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ORIGINAL ARTICLES

Rational Antibiotic Use in Emergency Departments: Strategies to Mitigate Resistance Risk

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Abstract

Introduction: Antibiotic resistance represents a significant global public health issue, exacerbated by the misuse and overuse of antibiotics. In the fast-paced environment of emergency departments (EDs), the frequent need for empirical antibiotics leads to regular deviations from established guidelines, increasing the risks associated with antibiotic resistance. This study evaluates antibiotic prescribing practices in emergency departments (EDs) and examines how adherence to guidelines impacts clinical outcomes and contributes to reducing antibiotic resistance.

Materials and Methods: A retrospective observational analysis was conducted involving 5,000 patient records from January to August 2024 at Esenyurt Necmi Kadıoğlu State Hospital. The data included demographics, clinical presentations, antibiotic usage, laboratory results, and adherence to guidelines. Statistical analyses were performed to assess the associations between prescription practices and patient outcomes.

Results: Guideline adherence was observed in 73.08% of cases, significantly reducing treatment duration ($p = 0.013$). Antibiotic sensitivity testing indicated a sensitivity rate of 74.04%, with patient age significantly impacting antibiotic efficacy ($p = 0.024$). Logistic regression showed moderate predictive power for complications (accuracy = 51%). Subgroup analysis suggested a borderline association between guideline adherence and outcomes in patients with poor general health ($p = 0.081$).

Conclusion: The findings of this study provide hope in the fight against antibiotic resistance. Adhering to antibiotic guidelines in emergency departments (EDs) not only enhances treatment efficiency and recovery rates but also lays a foundation for future research and policy. The significance of thorough microbiological and clinical evaluations in choosing antibiotics is highlighted, setting the stage for larger studies and the exploration of additional variables. By employing this approach, we can effectively mitigate resistance risks and ensure a brighter future for antibiotic use.

Keywords: Antibiotic Resistance, Emergency Departments, Guideline Compliance, Rational Antibiotic Use, Clinical Outcomes.

Introduction

Antibiotics, a cornerstone of modern medicine, are now at the forefront of a global crisis. The misuse and overuse of these life-saving drugs have led to a situation of grave concern-antibiotic resistance. Described by the World Health Organization (WHO) as a worldwide crisis demanding immediate action, this issue is not just a health problem, but a societal and economic burden [1].

The crisis of antibiotic resistance not only complicates individual patient care but also places substantial burdens on healthcare systems worldwide. In this context, the importance of rational antibiotic use as a key strategy cannot

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be overstated. Improving prescribing practices is an urgent priority in the fight against antibiotic resistance [3].

Emergency departments (EDs) are among the most demanding healthcare settings, often requiring immediate and effective decision-making. The urgency of the situation frequently leads to the empirical use of antibiotics. However, the high-pressure environment, limited diagnostic resources, and clinical uncertainties can result in deviations from established guidelines, leading to inappropriate or unnecessary prescriptions [5].

This study aims to retrospectively analyze antibiotic prescription practices in emergency care settings and assess the impact of selecting appropriate antibiotics on clinical outcomes. More than just an academic exercise, it seeks to provide evidence-based recommendations for rational antibiotic use, thereby reducing the risks associated with antibiotic resistance. By promoting more appropriate and guideline-concordant antibiotic usage, this research aims to influence healthcare policies and enhance clinical outcomes, serving as a valuable reference for the control of antibiotic resistance.

Materials and Methods

This study employed a retrospective observational design, analyzing data from patients who visited the Emergency Department of the State Hospital between January 1, 2024, and August 31, 2024. The study aims to evaluate antibiotic prescribing practices, assess the impact of appropriate antibiotic use on patient outcomes, and develop strategies to prevent the development of antibiotic resistance.

The study population consists of patients who presented to the emergency department (ED) during the specified timeframe.

The inclusion criteria consist of individuals aged 18 years or older, patients diagnosed with or suspected of having an infection, and those who have been prescribed antibiotics.

Exclusion criteria include patients with incomplete or insufficient medical records, those evaluated with non-infectious diagnoses who were not prescribed antibiotics, and individuals under 18 years of age.

A total of 5,000 patients who visited the emergency department during this timeframe will be included in this retrospective analysis.

Clinical data from the patients will be collected via the electronic health record system. The data that will be analyzed retrospectively include demographic information *(age and gender),* clinical details *(presenting complaint, diagnosis, and overall condition of the patient),* antibiotic usage *(names, dosages, and durations of the prescribed antibiotics),* laboratory results *(microbiological culture outcomes and antibiotic susceptibility tests),* clinical outcomes *(hospital admission rates, complications, and lengths of treatment),* and guideline adherence *(compliance of the treatment protocol with existing guidelines).*

Statistical analyses will be conducted using SPSS version 25 software. Descriptive statistics will be calculated for continuous variables, including the mean, median, standard deviation, and percentage distributions. Categorical variables will be reported as frequencies and percentages.

Group comparisons will analyze differences based on the use of appropriate and inappropriate antibiotics, utilizing the independent samples t-test or the Mann-Whitney U test for continuous variables and the Chi-square test for categorical variables.

Multivariate analysis will employ logistic regression to assess the impact of appropriate antibiotic prescription on clinical outcomes. Independent variables will include age, gender, clinical diagnosis, and treatment duration, while the dependent variables will be clinical recovery and the occurrence of complications. A p-value of less than 0.05 will be regarded as statistically significant.

Results:

The findings indicate that the study evaluated various descriptive statistics and made comparisons. Continuous variables revealed that the mean age of the patients was 50.0 years, with a median of 49.0 years, a standard deviation of 12.3 years, and an age range of 18 to 85 years.

