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CARBAPENEM RESISTANCE IN *ACINETOBACTER BAUMANNII*- IS IT WORTH THE HYPE? A RETROSPECTIVE STUDY DONE IN A TERTIARY CARE HOSPITAL

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Abstract

Background: *Acinetobacter baumannii*, frequently multidrug-resistant, poses a significant challenge in treating infections, particularly in the intensive care units (ICUs) of hospitals. Ventilator-associated pneumonia (VAP) caused by *Acinetobacter baumannii* is associated with high mortality rates and healthcare costs. Objective: This study aims to assess the prevalence and escalating antibiotic resistance of *Acinetobacter baumannii* isolates. Methods: Conducted as a retrospective cross-sectional investigation, data spanning December 2022 to December 2023 was collected from the Vitek2 system. Specimens were sourced from both ICU and general wards. Results: Analysis of data obtained from the Vitek2 system revealed 386 isolates of *Acinetobacter baumannii* across various specimen types, with prevalence rates of 41.7% (n=153), 27.4% (n=101), 18.4% (n=68), and 12.5% (n=46) in exudates, respiratory, urine, and blood samples, respectively. Patients with positive endotracheal culture for multidrug-resistant *Acinetobacter baumannii* exhibited a mortality rate exceeding 50% in ICU settings, indicating a high prevalence of VAP among critically ill patients. Conclusion: The widespread prevalence of multidrug-resistant *Acinetobacter baumannii* underscores its significance as a nosocomial pathogen, contributing to considerable morbidity and mortality. Combining interventions such as improving hand hygiene practices, educating healthcare staff about bacterial transmission via hands and contaminated environments, and revising infection control protocols is essential for controlling the spread of this organism in hospital settings.

Keywords: Acinetobacter Baumannii, Multi-Drug Resistant, Nosocomial, Carbapenemase, XDR.

INTRODUCTION

The taxonomy of the *Acinetobacter* genus has undergone substantial revisions in recent decades. Among its notable members, *Acinetobacter baumannii* has emerged as a significant pathogen in healthcare settings worldwide. *Acinetobacter baumannii*, a member of the Moraxellaceae family, is a Gram-negative bacterium primarily responsible for nosocomial infections. These infections encompass a wide range of conditions, such as hospital-acquired and ventilator-associated pneumonia (HAP, VAP), urinary tract infections, meningitis, bacteremia, as well as gastrointestinal and skin/wound infections. Instances of *Acinetobacter baumannii* strains displaying resistance to all available antibiotics have been documented, underscoring a critical issue demanding prompt attention from the global healthcare community. Adding to this concern is the organism's ability to persist in hospital environments for extended periods, facilitating its nosocomial transmission. *Acinetobacter baumannii* typically targets patients who are critically ill, particularly those with compromised skin integrity and inadequate airway protection [1]. 'Multi-drug resistant (MDR) *Acinetobacter spp*.' refers to isolates that demonstrate resistance to a minimum of three classes of antimicrobial agents, including all penicillins and cephalosporins (including inhibitor combinations), fluoroquinolones, and aminoglycosides. 'Extensively drug-resistant (XDR) *Acinetobacter spp*.' encompasses isolates that are resistant to the three

aforementioned classes of antimicrobials (MDR) and additionally exhibit resistance to carbapenems [2].

Carbapenems were previously the preferred treatment for multidrug-resistant (MDR) *Acinetobacter baumannii* infections. However, their extensive use has contributed to a notable rise in carbapenem resistance in recent years. Consequently, polymyxins have emerged as the primary antibiotics for treating MDR *Acinetobacter baumannii* infections, despite initial concerns regarding their systemic toxicity, including nephrotoxicity and neurotoxicity. The emergence of extensively drug-resistant isolates has spurred efforts to discover novel antimicrobials and develop new treatment strategies. *Acinetobacter baumannii* is recognized as one of the ESKAPE organisms, alongside *Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, and *Enterobacter spp*. These organisms collectively present a significant global health threat and pose a formidable therapeutic challenge due to their rising and evolving resistance patterns.[3]

