Muthanna, et al., Yemeni J Med Sci. 2024; 18: 20 - 26
https://doi.org/10.20428/yjms.v18i1.2527
https://journals.ust.edu/index.php/yjms

ORIGINAL ARTICLE OPEN ACCESS

Prevalence of Prescribing Macrolides and Aminoglycosides Among Dentists in Aden, Yemen. A cross-sectional Survey

Fares M.S Muthanna [1], Ameera A. Al-Humidi [2]

[1] *Pharmacy department, Faculty of Medicine and Health Sciences, University of Science and Technology, Aden, Yemen*

[2] *Basic Science department, Faculty of Medicine and Health Sciences, University of Science and Technology, Aden, Yemen*

ABSTRACT

This study assessed the understanding of dentists regarding the appropriate prescription of aminoglycosides and macrolides in Aden, Yemen. We carried out a cross-sectional study, enlisting a total of 150 licensed dentists from both public and commercial dental clinics. The data was gathered throughout the period of October to December 2023. Out of the 150 participants, 57% were men, and 47% had less than 5 years of experience. According to the poll, a large majority of dentists, 72%, use macrolides on a regular basis in their practice. In addition, azithromycin was the most commonly prescribed macrolide, accounting for 18% of total prescriptions. By comparison, aminoglycosides account for only 21% of all prescriptions, and neomycin is quite rare. 13% of persons with penicillin allergies were administered streptomycin, underscoring the necessity for safer alternatives. Dentists typically follow the prescribed time frame of 3-5 days to ensure the appropriate administration of macrolides. The findings indicated that individuals should get instruction on the proper utilization of aminoglycosides and macrolides, be provided with comprehensive information to enable them to make well-informed decisions on their treatment alternatives, and be obligated to adhere to guidelines grounded in empirical evidence from real-life scenarios. Effective antibiotic stewardship practices in Yemeni dentistry require collaboration among dentists, microbiologists, and public health officials. It is recommended to undertake additional research to expand the study's scope and include observational studies and interviews with dentists.

Keywords: Aminoglycosides, Macrolides, Prevalence, Dentists, Yemen.

***Corresponding author:** fares.mu.wu@gmail.com

© 2024 University of Science and Technology, Main Campus Aden, Yemen. This article can be unrestrictedly used, distributed or reproduced in any medium, provided that credit is given to the authors and the journal. Online ISSN: 2227-961X.

https://doi.org/10.20428/yjms.v18i1.2527

https://journals.ust.edu/index.php/yjms

Introduction

Oral hygiene is crucial for maintaining good physical and mental health, especially in Yemen, where there is a high incidence of tooth decay and gum disease [5]. Nevertheless, the efficacy of dental treatments is progressively hindered by antibiotic resistance, presenting a substantial obstacle given the vital role dentists play in addressing these oral disorders [6].

The extensive and unregulated utilization of antibiotics has resulted in a rapid increase in antibiotic-resistant bacteria, posing a significant menace to public health [7],[17]. Antibiotics are crucial in dentistry as they are necessary for both the prevention and treatment of infections that may occur as a result of dental treatments such as tooth extractions, root canals, and periodontal surgery [1],[18]. Regrettably, dentists frequently administer broad-spectrum antibiotics such as macrolides and aminoglycosides or even non-steroidal anti-inflammatory drugs [16]. These antibiotics have a high level of effectiveness against a wide variety of disease-causing organisms [2].

The excessive utilization of macrolides and aminoglycosides in dentistry gives rise to apprehensions owing to their deleterious impact on both oral health and patient welfare [3]. The excessive use of macrolide antibiotics has been associated with Clostridium difficile infections, which are notorious for their capacity to induce severe disease or even fatality. Improper utilization of aminoglycosides can also result in significant consequences, such as ototoxicity (ear damage) and nephrotoxicity (kidney damage) [4].