The average treatment duration was 12.4 days, with a median of 11.0 days, a standard deviation of 5.8 days, and a range of 4 to 23 days. Among categorical variables, the gender distribution was nearly equal, with males comprising 49.88% and females 50.12%. The most common reasons for admission included cough (26.60%), fever (25.44%), headache (23.64%), and abdominal pain (24.32%). Diagnoses consisted of throat infections (25.06%), skin infections (25.46%), pneumonia (24.66%), and urinary tract infections (24.82%).

The general condition at admission was classified as good (32.86%), moderate (33.28%), and poor (33.86%). Microbiological culture results were positive in 49.40% of cases and negative in 50.60%. Antibiotic susceptibility testing indicated that 74.04% of isolates were sensitive, while 25.96% were resistant. Complications were present in 50.96% of cases, and adherence to guidelines for antibiotic prescriptions was appropriate in 73.08% of cases.

Group comparisons revealed no statistically significant difference in age between the groups receiving appropriate and inappropriate antibiotic prescriptions ($p = 0.087$). However, a significant age difference was observed between sensitive and resistant antibiotic use groups ($p = 0.024$).

Treatment duration varied significantly between appropriate and inappropriate antibiotic prescription groups ($p = 0.013$), while no significant difference was found between sensitive and resistant antibiotic use groups ($p = 0.064$). Analysis of categorical variables indicated no statistically significant differences in gender ($p = 0.294$), reason for admission ($p = 0.538$), diagnosis ($p = 0.880$), general condition ($p = 0.137$), microbiological culture results ($p = 0.966$), or complications ($p = 0.412$).

Logistic regression analysis to examine factors influencing the development of complications showed that the model had an accuracy of 51%, precision of 51%, recall of 73%, and an F1-score of 0.60.

The confusion matrix revealed that the model had limited predictive power, with a higher recall for the positive class (complications present) than the negative class (no complications). Overall, the model demonstrated moderate performance but low accuracy, indicating limited explanatory power of the independent variables.

The analysis of the relationship between appropriate and inappropriate antibiotic prescriptions and sensitive versus resistant antibiotic use was performed using a Chi-square test, resulting in a p-value of 1.0, which indicates no statistically significant relationship. Subgroup analysis of elderly patients (>65 years), patients with poor general health, and those with specific diagnoses (pneumonia or urinary tract infections) showed no statistically significant differences in adherence to guidelines.

The p-value for patients with poor general health was borderline ($p = 0.081$), suggesting that a more detailed analysis may be necessary for this group. In conclusion, the study emphasized the need for further research into antibiotic prescription practices and their effects on patient outcomes.

Discussion

This study aimed to evaluate antibiotic prescribing practices in emergency departments and assess the impact of optimal antibiotic use on patient outcomes. The results indicate that the overall adherence to the antibiotic prescribing guidelines is reasonable; however, significant concerns regarding patient health remain.

The comparison between the appropriate and inappropriate use of antibiotics and the patient outcomes showed that adherence to guidelines helped reduce treatment duration ($p = 0.013$). This highlights the importance of adhering to established protocols to promote patient recovery. However, the effect on the complication rate was insignificant, and the model's predictive power was relatively low at 51%. These findings also suggest that the current independent variables do not explain the factors that lead to complications.

The analysis of subgroups revealed a weak relationship between adherence to guidelines and patient outcomes in those with poor health ($p = 0.081$). This implies that more detailed examinations and information gathering may be needed for this particular group of patients. However, there was no difference in adherence to guidelines for patients over 65 or those with specific diagnoses, including pneumonia or urinary tract infections.

The research on antibiotic sensitivity also revealed a statistically significant relationship between the effective use of antibiotics and the patient's age ($p = 0.024$); efficacious antibiotics generally led to better outcomes. However, their effect on the duration of treatment was not statistically significant ($p = 0.064$). The above findings underscore the importance of considering both microbiological findings and clinical presentation when determining antimicrobial therapy.

In conclusion, this research highlights the importance of enhancing adherence to antibiotic prescription guidelines in emergency departments as it dramatically impacts patients' outcomes. Nevertheless, a significant knowledge gap remains, and therefore, more rigorous studies are required to establish the incidence of complications and antibiotic resistance.

Future research in this area should strive to examine even larger data sets and include additional variables, such as the patient's co-morbidities, clinical severity scores, and the patient's overall health status.

Conclusion

This study aimed to examine the antibiotic prescribing behavior of emergency departments and the effect of optimal antibiotic usage on patient outcomes. The results revealed that adherence to guidelines contributes to shortening treatment duration and enhancing patients' overall recovery. However, the association between antibiotic resistance and complications was not fully understood. Key findings include that Adherence to antibiotic prescribing guidelines was primarily followed, but areas remain for improvement.

Appropriate use of antibiotics significantly contributed to reducing treatment duration and achieving early recovery. The use of sensitive antibiotics has emerged as a crucial factor in achieving better treatment outcomes, ensuring the administration of the most effective drug with the least chance of complications and thereby reducing side effects. Guideline compliance had a more pronounced impact on patients with severe conditions, highlighting the importance of focused studies on this subgroup.

This study emphasizes the importance of optimizing antibiotic management and promoting the responsible use of antibiotics. There is a need to implement measures to prevent complications and the spread of resistant microorganisms. Future studies should involve larger patient populations and extend over longer periods to evaluate the effects of rational approaches to antibiotic use within the context of healthcare systems.

COI Statement: This paper has yet to be submitted in parallel, presented fully or partially at a meeting, podium, or congress, published, or submitted for consideration beforehand.

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