared to adults, and it frequently coexists with other basic disorders. The remaining 4.8% were head and neck tumours, primarily adult-onset adenoidal hypertrophy, nasopharyngeal carcinomas, and smoking-induced nasopharyngeal lymphoid hyperplasia. In their study, [17] found that paranasal sinus disease was the primary aetiology of OME in 66% of patients. Only 1.8% of the patients could not be diagnosed. Adult OME is regarded as more controversial for the above reasons, especially when unilateral. Adults with OME need to be treated after being examined for any underlying diseases [7]. Cholesteatoma and chronic supportive OM (CSOM), which are other middle ear inflammatory diseases, are characterized by the presence of prolonged supportive middle ear inflammation, frequently with a continuously perforated tympanic membrane (the normal middle ear is lined by the altered respiratory epithelium). Chronic otorrhea is frequently associated with CSOM, which shows additional symptoms like hearing loss, otalgia, tinnitus, and a pressure-like sensation [18]. Therapy is frequently difficult because of the chronic nature of the illness and recurrent perforation, and it usually involves surgery and the use of antibacterial medicines. The middle ear is utilized for diagnosing cholesteroleatoma as it contains keratin and squamous epithelium. Only surgical treatments have been effective [7]. Although the many forms of the above-mentioned OM could be described as discrete diseases with distinctive clusters of clinical symptoms, sequelae, signs, and therapies, there is a lot of overlap among them, prompting one to think of OM as a continuum/spectrum of disorders. In addition to these significant intracranial and extracranial issues, AOM, CSOM, and cholesteatoma have been linked to mastoiditis, meningitis, sigmoid sinus thrombosis and development of brain abscesses; early diagnosis of these consequences is essential to reduce morbidity and mortality.

Copyright (c) 2023 Author (s). This is an open-access article distributed under the terms of Creative Commons Attribution License (CC BY).To view a copy of this license, visit https://creativecommons.org/licenses/by/4.0/

Methods

Using sterile cotton swabs, aseptic samples of each patient's ear discharge were collected. Following the inoculation of the samples onto agar plates, the plates were cultured in the aerobic incubator for 24 h at 37°C. The process used for the isolation and identification of microbial strains was based on the microbiological standards presented in the popular book by Cheesbrough [19, 20]. The susceptibility pattern of each bacterial isolate was analysed based on the standard criteria presented by the Clinical and Laboratory Standards Institute (CLSI, 2011) [4]. The 867 ear discharge samples that tested positive for microbes included 5 types of harmful microorganisms. These microbial species were dominated by *Pseudomonas* spp. (300 samples, i.e., 34.6%), *S. aureus* (200 samples, i.e., 23.0%), and *Proteus* spp. (193 samples, i.e., 22.2%; Table 2).

Results

Distribution of patients' ages and sexes who may have otitis media About 867 (86.7%) of 1000 ear discharge culture samples from suspected patients were determined to be positive for one or more bacterial species after investigation. According to the findings, there was a 50.2% and 49.8% risk for middle ear infections in men and women, respectively. Age groups 16 to 35 years had the highest rate of positive ear discharge cultures (38.0%), followed by 5 to 15 years (23.4%). There were discovered many types of harmful bacteria. Pseudomonas spp. 300 (34.6%) predominated among these bacterial species, followed by S. aureus 200 (23.0%), and Proteus spp. 193 (22.2%).

Table 1: Age and sex distribution of bacteria positive middle ear discharges diagnosed from patient

Variables	Frequency of bacteria positive ear discharges number(%)
Sex	
Men	436(50.2)
Women	431(49.8)
Age group in years	
<5	152(17.5)
5-15	203(23.4)
16-35	330(38.0)
36-50	105(12.1)
>51	77(8.8)

Five distinct types of harmful bacteria were found in the 867 patient ear discharge specimens that tested positive for bacteria. Psudomonas spp. 300 (34.6%) predominated among these bacterial species, followed by S. aureus 200 (23.0%), and Proteus spp. 193 (22.2%). (Table 2).

