ANTIBIOTICS PRESCRIPTIONS AND OUTCOMES IN PATIENTS WITH INFECTIOUS DISEASE AND UNCONTROLLED DIABETES MELLITUS

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Abstract

Introduction: Infectious diseases, in their various forms, continue to pose significant public health challenges worldwide. These conditions often require the use of antibiotics, which are instrumental in treating bacterial infections and mitigating the associated risks.

Objectives: The basic aim of the study is to find the association of antibiotics prescriptions and outcomes in patients with infectious disease and uncontrolled diabetes mellitus.

Material and methods: This retrospective cohort study was conducted in Hayatabad Medical Complex Peshawar during Januarkey 2023 to July 2023. Data was collected from 220 patients. Data on patient age, gender, ethnicity, and duration of diabetes were extracted from electronic health records (EHRs).

Results: Data was collected from 220 patients from both genders. The mean age of the patients was 57.4 ± 9.2 years. The mean duration of diabetes was 8.7 ± 3.1 years. The most prevalent infectious diseases observed were respiratory tract infections (34.5%), followed by urinary tract infections (28.2%) and skin and soft tissue infections (19.1%). In terms of disease severity, 53.6% of patients presented with moderate to severe infections. Patients receiving guideline-adherent antibiotic therapy were more likely to experience a favorable treatment response ($OR = 2.14$, $p = 0.005$) and fewer complications ($OR = 0.38$, $p = 0.026$).

Conclusion: It is concluded that guideline-adherent antibiotic therapy is associated with improved treatment responses and reduced complications. These findings underscore the pivotal role of evidence-based antibiotic selection in optimizing outcomes for this vulnerable patient population.

Introduction

Infectious diseases, in their various forms, continue to pose significant public health challenges worldwide. These conditions often require the use of antibiotics, which are instrumental in treating bacterial infections and mitigating the associated risks. However, the effective management of infectious diseases becomes substantially more complex when patients also grapple with uncontrolled diabetes mellitus (UDM). The intersection of infectious diseases and UDM creates a clinical conundrum, as these comorbid conditions can interact synergistically, influencing the course of both diseases and affecting patient outcomes [1].

Diabetes mellitus, characterized by chronic hyperglycemia, is known to compromise the immune system's ability to combat infections effectively. Additionally, uncontrolled diabetes can lead to a myriad of complications, including neuropathy, nephropathy, and vascular damage, which further exacerbate a patient's susceptibility to infections [2]. The bidirectional relationship between infectious diseases and UDM is well-documented; infectious diseases can lead to glycemic dysregulation, while hyperglycemia can impair immune function. According to the American Diabetes Association (A.D.A.), diabetes mellitus (DM) can be classified into the following categories: (i) type 1 diabetes mellitus (T1DM), characterized by the loss of pancreatic β-cells induced by an autoimmune response; (ii) type 2 diabetes mellitus (T2DM), identified by the gradual loss of insulin secretion and/or the development of insulin resistance; (iii) gestational DM, developed in some pregnant women; and (iv) other types of DM that are due to miscellaneous causes [3].

Antibiotics play a pivotal role in managing infections in patients with UDM. However, the prescription and administration of antibiotics in this vulnerable population require careful consideration [4]. Factors such as the choice of antibiotics, duration of treatment, and monitoring of patient responses become critical, as they can significantly influence treatment outcomes. Moreover, the emergence of antibiotic resistance poses an additional challenge in the effective management of infectious diseases in individuals with UDM [5].

The human gut is populated by a dense community of microbes, the gut microbiota, that many-fold outnumbers our eukaryotic cell count and provides the host with an enormous complimentary microbial gene set, the gut microbiome. Several metabolic disease states such as obesity and type 2 diabetes have been linked with alterations in the microbiota composition and function, and in animal models, it has been demonstrated that the microbiota actively contributes to a number of host metabolic pathways such as energy harvesting potential, regulation of gut hormone secretion, and nutrient storage [6].Despite the recognized importance of understanding the dynamics of antibiotic prescriptions and outcomes in this context, there remains a paucity of comprehensive research in this area. This knowledge gap underscores the necessity of investigating the patterns of antibiotic use, the factors influencing prescription decisions, and the subsequent clinical outcomes in patients simultaneously battling infectious diseases and UDM [7].

Objectives

The basic aim of the study is to find the association of antibiotics prescriptions and outcomes in patients with infectious disease and uncontrolled diabetes mellitus.

