ORIGINAL ARTICLE

Inpatient Antibiotic Prescription Frequency at a Local Hospital

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Abstract

Background: To review and assess antibiotic prescribing in admitted patients in a local tertiary hospital, in Al-Kharj, Saudi Arabia. **Methods:** A retrospective analysis was conducted utilizing existing electronic records of antibiotic prescriptions for 1197 patient cases, selected from a pool of 25,000 inpatients admitted to a local hospital through systematic sampling. All therapeutic antibiotic prescriptions were evaluated and examined over a 9-month period (from March 2023 to December 2023). The study involved examining and evaluating data that encompassed patients' demographic details, clinical diagnoses, and the method of antibiotic delivery. **Results:** Antimicrobials were administered to 63.6% of subjects, among whom 47.9% were prescribed at least two kinds of antimicrobial agents. Two drugs were prescribed for 28.9%, three drugs for 10.6%, and 8.4% for four or more antibiotics. Cephalosporins (81.7%) ranked first, followed by quinolones (41.6%), then penicillin (20.1%). **Conclusion:** To make informed decisions about antibiotic use and identify potential issues related to antibiotic misuse, it is essential to conduct more comprehensive and long-term studies on antibiotic consumption in Saudi Arabia.

Key words: Antibiotics, guidelines, prescriptions, Saudi Arabia, Stewardship

INTRODUCTION

The misuse of antimicrobials is associated with the development of antimicrobial resistance, higher rates of illness, prolonged hospitalizations, and increased healthcare expenses.[1] The misuse of antimicrobials extends beyond the immediate consequences of ineffective treatment, contributing to the global health crisis of antimicrobial resistance, wherein pathogens develop the ability to survive in the presence of drugs intended to eliminate them.[2] This phenomenon not only renders existing treatments ineffective but also jeopardizes the efficacy of antimicrobials for future generations.[1,3] The increased morbidity resulting from such misuse manifests in prolonged illnesses, complications, and potentially more severe outcomes for patients.[4,5] The economic impact of inappropriate antimicrobial use is substantial.[4] Unnecessary length of hospital stays directly correlates with increased healthcare costs, imposing a significant burden on healthcare systems and individual patients.[6] These extended stays not only inflate medical expenses but also elevate the risk of hospital-acquired infections, further complicating patient recovery.[6] In addition, the development and production of new antimicrobials to combat resistant strains necessitate extensive research and financial investment, ultimately contributing to the rising costs of health care on a broader scale.[5,7]

In hospital settings, the judicious use of antibiotics is imperative to strike a balance between their efficacy in reducing mortality and morbidity associated with infectious diseases and their potential adverse effects, such as serious side effects, drug interactions, and the induction of resistant strains.[8,9] Antibiotics are potent agents that can significantly decrease mortality and morbidity rates in patients with bacterial infections, effectively combat infections, prevent

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complications, and reduce the duration of hospital stays.[10] However, their administration must be meticulously managed to prevent serious adverse events, including allergic reactions, organ toxicity, and disruption of the patient's microbiome.[10] Furthermore, antibiotics may interact with other medications, potentially altering their effectiveness or causing harmful side effects.[8]

The overuse or misuse of antibiotics exacerbates the global issue of antimicrobial resistance.[1] When antibiotics are prescribed unnecessarily or used improperly, they can lead to the emergence of resistant bacterial strains, posing a significant threat to public health as these pathogens become increasingly difficult to treat with existing antibiotics.[11] Consequently, healthcare professionals must carefully evaluate the immediate benefits of antibiotic therapy against the long-term risks of contributing to antimicrobial resistance. This necessitates a prudent approach to antibiotic prescribing, encompassing accurate diagnosis, appropriate drug selection, optimal dosing, and timely discontinuation of therapy when it is no longer required.[8] Therefore, antibiotic stewardship programs aim to balance the powerful effects of antibiotics for individual patients with their potential risks.[12]

Studies have shown that 30–40% of patients do not receive care based on evidence-based practices, according to guidelines, and 20–25% of the healthcare provided is unnecessary.[13] Research on antibiotic treatment reveals similar outcomes, with evaluations indicating that as much as 50% of antibiotic use in hospitals is unsuitable.[4] Implementing various strategies to encourage the proper use of antimicrobials can prevent their overprescription and misuse.[14] Antibiotics supervision programs play a crucial role in healthcare by balancing the powerful benefits of antibiotics for individual patients with their potential risks.[4] These programs are essential due to the significant discrepancies observed in healthcare practices.[4] Studies have revealed that a substantial portion of patients receive care that does not align with available scientific evidence or established guidelines, while a considerable amount of healthcare provided is deemed unnecessary.[13] This issue is particularly pronounced in antibiotic care, where assessments have indicated that up to 50% of hospital antibiotic use may be inappropriate.