Table 2: Three-year retrospective analysis of bacterial isolates from ear discharges

Bacteria isolated	Frequency	Percentage (%)
Psudomonas spp.	300	34.6
S.aureus	200	23.0
Proteus spp.	193	22.2
E. coli	174	20.2
Total	867	100

Discussion

Although ear infections are seen to be a very frequent and controllable medical problem around the world if left untreated, they can present serious implications such as speech difficulties, patient and

Copyright (c) 2023 Author (s). This is an open-access article distributed under the terms of Creative Commons Attribution License (CC BY).To view a copy of this license, visit https://creativecommons.org/licenses/by/4.0/

family pain, hearing loss, and financial burden on the healthcare system [2]. Thus, addressing the aetiology of ear infections and related patterns of antibiotic susceptibility may help to lower the severity of the infection sequelae and influence the empirical antibiotics that clinicians will administer, particularly in developing countries [21]. Otitis media is a condition that can affect both children and adults. The peak-age prevalence was seen in children aged <15 years [22–24]. The high prevalence of otitis media in children may be caused by recurrent upper respiratory tract infections, immature immune systems, horizontal Eustachian tubes, and malnutrition [21]. Antibiotic-resistant bacterial infections can lead to serious diseases, high mortality rates, inpatient admission, a greater chance of complications, and long hospital stay [22, 23]. The pathogenic microbial strains that were most frequently isolated from the suspected otitis media patient ear secretions included *S. aureus*, *E. coli*, *Pseudomonas* spp., and *Proteus* spp. [4]. Earlier studies noted that *Pseudomonas* spp. was the primary bacterial strain responsible for middle ear infections, followed by *S. aureus* and *Proteus* spp. [24, 25]. According to previous studies, *Proteus* spp. and *S. aureus* differ significantly between children and adult patients suffering from discharging ears. Unlike kids, *S. aureus* was the most prevalent microbial strain affecting adult patients, hence the inverse was true. Several *Proteus* species are usually found in unhygienic environments, such as faeces, manures, moist soils, etc., where children could be exposed because of their lack of hygiene education and data. Conversely, the high frequency of *S. aureus* in adults could be attributed to their normal presence in the adult's respiratory tracts and skin samples [26, 21]. Drugs like gentamicin and norfloxacin could be used as alternative antibiotic drugs for empirically treating otitis media, as the above microbes showed low resistance to these drugs [21]. Otitis media is a common disorder that affects children, making it one of the major reasons individuals seek treatment. The results of this study showed that the 3 most prevalent bacteria isolated from the ear discharge samples, collected from patients suspected of middle ear infections, were *S. aureus*, *Pseudomonas* spp., and *Proteus* spp., which also showed a significant relationship between age and probability of developing middle ear infections. *S. aureus* infections in adults showed a higher infection rate compared to *Pseudomonas* spp. infections in children. *S. aureus* and *Pseudomonas* sp. showed higher resistance to the list of antimicrobial drugs that were tested,

Conclusions

The most frequent bacterial species isolated in this study were *Staphylococcus aureus*, *Pseudomonas* spp., and *Proteus* spp. The results of this study showed that *Pseudomonas* spp. was the most prevalent isolate that affected children, while the adults were primarily infected by *S. aureus*.

References

1. Ullauri A. and Castrillon R. (2014).“WHO ear and hearing disorders survey: Ecuador national study 2008-2009,” *Conference Papers in Science*, vol. 2014, Article ID847526, 13 pages.
2. World Health Organization (2015).Deafness and hearing loss, Fact Sheet 300.
3. http://www.who.int/mediacentre/factsheets/fsHYPERLINK "http://www.who.int/mediacentre/factsheets/fs300/en/" HYPERLINK "http://www.who.int/mediacentre/factsheets/fs300/en/"
4. Alberti P. W (2001). “The pathophysiology of the ear,” in *Occupational Exposure to Noise Evaluation, Prevention and Control*, B. Goelzer, C. H. Hansen, and G. A. Sehrndt, Eds., pp. 63–78, World Health Organization (WHO).
5. Ayele Argaw-Denboba,1 Asrat Agalu Abejew,2 and Alemayehu Gashaw Mekonnen3 (2015) . Antibiotic-Resistant Bacteria Are Major Threats of Otitis Media in Wollo Area, Northeastern Ethiopia: A Ten-Year Retrospective Analysis. International Journal of Microbiology,Volume 2016, Article ID 8724671, 9 pages.

Copyright (c) 2023 Author (s). This is an open-access article distributed under the terms of Creative Commons Attribution License (CC BY).To view a copy of this license, visit https://creativecommons.org/licenses/by/4.0/