Aım and Objectıve

The primary aim of this study was to assess the prevalence of *Acinetobacter baumannii* isolates and to investigate any trends indicating rising antibiotic resistance within these isolates. This objective entails examining the frequency at which *Acinetobacter baumannii* is encountered in clinical settings and evaluating whether there is a notable escalation in resistance to commonly used antibiotics among these isolates over time. By conducting such an analysis, the study seeks to provide insights into the current status of *Acinetobacter baumannii* infections and the potential challenges posed by antibiotic resistance in their management. This information is crucial for guiding antibiotic stewardship efforts and developing effective strategies to combat infections caused by this pathogen.

MATERIAL AND METHOD

This research adopts a retrospective cross-sectional design, which entails analyzing data collected over a specific period from December 2022 to December 2023. The data collection method utilized the Vitek2 system, a diagnostic tool commonly employed in clinical laboratories. Ethical clearance has been obtained, and the assigned number is available. (094/06/2023/IEC/SMCH) A total of 772 specimens were included in the study, representing a diverse range of samples obtained from both Intensive Care Units (ICU) and General wards within the healthcare setting. This approach allows for the comprehensive examination of bacterial characteristics and trends over time, providing valuable insights into the epidemiology and management of infectious diseases in different clinical settings.

RESULT

Information gathered from the VITEK2 system from December 2022 to December 2023 revealed noteworthy insights regarding *Acinetobacter baumannii* isolates. Among a total of 6,128 isolates, 772 were identified as *Acinetobacter baumannii*. The Intensive Care Unit (ICU) had the highest number of isolates, with 414 instances of *Acinetobacter baumannii*, while the ENT Ward had the lowest, with only 9 isolates as shown in Figure 1.

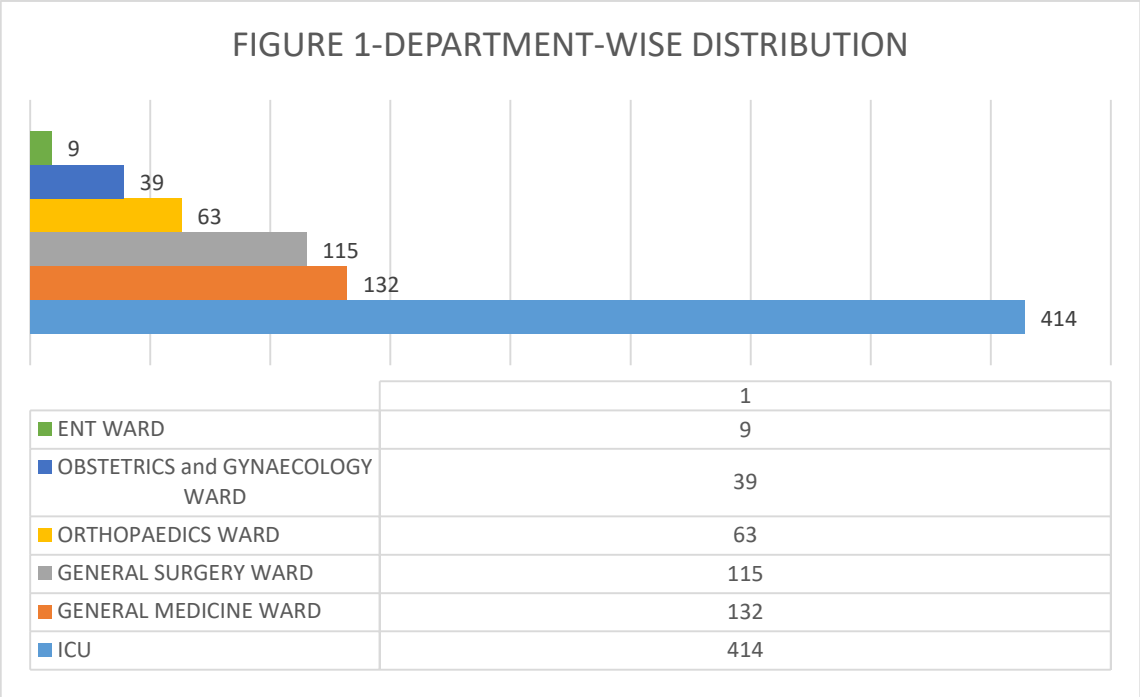

Figure 1: Department-wise distribution.