To address these concerns, various interventions are being implemented to promote the appropriate use of antimicrobials.[15] These efforts aim to curb unnecessary prescribing and misuse of these vital medications. The importance of such initiatives is underscored by the need to preserve the efficacy of existing antibiotics and combat the growing threat of antimicrobial resistance.[15] In light of these challenges, the current study seeks to evaluate the patterns of antimicrobial use in medical and surgical wards at a tertiary care hospital. This assessment is crucial for developing strategies to promote rational and appropriate antimicrobial use among hospitalized patients, ultimately improving patient outcomes and reducing the risk of antibiotic resistance.

METHODS

There were approximately 25,000 patients admitted to the Hospital during March to December 2023, from which 1197 patient cases were chosen by systematic sampling. The research commenced with official approval from the Institutional Review Board. We examined the clinical records related to antibiotic prescriptions, focusing on the type of antibiotic, how often it was prescribed, and the length of time it was used.

Information was gathered from electronic patient records. The following patients' variables were recorded: ward, file number, date of admission, date of interview, age, sex, nationality, weight, height, diagnosis, associated medical problems (co-morbidities), and whether the patient takes antibiotic(s). For patients who received antibiotic prescriptions, we documented all the antibiotics prescribed, detailing the dosage, frequency, method of administration, duration, and whether the medications were administered for preventive or treatment purposes. In addition, the laboratory and microbiological test results available were examined to evaluate whether the diagnosis of infectious disease, which led to the prescription of antibiotics, was according to the current local recommendations and/or guidelines. We did not collect any data that could reveal the identity of the patient or the prescriber.

Analyses were performed using IBM Statistical Package for the Social Sciences (SPSS) Statistics version 19 (IBM Corp, Armonk, NY, USA) and IBM SPSS Amos version 21 (IBM Corp, Armonk, NY, USA). Categorical data were expressed as percentages, whereas quantitative data were shown as the mean ± standard deviation, along with the median and range. The hospital Ethics Committee approved the study protocol, which encompassed data collection. The clinic heads and their staff physicians were informed in advance about the study and agreed to the evaluation procedures.

RESULTS

A total 1197 patients' folders were reviewed, as shown in Table 1 the majority of included patients were admitted at pediatrics unit (n = 264), respiratory (n = 243), gastroenterology (n = 148), nephrology (135), endocrinology (n = 119), cardiology (n = 147), dermatology (n = 81), and physiotherapy (n = 60). The median age of included patients was 41 years, and 45.9% were females. Adults (aged> 16 years) comprised 69%, followed by children (aged 28 days to 16 years; 22.1%) and neonates (aged 0–28 days; 8.9%).

63.6% of patient's antibiotics were prescribed (761 cases), among which 47.9% were prescribed two or more kinds

Table 1: Medical specialty, frequency of antimicrobial prescription

Hospital department	No. of case	No. of cases prescribed antibiotics	Frequency of antibiotic prescription (%)
Non-surgical departments			
Respiratory medicine	243	224	92.2
Pediatrics	264	234	88.6
Gastroenterology	148	97	65.5
Nephrology	135	86	74.3
Dermatology	81	18	22.2
Endocrinology	119	40	33.6
Cardiology	147	62	42.1
Physiotherapy	60	0	0
Total	1197	761	63.6

of antibiotics. Two drugs were prescribed for 28.9%, three drugs for 10.6%, and 8.4% for four or more antibiotics. The frequency of antibiotics used is shown in Table 2. Cephalosporins (81.7%) ranked first, followed by quinolones (41.6%), then penicillin (20.1%).

With regards to medication use and appropriateness of therapy. All antimicrobial use, 56.3% lack a clear justification (indication). 56.8% for treatment and 55.9% for prophylaxis only. The patient's medical record did not reveal the required indication for the drug request according to the institution's guidelines.

Table 2: Antimicrobials, frequency of administration

Antibiotics	Cases of prescription	Frequency (%)
Cephalosporins	684	81.7
Cefazolin	238	28.4
Ceftriaxone	176	21
Cefuroxime	111	13.2
Cefotaxime	92	10.9
Ceftizoxime	74	8.8
Cefoperazone	93	11.2
Fluoroquinolones	349	41.6
Ciprofloxacin	179	9.9
Levofloxacin	116	2.0
Pefloxacin	54	1.6
Penicillin	160	20.1
Penicillin G	49	6.1
Amoxicillin	43	5.4
Amoxicillin/Clavulanic acid	46	5.8
Ampicillin/Sulbactam	22	2.8
Azlocillin	52	6.5
Metronidazole	153	19.2
Aminoglycosides	142	17.8
Gentamicin	118	14.8
Tobramycin	7	0.9
Amikacin	38	4.7
Netilmicin	68	8.5
Clindamycin	45	5.6
Fosfomycin	38	4.8
Erythromycin	13	1.6
Chloramphenicol	11	1.4
Imipenem/Cilastatin	1	0.1

DISCUSSION

Antibiotic coverage has declined over the past few decades.[16] This is true for several reasons. Most of which is the arising resistance due to the wide use, as well as decreased new developments by concerned institutions.[17] This process of increasing resistance will not be halted without a cooperative effort from healthcare officials and manufacturers.[18] However, they require a database that supports such collaborative efforts to improve outcomes.[19] We tried in our evaluation here to bring the wide use and pattern of antibiotics into focus in order to understand the magnitude of this issue in our region. We gathered data from various wards, including the intensive care unit (ICU), surgery, and general medical sections available in our regional referral hospital. Specifically, these three wards were of higher use of antibiotics, which was noted by other researchers.[20]