In order to develop successful approaches to encourage appropriate antibiotic prescribing practices, it is essential to obtain a thorough comprehension of the present utilization of macrolide and aminoglycoside antibiotics by dentists in Yemen. Although previous studies [15] have shown worrying patterns in dental prescription practices worldwide, there is a scarcity of accurate data specifically focused on Yemen.

This study seeks to fill this void by investigating the prevalence of macrolide and aminoglycoside utilization among dentists working in Aden, Yemen, particularly those employed in the city's primary and most notable healthcare facility.

The study's findings offered useful data for healthcare practitioners globally in addressing the problem of antibiotic resistance. The aim examined the determinants that impact prescribing decisions in Yemeni dentistry and utilize this data to design focused interventions, including as educational initiatives and clinical protocols, to enhance antibiotic safety. In the end, the study provided significant insights that may be used to create more efficient treatment procedures.

Methods and Materials

Study Design

This study employed a cross-sectional descriptive methodology to conduct a survey of dentists in South Yemen. The study was conducted from October to November 2023. Participants were selected for inclusion based on their current involvement in either the Aden or Yafaa governorates. Data collection involved the utilization of self-administered surveys, preceded by a literature study to inform the questionnaire design.

Sample Selection

The study aimed to ensure a representative sample of dentists in the Aden governorates by enrolling a diverse group. A full sampling frame would have been ideal, but stratified random sampling was used if a full frame was unavailable. A convenience sample of dentists operating in the areas was used, and RaoSoft's online (http://www.raosoft.com/samplesize.html) sample size calculator was used to determine the sample size. The calculation considered factors like the required level of certainty, expected frequency of the primary attribute, and allowable error margin. The sample consisted of 141 individuals.

© 2024 University of Science and Technology, Main Campus Aden, Yemen. This article can be unrestrictedly used, distributed or reproduced in any medium, provided that credit is given to the authors and the journal. Online ISSN: 2227-961X.

https://doi.org/10.20428/yjms.v18i1.2527

https://journals.ust.edu/index.php/yjms

Data Collection Instrument: Questionnaire Development

The study utilized a self-administered questionnaire to collect data. The instrument, originally developed and validated by Kaul et al. (2018), underwent necessary modifications and cultural adaptation to ensure its appropriateness for the Yemeni context. The final version of the questionnaire had 7 items. This process yielded a final instrument comprising seven items.

Data collection employed a mixed-mode approach, incorporating both in-person and online techniques. Participants who received a paper questionnaire in person were allotted 1-7 days for its return and were then reminded over email or WhatsApp. For the web-based survey, a link was distributed to all respondents, allowing for electronic submission. After a four-week data collection period, all entries were transferred to the online survey software for analysis. Descriptive statistics were generated using Excel to summarize the collected data. Additionally, Excel facilitated the creation of charts and graphs to visually represent the findings. The questionnaire itself encompassed sections on demographics (e.g., age, gender, years of experience), antibiotic prescribing habits (frequency, specific medications, dosages), and reasons for antibiotic choice (e.g., patient need, diagnostic limitations).

Content Validation

To ensure questionnaire validity, feedback was sought from three dental and medical experts who reviewed the questionnaire for clarity, comprehensiveness, and relevance. Their feedback was incorporated into the questionnaire after pilot testing.

Pilot Study

A pilot study involving approximately 30 dentists in Aden was conducted to assess questionnaire clarity, comprehensiveness, and internal consistency using Cronbach's alpha coefficient.

Data Collection Procedures

Following pilot study revisions, the final questionnaire was distributed to eligible dentists in Aden using online survey platforms or paper-based methods, considering dentists' technological

Data Confidentiality

Collected data, whether from online or paper surveys, were entered into a secure electronic database and coded for consistency. Data cleaning procedures were implemented to verify accuracy and ensure dataset integrity.

Data Analysis

A statistical analysis plan was developed to derive meaningful insights from the collected data, employing descriptive statistics to summarize dentist demographics and antibiotic prescribing practices. Prevalence rates of macrolide and aminoglycoside use were calculated, stratified by penicillin allergy status, to explore potential associations between dentist characteristics and prescribing practices. Statistical tests such as chi-square or Fisher's exact tests were utilized to assess associations, while subgroup analyses were conducted where feasible.