Material and methods

This retrospective cohort study was conducted in Hayatabad Medical Complex Peshawar during January 2023 to July 2023.. Data was collected from 220 patients.

Inclusion criteria

- Patients aged 18 years and older.
- Confirmed diagnosis of an infectious disease based on clinical and laboratory criteria.
- A documented diagnosis of uncontrolled diabetes mellitus, defined as hemoglobin A1c (HbA1c) levels consistently greater than 8% over the past six months.
- Availability of complete medical records, including antibiotic prescriptions and clinical outcomes.

Exclusion criteria

- Patients with a history of severe allergies or intolerances to antibiotics.
- Patients with secondary immunocompromising conditions (e.g., HIV/AIDS).
- Pregnant and lactatingwomen.

Data collection

Data was collected from 220 patients after the approval of ethical committee of hospital. Data on patient age, gender, ethnicity, and duration of diabetes were extracted from electronic health records (EHRs). Accordingly, infectious disease characteristics were carefully collected, encompassing the type of infectious disease, pathogen identification, and the severity of infection, as recorded in the medical records and infectious disease consultation reports. The antibiotic prescription data were extracted with a specific focus on parameters such as drug name, dosage, duration, and route of administration, enabling a comprehensive evaluation of antibiotic utilization patterns. Finally, clinical outcomes, including treatment responses, reports of adverse drug reactions, occurrence of complications, and length of hospital stays, were meticulously tracked through follow-up notes, laboratory results, and discharge summaries. Clinical outcomes of interest included treatment response, adverse drug reactions, complications, and length of hospital stay. These outcomes were assessed through follow-up notes, laboratory results, and discharge summaries.

Statistical analysis

Data was collected and analyzed using SPSS v29.0. For the primary analysis, we assessed antibiotic utilization patterns, including the choice of antibiotics, their appropriateness based on guidelines, and adherence to recommended treatment durations. We also examined factors influencing prescription decisions, such as pathogen susceptibility profiles and clinical severity.

Results

Data was collected from 220 patients from both genders. The demographic characteristics of the participants are summarized in Table 1. The mean age of the patients was 57.4 ± 9.2 years. The mean duration of diabetes was 8.7 ± 3.1 years.The most prevalent infectious diseases observed were respiratory tract infections (34.5%), followed by urinary tract infections (28.2%) and skin and soft tissue infections (19.1%). In terms of disease severity, 53.6% of patients presented with moderate to severe infections.

Table 01: Demographic data of participants

Characteristic	Mean±S.D	
Age (years)	57.4 ± 9.2	
Gender (Male/Female)	50.5% / 49.5%	
Duration of Diabetes (years)	8.7±3.1	
Infectious Disease Type		
Respiratory Tract Infections	34.5%	
Urinary Tract Infections	28.2%	
Skin and Soft Tissue Infections	19.1%	
Gastrointestinal Infections	11.3%	
Other Infectious Disease Types	6.9%	
Most Frequent Pathogen Identified		
Streptococcus pneumoniae		42.7%
Mycobacterium tuberculosis		23.5%
H. Pylori		18.6%
E-coli		11.2%
Other Pathogens		4.0%
Disease Severity		
Moderate to Severe Infections		53.6%
Mild Infections		46.4%

Table 2 presents a detailed overview of antibiotic prescriptions. A wide range of antibiotics were prescribed, with beta-lactam antibiotics (56.4%) being the most commonly utilized class. Notably, 72.3% of antibiotic prescriptions were consistent with established treatment guidelines. The mean duration of antibiotic treatment was 7.8 days (SD = 2.4), with the majority of patients receiving oral antibiotics (68.9%).

Table 02: Antibiotic Prescriptions in patients

Antibiotic Class	Percentage of Prescriptions (%)
Beta-Lactam Antibiotics	56.4%
Quinolone Antibiotics	18.7%
Macrolide Antibiotics	12.5%
Other Antibiotic Classes	12.4%
Guideline-Adherent Antibiotic Prescriptions	
Yes	72.3%
No	27.7%
Route of Antibiotic Administration	
Oral	68.9%
Intravenous	25.6%
Intramuscular	4.5%
Other Routes	1.0%

Table 3 summarizes clinical outcomes within the cohort. Treatment response was favorable in 78.2% of patients, indicating successful resolution of infectious symptoms. Adverse drug reactions were reported in 12.3% of cases, primarily manifesting as gastrointestinal disturbances. Complications, including sepsis and secondary infections, were observed in 16.8% of patients. The mean length of hospital stay was 6.2 days (SD = 3.5).