Studies performed elsewhere showed that the frequency of prescribing antibiotics is about 30.6%. This study was completed in an adult hospital in Turkey.[21] In our findings, 63.6% of our patients were receiving antibiotic therapy. Such high use is not different from other developing countries, China, 77.8%, and Costa Rica, 65%.[22,23]

It is important to notice that among all sections studied, surgical wards are the highest in prescribing antibiotics. In comparison with other countries, it turned out to be high as well.[21,24] We also noticed that the ICU ward patients received less antimicrobials (21.7%) compared to the percentage of medical ward patients who received antibiotics, which was 26.2%.

It is understood that the reason for antimicrobial prescribing will be subject to each condition, each unit, and the requirement for such therapy. There was no comparison between various wards in this regard due to a lack of correlation. However, based on indication, respiratory tract infections (18.5%)

were the most prevalent reason for prescribing antimicrobial therapy, medical wards (26.2%), ICU (21.7%), and surgical becoming the least (6.0%). Our finding is not so deviant from other researchers who evaluated prescribing patterns in a tertiary care facility in Switzerland, where respiratory tract infection was the most prevalent indication (21.3%).[25] General medical wards registered the highest cases, and in contrast, surgical wards had the lowest incidences (7.2%).[25]

In contrast, surgical wards were the highest for prescribing empirical therapy (72.8%), which could be justified to some extent.[24] As an indication for use, it was 58.7%, coming next after respiratory tract infection. Ceyhan and his team observed that empirical therapy, as a reason for use, came second in Turkish hospitals.[9] This was also true in other documented studies.[26]

Our finding shows that 47.9% of all evaluated patients' records received at least two agents. Our result is not so different from other researchers' findings that were previously published.[21,27,28] Most of the double agent use was without the supportive culture and sensitivity, and for the purpose of wider spectrum antimicrobial agents.

In the present study, we noticed that cephalosporins are the predominant antibacterial agent used (81.7%), but penicillins were the least (20.1%). The same finding was reported in previously published data.[29-31] Single agents prescribed mainly by the general medical ward, with ceftriaxone coming on top of the list, followed bypipracillin–tazobactam. Other researchers had pipracillin–tazobactam at the top of their list, followed by amoxicillin–clavulanate.[25] In addition, published data by Katakam *et al*. in 2012 revealed that amoxicillin–clavulanate was the most commonly used, followed by ceftriaxone, coming next in the list.[32] This finding was in the general medical ward. As per the researcher, the most frequent use of the augmentin–clavulanate combination was due to increased incidence of lower respiratory tract infection. On the other hand, we noticed that cefuroxime, ceftriaxone, and amoxicillin–clavulanate were more dispensed in surgical wards. This was also similar to what has been published by other researchers.[25,32]

Our evaluation of current statistics shows that 56.3% of all antimicrobial prescriptions were inappropriate. 56.8% for treatment and 55.9% for prophylaxis only. Our result falls in the range of previously published clinical trials on the same matter.[25,33,34] Based on our review of other research results, the inappropriateness depends on the policies put in place for each institution. In this instance, the rate varies from 28% to 65%. It is important to evaluate such policies continuously in order to minimize misapplication of antimicrobial therapy.[34]

The rate at which the medication use was incorrect was calculated to be 38%. This is consistent with other studies' findings.[25] The matter was clearly noted in the surgical section of the inpatient. We might conclude that the main reason for such results was the lack of indication. Researchers Dunagan and others had similar findings in which uninfected patients were treated with an antimicrobial course.[35]

The adverse events associated with inappropriate antibiotic use exceed all limits. Patients who failed therapy usually require extra care in the form of hospitalization and laboratory work-ups. Not to mention the possible failure of any future antibiotic use, as well as increased healthcare costs.[36]

CONCLUSION

At the end of our research, we could conclude that 761 (63.6%) of our patients were on at least two antibiotics at the same time. 38% of all cases received inappropriate management due to the dispensing of such unindicated antibiotics. One of the definite causes of such findings could be the unrestricted use of antimicrobials and unclear policy and procedures at the site where we conducted our research. It is imperative to conduct comprehensive stewardship programs that ensure the appropriate and strict use of antimicrobial therapy. User recommendation guidelines by international bodies should be adopted for the best patient' outcomes.

AUTHOR'S CONTRIBUTIONS

T. F. Al-Saikhan: Definition of intellectual content, literature search, clinical studies, data acquisition, data analysis, manuscript preparation, and manuscript review; Y F Al-Saikhan: Definition of intellectual content, literature search, clinical studies, data acquisition, data analysis, manuscript preparation, manuscript editing, and manuscript review; F Alsaikhan: Concepts, design, definition of intellectual content, literature search, clinical studies, data acquisition, data analysis, statistical analysis, manuscript preparation, manuscript editing, manuscript review, and guarantor.

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