Statistical Software

Data analysis was conducted using statistical software such as SPSS, facilitating descriptive statistics, hypothesis testing, and regression analyses as required.

Ethical Considerations

The study adhered to ethical principles outlined in the Declaration of Helsinki, ensuring informed consent, participant anonymity, and data confidentiality. Informed consent forms were provided to all participants, outlining study objectives, methodology, potential risks, and voluntary participation rights. The ethical approval of this study is (MEC No/AD030).

Results

The study included predominantly male dentists

© 2024 University of Science and Technology, Main Campus Aden, Yemen. This article can be unrestrictedly used, distributed or reproduced in any medium, provided that credit is given to the authors and the journal. Online ISSN: 2227-961X.

https://doi.org/10.20428/yjms.v18i1.2527

https://journals.ust.edu/index.php/yjms

(57%) practicing primarily in Aden (95%), with 47% having 2-5 years of experience. Distribution between public (31%) and private practice (38%) was relatively even, reflecting diverse practice settings among participants table (1).

The majority of dentists (51%) prescribed antibiotics for a duration consistent with antibiotic stewardship principles (3-5 days). However, a significant portion (48%) prescribed antibiotics for longer durations (5-7 days). Dental abscesses (41%), periodontal abscesses (41%), and pericoronitis (36%) were the procedures most commonly associated with antibiotic prophylaxis, aligning with established clinical practices table (1).

Table 1 : Demographic distribution of variables n = 141

Demographics		n (%)
Gender	Male	57%
	Female	42%
Residential status	Aden	95%
	Yaffae	4%
Working area	Public	31%
	Private	68%
Year of experience	Less than 2 years	21%
	2-5 years	47%
	More than 5 years	30%
Number of operations	Less than 10	54%
	More than 10	45%
No. of days of prescription	3-5 days	51%
	5-7 days	48%
Clinical procedures for prophylaxis	Dental Abscess	41%
	Periodontal Abscess	41%
	Pericoronitis	36%
	Acute pulpitis	23%
	Peri-implantitis	14%
	Dry Socket	9%
	Others	11%

Macrolides were the most frequently prescribed antibiotic class (72%), with Azithromycin (18%), Erythromycin (15%), and Clarithromycin (10%) being the most common choices. This highlights a potential concern for overuse of broad-spectrum antibiotics (Table 2).

Aminoglycoside use was less prevalent (21%), with Gentamicin (8%) being the primary choice, followed by limited use of Neomycin (1%). This finding suggests awareness among dentists of the potentially severe side effects associated with aminoglycosides (Table 2).

The presence or absence of penicillin allergies significantly impacted antibiotic selection. For patients without penicillin allergies, macrolide use increased substantially (43%), with Azithromycin (18%) being the most commonly prescribed option. This highlights a potential overreliance on broad-spectrum alternatives (Table 2). Conversely, macrolide use was even higher for patients with penicillin allergies (72%), suggesting a preference for broader-spectrum antibiotics despite the availability of narrower-spectrum options that could be effective (Table 2).

Table 2: Descriptive Analysis of Antibiotic Prescriptions n = 141

	Drugs	n (%)
Macrolides in adults without penicillin allergy	Erythromycin	15%
	Azithromycin	18%
	Clarithromycin	10%
Aminoglycosides in adults without penicillin allergy	Streptomycin	3%
	Gentamycin	8%
	Neomycin	2%
	Others	44%
Macrolides in adults with penicillin allergy	Erythromycin	33%
	Azithromycin	30%
	Clarithromycin	9%
Aminoglycosides in adults with penicillin allergy	Streptomycin	13%
	Gentamycin	7%
	Neomycin	1%
	Others	7%

The analysis of dosage practices among dentists revealed that a majority prescribed Erythromycin (40%), Azithromycin (35%), and Gentamicin (12%) within recommended ranges. This adherence suggests a conscientious approach to balancing treatment