Among the 772 isolates identified, prevalence rates varied across different specimen types: exudates exhibited the highest prevalence at 41.7%, followed by respiratory samples at 27.4%, urine samples at 18.4%, and blood samples at 12.5%. The particular concern was the presence of multidrug-resistant (MDR) *Acinetobacter baumannii* strains, which were notably prevalent across all specimen types. These MDR strains were found in 138 exudate samples, 124 respiratory samples, 58 urine samples, and 44 blood samples, as depicted in figure 2, highlighting the widespread nature of antibiotic resistance in *Acinetobacter baumannii*.

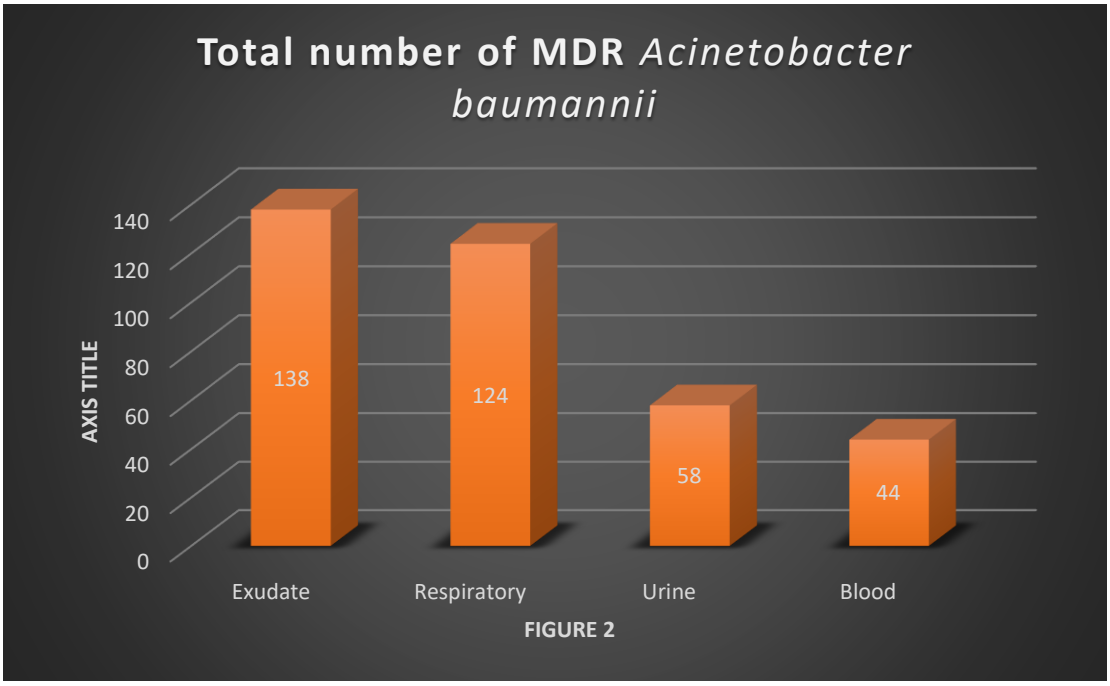

Figure 2: Total number of MDR *Acinetobacter baumannii* isolates

Within respiratory specimens, endotracheal (ET) cultures were performed, involving a total of 62 samples.Alarmingly, a substantial proportion of these samples (50 out of 62) had growth of MDR *Acinetobacter baumannii*. Furthermore, among these MDR strains, 42 exhibited resistances to carbapenem antibiotics. Significantly alarming was the mortality rate, exceeding 50% observed among ICU patients with positive endotracheal (ET) cultures for carbapenem-resistant *Acinetobacter baumannii*, suggesting a notable burden of ventilator-associated pneumonia.

