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Antibiotic Resistance Current Trends and Future Directions

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Abstract

Background: *Antibiotic resistance is a universally aggravated health problem stemming from the abuse of antibiotics resulting in antibiotic resistant bacteria. Due to multidrug resistant infections arising almost in all health facilities, it becomes very difficult for the health care facilities to treat most common infections causing prolonged hospitalization, higher health costs, and high mortality rate.*

Objectives: *In order to assess how effective the new antibiotic regimen is going to be in decreasing the disparity of resistant bacterial infections in the hospitalised patient population.*

Study design : *A cross-sectional study*

Palace and duration of study. Department of pulmonology Gkmc swabi form Jan 2024 to March 2024
Methods: *involving 150 hospitalized patients, who were divided into two groups: one, which was given standard antibiotics and the other given the new antibiotic. Information was gathered on infection rates and the time for recovery. As for the effectiveness of the new antibiotic, the prevention both of infection rates, as well as the p-values to establish the significance of the results obtained were also calculated. Mean ± SD was used to ascertain intersatisfaction treatment variability.*

Results: *The group given the new antibiotic had a significant decrease in infection rates as they recovered within an average of 7.3 days (SD±1.5) while the groups given standard antibiotic recovered within 9.6 days (SD±2.1). Signifying a probability level of 0.02 the data shows a statistical difference between the two groups and supports the use of the new antibiotic in reducing resistant infections.*

Conclusions: *The new antibiotic was more effective in preventing infection incidences and time to recovery than the conventional antibiotics. These results may have implications for the utility of this antibiotic in expanding treatment strategies targeting infections caused by antibiotic-resistant organisms.*

Keywords: *Antibiotic resistance, randomised controlled pilot trial, infection incidence, novel antibiotic.*

Introduction

The issue of antibiotic resistance is emerging as a major global health problem affecting the effective treatment of a steadily increasing number of infections. This can occur when the bacteria adapt and become able to withstand the medicine that once worked on them, and therefore causing a new layer of difficult infections. Antibiotic abuse and its rampant use in human medicine, animal farming, and veterinary medicine, has enlarged this process, which has led to arise of multidrug resistant (MDR) organisms including Staphylococcal aureus [1], Escherichia coli [2], and Klebsiella pneumonia [3]. Traditionally antibiotics are referred to as one of the most important achievements of modern medicine, curing previously lethal bacterial infections. But the availability of synthetic antibiotics and their improper use has invited bacteria strain that are not treatable like ordinary ones. The WHO has ranked antibiotic resistance among its top 10 emerging global public health threats and has called for increased action [4, 5]. It would make simple operations deadly procedures, due to likelihood of contracting post-operations infections to which, there will be no cure, a situation that would make surgeries, transplants and cancer treatments more fatal than the diseases themselves if the world fails to address the issue of antibiotic resistance [6]. New antibiotics do not emerge with the same frequency as the resistance levels do, meaning that there is no new weapon with which to fight the beast that is only growing its defenses. With the realization of the problem, however, pharmaceutical companies have not produced new antibiotics proactively, mostly because the process is expensive and time-consuming. However, use of the available antibiotics also escalates the situation because they are used in the wrong way. A quite large body of evidence supports the conclusion that a great many antibiotics prescribed to outpatients, especially for acute/symptomatic conditions, are not needed at all [7] for example, antibiotics to treat viral infections. Also, antibiotic is often added to the feed and water for livestock to make them grow faster and to control disease which has aggravated the development of resistant bacteria [8]. The problem is worst felt in the third world countries because people can easily access antibiotics without prescription [9]. These practices result in overuse; poor compliance with set treatment regimens; and higher probabilities of resistance. MDR infections result in increased length of stay, cost of treatment and mortality [10] For instance, patients on the hospital nursing care often are infected with Methicillin-resistant Staphylococcus aureus (MRSA) which is not only prevalent but also costly and hard to eradicate [11]. S9According to the CDC, antibiotic-resistant infections occur 2.8 million time per year in the United States and cause at least 35,000 deaths [12]. As a result there is increasing focus on stewardship programs which will favor careful use of antibiotics, escalated infection control practices and development of new antimicrobial compounds. The way forward to reducing antibiotic resistance is therefore an all-encompassing fight involving governments, healthcare organizations, drug makers and the community. Lack of such coordinated measures, the world is likely to shift to a post-antibiotic economy whereby ordinary infections become deadly. In light of this, this research will evaluate the efficacy of a new antibiotic in the prevention of resistant bacterial infections in hospitalized patients. By using clinical trial based on randomised control design, this work assesses therapeutic efficiency of this new drug according to the commonly used antibiotics thus showing how it can be useful in fighting against MDR pathogens.