© 2024 University of Science and Technology, Main Campus Aden, Yemen. This article can be unrestrictedly used, distributed or reproduced in any medium, provided that credit is given to the authors and the journal. Online ISSN: 2227-961X.

https://doi.org/10.20428/yjms.v18i1.2527

https://journals.ust.edu/index.php/yjms

efficacy with minimizing the risks associated with these medications. Conversely, a lower percentage of dentists prescribed Streptomycin at 1-2 g per day (11%), followed by Gentamicin at 3-5 mg/kg per day (12%), and Neomycin at 500 mg every 6-8 hours (2%). These findings underscore variability in dosage practices and highlight the importance of adherence to recommended guidelines to optimize therapeutic outcomes and mitigate potential adverse effects (Table 3).

Table 3: Descriptive Analysis of variables n = 141

Regimens	Duration of treatment	n (%)
Macrolides Regimen	Erythromycin 250-500 mg every 6 hours	40%
	Clarithromycin 250-500 mg every 12 hours	10%
	Azithromycin 500mg on day1, then 250mg on days 2-5	35%
Aminoglycosides Regimen	Streptomycin 1-2 g daily	11%
	Gentamicin 3-5 mg/kg/day	12%
	Neomycin 500 mg every 6-8 hours	2%

Discussion

This study sheds light on antibiotic prescribing habits among dentists in Yemen, revealing both encouraging trends and areas where practices could be optimized. The study finding indicated that, male dentists with a substantial proportion having less than 5 years of experience, reflects a predominantly common trend in developing countries where younger dentists often constitute a significant portion of the workforce. This result underscores the need for future research to explore potential differences in antibiotic prescribing patterns between genders and across varying levels of professional experience. Understanding the attitudes and knowledge base of younger dentists compared to their more seasoned counterparts could provide valuable insights into evolving antibiotic prescribing practices in Yemeni dentistry.

A positive takeaway is that over half of dentists prescribed Aminoglycosides and Macrolides for a duration consistent with antibiotic stewardship principles (3-5 days). This adherence suggests some awareness of the importance of responsible antibiotic use. This is crucial in combating the growing threat of antibiotic resistance, where bacteria develop the ability to evade the effects of these medications.

A noteworthy finding of this study is the high prevalence of macrolide use particularly medications like Azithromycin, Erythromycin, and Clarithromycin among dentists in Aden, Yemen, with high majority of dentists reporting their prescription. This rate exceeds those reported in similar studies from other regions, such as England [10] , indicating a potential overreliance on these broad-spectrum antibiotics within Yemeni dental practice. Such extensive use raises concerns about the emergence of antibiotic-resistant bacteria and the associated risks of adverse effects. Further investigation into the drivers behind this trend is crucial to formulate targeted interventions aimed at promoting more judicious antibiotic prescribing habits.

Among the macrolides prescribed, Azithromycin emerges as the most commonly chosen antibiotic. This outcome was similar to one study published in Saudia Arabia by Al Khuzaei, N. M et al [11], The popularity of Azithromycin can be attributed to its convenient single-dose or short-course regimens, which may influence dentists' preference over alternatives like Erythromycin or Clarithromycin [12]. Exploring the rationale behind these prescribing decisions could provide valuable insights into optimizing antibiotic use strategies in Yemeni dentistry.

The study also reveals a lower prevalence of aminoglycoside use , with Gentamicin being the primary choice which aligns with best practices due to their potential for severe side effects [13]. However, the notable use of Streptomycin for penicillin-allergic patients raises concerns, given its

© 2024 University of Science and Technology, Main Campus Aden, Yemen. This article can be unrestrictedly used, distributed or reproduced in any medium, provided that credit is given to the authors and the journal. Online ISSN: 2227-961X.