6. FaucA. S. and Longo C. (2008). Harrison's Principles of Internal Medicine, McGraw-Hill, New York, NY, USA, 17th edition .
7. Afolabi O. and Nwawolo C. C. (2012). "Pattern of bacterial isolates in the middle ear discharge of patients with chronic suppurative otitis media in a tertiary hospital in north central Nigeria," African Health Sciences, vol. 12, no. 3, pp. 362–368 .
8. Ali Qureishi1,Yan Lee2 ,Katherine Belfield3 ,John P Birchall4 ,Matija Daniel2(2014). Update on otitis media – prevention and treatment. Infection and Drug Resistance, 7,P: 15–24.
9. Senturia BH, Bluestone CD, Klein JO, et al. (1980). Report of the ad hoc committee on definition and classification of OM and OME. *Ann Otol Rhinol Laryngol*.;89:3–4.
10. Berger G. (1989). Nature of spontaneous tympanic membrane perforation in acute otitis media in children. *J Laryngol Otol*.;103 (12):1150–1153.
11. Kalu SU, Ataya RS, McCormick DP, Patel JA, Revai K, Chonmaitree T. (2011). Clinical spectrum of acute otitis media complicating upper respiratory tract viral infection. Pediatr Infect Dis J.;30(2):95-99.
12. Rosenfeld RM, Kay D. (2003). Natural history of untreated otitis media. *Laryngoscope* ;113(10):1645–1657.
13. Venekamp RP, Sanders S, Glasziou PP, Del Mar CB, Rovers MM. (2013). Antibiotics for acute otitis media in children [review]. *Cochrane Database Syst Rev*.;1:CD000219.
14. Stool S.E., Field M.J. (1989). The impact of otitis media. *Pediatr Infect Dis J*.;8(Suppl 1):S11–S14.
15. Chesney J, Black A, Choo D. (2013). What is the best practice for acute mastoiditis in children? *Laryngoscope*. Epub July 12.
16. van Zon A, van der Heijden GJ, van Dongen TM, Burton MJ, Schilder AG. (2012). Antibiotics for otitis media with effusion in children [review]. *Cochrane Database Syst Rev*.;9:CD009163.
17. Kubba H, Pearson JP, Birchall JP. (2000). The aetiology of otitis media with effusion: a review. *Clin Otolaryngol Allied Sci*.;25(3):181–194.
18. Finkelstein Y, Ophir D, Talmi YP, Shabtai A, Strauss M, Zohar Y. (1994). Adult onset otitis media with effusion. *Arch Otolaryngol Head Neck Surg*.;120(5):517–527.
19. Reiss M, Reiss G. (2010). Supparative chronic otitis media: etiology, diagnosis and therapy. *Med Monatsschr Pharm*.;33(1):11–16; quiz 17–18. German.
20. Cheesbourgh M. Cheesbourgh (2006). Medical Laboratory Manual for Tropical Countries. Part 2, Butterworthr-Heineman LTD, England, UK, 2nd edition.
21. Bauer A.W, Bauer,W. M, Kirby, J. C. Sherris, andM. Turch (1966). "Antibiotic susceptibility testing by a standardized single disk method," American Journal of Clinical Pathology, vol. 45, no. 4, pp. 493–496.
22. bayeh abera,1 fantahun biadglegne(2009).antimicrobial resistance patterns of *staphylococcus aureus* and *proteus* spp. From otitis media at bahir dar regional laboratory, north west ethiopia. Bayeh abera, fantahun biadglegne, *ethiop med j, vol. 47 no. 4.*
23. Beulah Edwin , Vincent Prasanna , I Kannan , VM Hemlata Katiyar , Elango Dhanapal2(2014). Incidence Of Bacterial colonization in the oropharynx of patients with ENT infections. International Journal of Medical Science and Public Health , Vol 3 , Issue 8.

Copyright (c) 2023 Author (s). This is an open-access article distributed under the terms of Creative Commons Attribution License (CC BY).To view a copy of this license, visit https://creativecommons.org/licenses/by/4.0/

24. Mosges R. and Eichel A. (2011).Treatment of acute otitis externa with ciprofloxacin otic 0.2% antibiotic ear solution. Therapeutics and Clinical Risk Management ,(7),P: 325–336.

25. Iseh K. and Adegbite T. (2004) . Pattern and Bacteriology of Acute Suppurative Otitis Media in Sokoto, Nigeria. Annals of African Medicine Vol. 3, No. 4; 164 – 166.

26. Muluye D. and Nega T. (2013). "Bacterial isolates and drug susceptibility patterns of ear discharge frompatients with ear infection at Gondar University Hospital, Northwest Ethiopia," BMC Ear, Nose and Throat Disorders, vol. 13, no. 1, article 10.

27. Ferede D, Geyid A, Lulseged S et al. (2001). Drug susceptibility pattern of bacterial isolates from children with chronic suppurative otitis media. Ethiop J Health Dev;15 (2):89-96.

Copyright (c) 2023 Author (s). This is an open-access article distributed under the terms of Creative Commons Attribution License (CC BY).To view a copy of this license, visit https://creativecommons.org/licenses/by/4.0/