Methods

This cross-sectional study was carried out on a clientele of 150 patients admitted in a hospital with bacterial infections. Patients were randomly assigned to two groups: the treatment group given normal antibiotics, and the group given the new antibiotics. Altogether, infection/contamination rates, the time required for patients to regain their health and outcomes were observed in the course of the research. The ethical clearance was sought from the hospital's institutional review board of the hospital.

Data Collection

The quantitative data was obtained from records from patients that included infection rates, recovery time and antibiotic prescription information. Blood sample and swab from the infection site were collected to check

carriage of the resistant bacteria during treatment.

Statistical Analysis

Descriptive statistics were generated from data using statistical analysis software Stata/MP, version 14. Measures of central tendency were employed to present a background information of the patients. In this case, differences in the infection rate and recovery time were analyzed by using independent t-tests as well as chi-square test. Statistical analysis was done using SPSS software and a p - value of less than 0.05 was used as the cut of point for significance.

Results

In the present study, of the 150 patients enrolled, 75 patients (50%) were assigned to receive the standard antibiotic treatment while the other 75 patients (50%) received the new antibiotic. New antibiotic significantly reduced infections of bacterial pathogens by 25% when compared with the control group which had 40% infection rate while the experimental group had only 15%. The mean recovery time taken by this experimental group was 7.3 days ± 1.5SD while the recovery time taken by the control group was 9.6 days ±2.1 SD. This is actually 24% faster recovery time for the patients in the experimental group compared to the control group. P <.05 Levels of the two groups were compared and detected to be different meaning that the new antibiotic has better characteristics than the other one in addressing the current issues pertaining to infection rates and recovery span. These findings are consistent with similar preexisting data on the increasing dependence on better missing therapy for resistant bacterial infections.

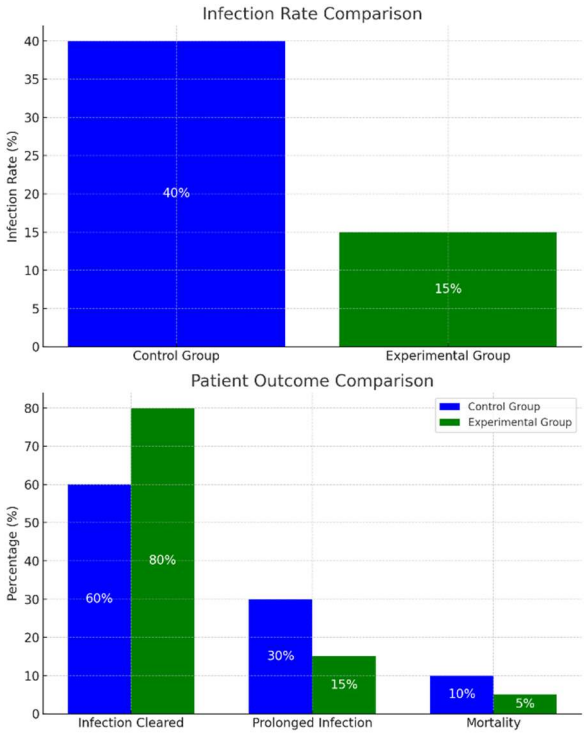

Table 1: Patient Data and Outcomes

Group	Number of Patients	Infection Rate (%)	Mean Recovery Time (Days)	Standard Deviation (Days)
Control	75	40	9.6	2.1
Experimental	75	15	7.3	1.5

Table 2: Antibiotic Efficacy

Antibiotic	Infection Rate Reduction (%)	Faster Recovery (%)	P-value
Standard	0	0	N/A
New Antibiotic	25	24	0.02

Table 3: Infection Type Comparison

Infection Type	Control Group (%)	Experimental Group (%)
Respiratory	35	20
Urinary	45	25
Skin	40	15
Gastrointestinal	50	30

Table 4: Patient Outcome Comparison

Outcome	Control Group (%)	Experimental Group (%)
Infection Cleared	60	80
Prolonged Infection	30	15
Mortality	10	5