outdated status and associated risks. This finding was in line with CATES JE, et al.1951. Understanding the factors influencing this choice and promoting awareness of safer alternatives is imperative to mitigate potential adverse outcomes. Interestingly, the presence or absence of penicillin allergies significantly impacted antibiotic selection. For patients without penicillin allergies, the study found a substantial increase in macrolide use . This suggests a potential overreliance on broad-spectrum options when narrower-spectrum alternatives might be just as effective. Educational interventions aimed at promoting the use of these narrower options when appropriate could be beneficial. The study confirms existing research findings that the presence of a penicillin allergy significantly increases the use of both macrolides and aminoglycosides. This inclination towards broader-spectrum antibiotics in such cases highlights a potential gap in exploring alternative, narrower-spectrum options. Educational interventions focusing on effective management of penicillin allergies and promoting the appropriate selection of antibiotics are essential to enhance patient care while minimizing unnecessary broad-spectrum antibiotic use.

Conversely, the study also found even higher macrolide use for patients with penicillin allergies . Another study revealed opposite finding [10]. This could indicate a knowledge gap regarding effective alternative antibiotics for those who cannot tolerate penicillin. Further education and awareness campaigns could help address this issue. While the study doesn't delve into specific dosages for safety reasons, it suggests that dentists generally adhered to recommended ranges for Erythromycin, Azithromycin, and Gentamicin . This is encouraging as proper dosing ensures treatment efficacy while minimizing the risks of side effects and resistance development. However, exploring adherence for less frequently used antibiotics could be a valuable area for future research.

Limitations and Future Directions

Several limitations of this study warrant consideration. The geographic scope was confined to dentists practicing in Aden, which may limit the generalizability of findings to other regions within Yemen. Future research should encompass a broader geographical area to obtain a more comprehensive understanding of antibiotic prescribing practices across the country.

Another potential limitation is the reliance on self-reported data, which can introduce biases such as recall bias or social desirability bias. Incorporating observational studies to monitor actual prescribing practices alongside qualitative methods like dentist interviews could provide richer insights into the decision-making processes behind antibiotic prescribing in Yemeni dentistry.

Educational Interventions

The study underscores the need for targeted educational interventions aimed at promoting responsible antibiotic use among Yemeni dentists. These programs should emphasize considerations of narrower-spectrum antibiotic options whenever feasible, adherence to evidence-based guidelines for antibiotic prophylaxis, and the potential risks associated with broad-spectrum antibiotics like macrolides and aminoglycosides.

Collaboration

Collaboration between dentists, microbiologists, physicians, and public health officials is crucial for developing and implementing effective antibiotic stewardship programs within Yemeni dentistry. By fostering interdisciplinary collaboration, stakeholders can work together to establish guidelines, monitor antibiotic use patterns, and implement interventions aimed at optimizing antibiotic prescribing practices.

Conclusion

This study provides valuable insights into the current patterns of antibiotic use among dentists in Aden,

© 2024 University of Science and Technology, Main Campus Aden, Yemen. This article can be unrestrictedly used, distributed or reproduced in any medium, provided that credit is given to the authors and the journal. Online ISSN: 2227-961X.

Yemen, highlighting both areas of concern and positive practices. While the widespread use of macrolides raises issues regarding antibiotic resistance and adverse effects, commendable adherence to recommended antibiotic durations and dosages for macrolides is observed. Moving forward, concerted efforts in education, collaboration, and further research are essential to promote responsible antibiotic use, safeguard patient health, and preserve antibiotic efficacy in Yemeni dentistry. By addressing these areas, the Yemeni dental community can enhance patient care and contribute to global efforts against antibiotic resistance.

References:

[1] Buonavoglia A, Leone P, Solimando AG, Fasano R, Malerba E, Prete M, et al. Antibiotics or no antibiotics, that is the question: an update on efficient and effective use of antibiotics in dental practice. *Antibiotics*. 2021;10(5):550.

[2] Marek CL, Timmons SR. Antimicrobials in pediatric dentistry. In: *Pediatric Dentistry*. Elsevier; 2019. p. 128–41.

[3] Muteeb G, Rehman MT, Shahwan M, Aatif M. Origin of antibiotics and antibiotic resistance, and their impacts on drug development: a narrative review. *Pharmaceuticals*. 2023;16(11):1615.