DISCUSSION

The widespread prevalence of multidrug-resistant (MDR) *Acinetobacter baumannii* strains in healthcare environments represents a significant concern, posing a formidable challenge in the global fight against antimicrobial resistance. The extensive distribution of these strains across various specimen types, including exudate, respiratory, urine, and blood samples, underscores the profound and pervasive nature of *Acinetobacter baumannii*'s resistance to antibiotics. Of particular concern is the high frequency of MDR *Acinetobacter baumannii* growth detected in respiratory specimens, notably in endotracheal (ET) cultures. The substantial proportion of these cultures yielding MDR strains resistant to carbapenem antibiotics raises serious concerns about the diminishing effectiveness of available treatment options for these infections.

Furthermore, the troubling revelation of a mortality rate exceeding 50% among ICU patients with positive ET cultures for carbapenem-resistant *Acinetobacter baumannii* accentuates the tangible impact of these infections on patient outcomes. This highlights the urgent need for robust antimicrobial stewardship initiatives and rigorous infection control measures to limit the spread of MDR *Acinetobacter baumannii* and alleviate the associated burden of ventilator-associated pneumonia [4]. Given the limited treatment options due to multidrug resistance, judicious use of antibiotics is crucial in managing *Acinetobacter baumannii*-related VAP. Combination therapy and alternative agents such as polymyxins may be necessary in severe cases. Moreover, ongoing research into novel antimicrobial agents and vaccines against *Acinetobacter baumannii* hold promise for future prevention and treatment strategies.

Overall, addressing VAP caused by *Acinetobacter baumannii* requires a concerted effort from healthcare providers, infection control teams, and researchers to implement effective preventive measures and develop innovative treatment approaches. By taking proactive steps to combat this challenging pathogen, healthcare facilities can improve patient outcomes and reduce the burden of VAP in ICU settings [5]. In essence, these findings illustrate the critical importance of concerted efforts to address antimicrobial resistance in healthcare settings, emphasizing the need for prudent antibiotic usage, enhanced surveillance, and innovative strategies to combat this growing threat to public health. Enhanced cleaning and disinfection protocols, bundling patients, implementing active surveillance, and promoting antimicrobial stewardship practices can further contribute to controlling *Acinetobacter baumannii* outbreaks. By combining these interventions and fostering a multidisciplinary approach to infection control, healthcare facilities can effectively mitigate the spread of multidrug-resistant *Acinetobacter baumannii* and reduce the associated burden on patient health outcomes. The findings of the study reveal a concerning pattern indicating a gradual rise in the prevalence of multi-drug resistant *Acinetobacter baumannii* isolates. This suggests an escalating trend over time, indicating a growing challenge in the management of infections caused by this pathogen. Such an increase

in resistant strains could potentially lead to difficulties in treating infections effectively, posing significant implications for patient care and public health [6]. Therefore, the buzz surrounding carbapenem-resistant *Acinetobacter baumannii* is justified.

CONCLUSION

The extensive presence of multidrug-resistant *Acinetobacter baumannii* highlights its substantial influence as a nosocomial pathogen, presenting a significant challenge in healthcare settings globally. Controlling *A. baumannii*-related VAP requires a multifaceted approach. Rigorous adherence to infection control measures, including proper hand hygiene, environmental cleaning, and the use of personal protective equipment, is paramount to prevent transmission within healthcare facilities. Additionally, strategies such as implementing active surveillance, and promoting antimicrobial stewardship practices can help limit the spread of the bacterium and reduce the risk of VAP[7]. Ensuring rigorous adherence to hand hygiene protocols can significantly reduce the transmission of *Acinetobacter baumannii* and other healthcare-associated pathogens. Furthermore, revising infection control protocols to incorporate specific measures tailored to combat *Acinetobacter baumannii* is crucial.

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