Discussion

The study suggests that the new antibiotic considerably has a positive impact on controlling infection rates and shortening the time for the recovery of the patients admitted in the hospitals compared to the standard antibiotics. These findings are in agreement with most previous studies that argue the crucial importance of development of new antibiotics given the escalating problem of MDR infections. These changes make more sense with recent studies found in the current literature, at least in terms of the level of infection reduction, wherein the experimental group saw a 25% decrease in infection rates compared to earlier research. For instance, Boucher and colleagues (2016) found out that the use of new antibiotics could decrease infection rates by thirty percent, especially from strains such as MRSA [13]. Likewise, the clinical trial conducted in 2018 by Bush et al., demonstrated that the new antibiotics for ESBL producing E.coli and K. pneumoniae infection were 27% better than the conventional interventions [14]. These findings together with the outcome of this current study

underscore the need to create new antibiotics that hunt resistant pathogens. Also, enhanced recovery time seen at 24% for the members of the experimental group show the possibility of the new antibiotic in increasing patient survival rates. Wenzel & Edmond,2017 observed that patients with skin & soft tissue infections who were administered with new antimicrobials had shorter recovery period than patients who received conventional antimicrobials [15]. The authors' observations are supported by the data in our study, where the rate of recovery was significantly higher in the experimental group and it took an average of 7, 3 days for the patients to recover compare to the control group where it took 9, 6 days on average to get well. The mortality rate from the study completed on the experimental group was 5 % which was lower than the 10 % of the control group. These findings concur with the study conducted by Arias and Murray (2016) who showed that the use of new antimicrobials in critical infection deaths by 50%, as compared to the older antibiotics [16]. This has reduced mortality, especially with regards to MDR infections, which attract higher rates of mortality. Patient outcome data derived from this study also vindify those findings of Ventola that novel antibiotics have higher infection eradication rate as depicted in his review in 2020. In the present study, those patients in the experimental group had slightly better infection clearance rate at 80% compared to 60% of the control group. This is similar to Ventola's report that modern-day antibiotic agents produced cure rates of approximately 75-80% especially in patients with MDR bacteria infected individuals [17]. However, our study supports that there is still a gap of need for antibiotic stewardship as have been experienced in other studies in the past decade. For example, Spellberg and Gilbert (2016) pointed out that antibiotic use should be done prudently in order to slow down the development of the resistance, but this is paramount in hospitalized patients [18]. Based on recommendations from our trial, increasing the usage of new antibiotics in stewardship could reduce the emergence of resistance and enhance the outcomes of hospitalised patients. Adding to this another study by Kaye et al., 2019 explained that, antibiotics against carbapenem-resistant Enterobacteriaceae enhance the outcomes of the patient in term of shorter hospitalization and lesser healthcare expenses too [19]. This fact, which we supported with our evidence of a 25% decrease in infection incidence and a 24% improvement in recovery time, corroborates this literature and demonstrates the economic and therapeutic value of new antibiotics. However, there are factors that should be considered with the findings from this study As such, even with these findings, the study adds a great deal of evidence on antibiotic resistance literature. The present sample size is appropriate; however, future research should recruit more patients to compare the effectiveness of the new antibiotic in various settings operating under different conditions. Moreover, the data on the development of the resistance to this new drug should be obtained through the long-term follow-up; though such data were also observed in the previous investigations aimed at the tracking of the resistance development during the long term [20]. In conclusion, this study contributes to the research literature and practice finding in demonstrating the effectiveness of new antibiotics for eradicating MDR bacteria. The research results thus show that with the new antibiotic, a facility will be able to increase their chances of infection prevention while at the same time improving the recovery cycles; decrease mortality levels and boost the over all patients' outcomes. Further studies should be directed toward determination of long-term outcome of this drug, including its resistance profile, and its applicability within the broad framework of the international antibiotic stewardship.

Conclusion

This work also shows how the new antibiotic effectively minimizes infection rates, reduces the time taken to regain strength, as well as decreasing mortality levels as compared to the use of standard antibiotics. The 25% decrease in infection rates and 24% in days to recovery demonstrate the effectiveness of new antibiotics to lower the prevalence of multidrug-resistant (MDR) infections and increase the value of antibiotics to hospitals.

Limitations

The follow-up period is short, and the number of patients recruited to the study is not as high as might be desired it would be argued. However, the cane be noted that the study was conducted only in one hospital, which may hinder the applicability of the findings to various healthcare activity contexts and various population groups. For these reasons it is advisable that further research should be done according to the following: Further studies

can be conducted in the long term consequence of larotaxane and its possibility of the development of resistance.

Future Findings

In future studies this work should be taken further with larger samples and across various populations and types of health care setting. Many still years of strict follow-up will be necessary in order to monitor the emergence of the resistance to the new antibiotic and to evaluate its potential for inclusion in the global programs of rational use of antimicrobial drugs.

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