[4] Hurkacz M, Dobrek L, Wiela-Hojeńska A. Antibiotics and the nervous system—which face of antibiotic therapy is real, Dr. Jekyll (neurotoxicity) or Mr. Hyde (neuroprotection)? *Molecules*. 2021;26(24):7456.

[5] Al Anouti F, Abboud M, Papandreou D, Haidar S, Mahboub N, Rizk R. Oral health of children and adolescents in the United Arab Emirates: a systematic review of the past decade. *Front Oral Health*. 2021;2:744328.

[6] Atta L, Mushtaq M, Raza A, Khalid A, Ul-Haq Z. Targeting glucosyltransferases to combat dental caries: current perspectives and future prospects. *Int J Biol Macromol.* 2024;134645.

[7] Hamdani SS, Bhat BA, Tariq L, Yaseen SI, Ara I, Rafi B, et al. Antibiotic resistance: the future disaster. *Int J Res Appl Sci Biotechnol.* 2020;7.

[8] Al-Hammadi S, Dubais M, Madfa A. The prevalence of tooth wear among a group of Yemeni adults. *J Oral Res*. 2019;8(6):478–87.

[9] Sweeney LC, Dave J, Chambers PA, Heritage J. Antibiotic resistance in general dental practice—a cause for concern? *J Antimicrob Chemother*. 2004;53(4):567–76.

[10] Ahmadi H, Ebrahimi A, Ahmadi F. Antibiotic therapy in dentistry. *Int J Dent.* 2021;2021(1):6667624.

[11] Al Khuzaei NM, Assery MK, Al Rahbeni T, Al Mansoori M. Knowledge of antibiotics among dentists in Saudi Arabia. *J Int Oral Health*. 2017;9(2):71–80.

[12] Rothermel CD. Single-dose azithromycin for acute otitis media: a pharmacokinetic/pharmacodynamic rationale. *Curr Ther Res*. 2003;64:4–15.

[13] Contaldo M, D'Ambrosio F, Ferraro GA, Di Stasio D, Di Palo MP, Serpico R, Simeone M. Antibiotics in dentistry: a narrative review of the evidence beyond the myth. *Int J Environ Res Public Health*. 2023;20(11):6025.

[14] Cates JE, Christie RV, Garrod LP. Penicillin-resistant subacute bacterial endocarditis treated by a combination of penicillin and streptomycin. *Br Med J*. 1951;1(4708):653–6.

[15] Hasan S, Al-Omar MJ, AlZubaidy H, Al-Worafi YM. Use of medications in Arab countries. In: *Handbook of Healthcare in the Arab World*. Cham: Springer International Publishing; 2021. p. 2197–2238.

[16] Muthanna FM. Knowledge and practice of dentists regarding prescribing of non-steroidal anti-inflammatory drugs (NSAIDs) in Yemen: a

© 2024 University of Science and Technology, Main Campus Aden, Yemen. This article can be unrestrictedly used, distributed or reproduced in any medium, provided that credit is given to the authors and the journal. Online ISSN: 2227-961X.

https://doi.org/10.20428/yjms.v18i1.2527

https://journals.ust.edu/index.php/yjms

cross-sectional analysis. *Libyan J Med Appl Sci*. 2024;1–10.

[17] Halboup AM, Alzoubi KH, Othman GQ. Awareness of bacterial resistance to antibiotics among healthcare providers in Sana'a City, Yemen. *Yemeni Journal for Medical Sciences*. 2018;12(1):12-21.

[18] Kubas MA, Zabad AA, Alqadhi DM, AL-Azab MA. Antibiotic resistance trends of Gram-negative bacteria most frequently isolated from inpatients in a tertiary care hospital in Sana'a, Yemen. *Yemeni Journal for Medical Sciences*. 2018;12(1):22-30.

© 2024 University of Science and Technology, Main Campus Aden, Yemen. This article can be unrestrictedly used, distributed or reproduced in any medium, provided that credit is given to the authors and the journal. Online ISSN: 2227-961X.