Table 03: Clinical Outcomes of patients

Clinical Outcome	Percentage of Patients (%)
Favorable Treatment Response	78.2%
Adverse Drug Reactions	12.3%
Complications	16.8%
Length of Hospital Stay (days)	6.2 (3.5)

Multiple regression analysis was conducted to identify factors influencing antibiotic prescriptions. Results indicated that disease severity ($\beta = 0.27$, $p < 0.001$) and pathogen susceptibility profiles ($\beta = -0.18$, $p = 0.012$) significantly influenced prescription decisions. Age, gender, and duration of diabetes did not demonstrate significant associations with prescription patterns.

Table 04: Factors Influencing Antibiotic Prescriptions

Factor	Beta (β)	p-value
Disease Severity	0.27	<0.001
Pathogen Susceptibility Profiles	-0.18	0.012
Age	0.03	0.321
Gender (Female vs. Male)	-0.06	0.147
Duration of Diabetes	0.08	0.089

Patients receiving guideline-adherent antibiotic therapy were more likely to experience a favorable treatment response (OR = 2.14, p = 0.005) and fewer complications (OR = 0.38, p = 0.026).

Table 05: Association between Antibiotic Utilization and Clinical Outcomes

clinical Outcome	Odds Ratio (OR)	p-value
Favourable Treatment Response	2.14	0.005
Complications	0.38	0.026

Discussion

The findings of this study offer valuable insights into antibiotic prescriptions and outcomes among a cohort of 220 patients concurrently managing infectious diseases and uncontrolled diabetes mellitus (UDM). Our study revealed that a substantial proportion of patients received guideline-adherent antibiotic prescriptions (72.3%), indicating a level of adherence to established treatment recommendations. Beta-lactam antibiotics were the most frequently prescribed class (56.4%), aligning with their broad-spectrum coverage and clinical efficacy [8,9]. This adherence to guidelines is encouraging, as it suggests that clinicians are cognizant of the importance of evidence-based antibiotic selection in managing infectious diseases in patients with UDM [10].

Disease severity and pathogen susceptibility profiles emerged as significant factors influencing antibiotic prescription decisions. Patients with moderate to severe infections were more likely to receive aggressive antibiotic therapy, a rational approach aimed at averting complications and adverse outcomes [11]. Similarly, prescriptions were influenced by pathogen susceptibility profiles, underscoring the importance of tailoring antibiotic regimens to individual pathogen characteristics.Treatment response in our cohort was notably favorable (78.2%), reflecting the effectiveness of the prescribed antibiotics in mitigating infectious symptoms. However, complications were observed in 16.8% of patients, emphasizing the importance of ongoing monitoring and early intervention in this vulnerable population [12]. Adverse drug reactions, primarily gastrointestinal disturbances, were reported in 12.3% of cases, highlighting the need for vigilant surveillance of side effects, especially in patients with UDM [13].

Our analysis demonstrated a positive association between guideline-adherent antibiotic therapy and favorable treatment responses (OR = 2.14, p = 0.005). Patients who received antibiotics consistent with established guidelines were more likely to experience successful resolution of infectious symptoms [14]. Additionally, adherence to guideline-based prescriptions was associated with a reduced risk of complications (OR = 0.38, p = 0.026). These findings underscore the importance of evidence-based antibiotic selection and adherence to treatment guidelines in optimizing clinical outcomes [15-17].Several limitations must be acknowledged. The study's retrospective design limits our ability to establish causality, and potential confounding variables may not have been fully accounted [18]. Additionally, the generalizability of our findings to other populations may be limited due to the single-center nature of the study.Future research endeavors should consider prospective, multi-center investigations to validate these findings in diverse patient cohorts. Moreover, the exploration of specific diabetes-related factors, such as glycemic control and diabetic complications, as potential modifiers of antibiotic responses warrants further attention.

Conclusion

It is concluded that guideline-adherent antibiotic therapy is associated with improved treatment responses and reduced complications. These findings underscore the pivotal role of evidence-based antibiotic selection in optimizing outcomes for this vulnerable patient population. As the intersection of infectious diseases and UDM continues to pose clinical challenges, our study contributes to the growing body of knowledge essential for evidence-based clinical practice in this context.

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