ACINETOBACTER BAUMANNII ISOLATED FROM BURN PATIENTS: PREVALENCE AND DRUG RESISTANCE PATTERN

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ABSTRACT: Background: Clinicians recently have had serious concerns because of the prevalence and spread of Multi Drug Resistant *A. baumannii* in infections those patients in hospitals contract. Because it can colonize and spread illnesses among patients in the critical care unit (ICU) who have immunocompromised state. In the hospital context, *Acinetobacter baumanii* has become a significant opportunistic pathogen.

Material and Methods: The investigation was conducted From June 2022 to May 2023 and 368 isolates of *A. baumannii* from burned patients were used. All patients had regular wound cultures performed 24 hours following a burn injury. The entirety of the clinical sample that was obtained at the microbiology lab underwent tests for AST, identification, and isolation by using standard microbiology protocol. There were no duplicate clinical samples among the 870 clinical samples from which we obtained 368 *Acinetobacter baumannii* isolates over the course of a year.

Results: The 870 clinical specimens yielded a total of 594 pathogenic bacteria, giving the clinical specimen a 68.3% culture positivity rate. *A. baumannii* had 368 isolated cases, which corresponds to a 62% prevalence rate. In all clinical samples wound samples consistently produced the highest percentage of positive *A. baumannii* cultures. According to demographic distribution most of the infections occurred in male patients (77.4%) as compared to female patients (22.6%).

Conclusion: There is an urgent need for diligent microbiological monitoring everywhere in clinical settings due to the lack of new antibiotics currently being developed and the rise of bacteria that are multidrug resistant and pan drug-resistant.

Keywords: *Acinetobacter baumannii*, Multidrug Resistant, Burn patients, Drug Resistance.

Introduction

Clinicians recently have had serious concerns because of the prevalence and spread of Multi Drug Resistant *A. baumannii* in infections those patients in hospitals contract. Only a handful of the illnesses include bacteraemia, pneumonia brought on by a ventilator, meningitis, infections of the, typical wounds, burns and urinary tract. [1-3] Because it can colonize and spread illnesses among patients in the critical care unit (ICU) who have immunocompromised state, In the hospital context, *Acinetobacter baumanii* has become a significant opportunistic pathogen. [4] Additionally, it is infecting burn victims as well as other immunocompromised people. [5] Widespread multidrug resistance complicates the antimicrobial therapy of such serious illnesses. The exceptional capacity of *A. baumanii* to build resistance against key antibiotic classes through a variety of pathways is one of the organism's most noticeable characteristics. [6] Penicillin-binding protein changes, the presence of different enzymes, and decreased penetration through the outer membrane are just a few of the mechanisms that contribute to *A. baumanii* resistance. [7] With the exception of colistin and tigecycline, it is possible for *A. baumanii* isolates to exhibit full resistance when multiple pathways are co-expressed. [8]. One of the additional modalities of beta-lactam resistance, along with modifications to antibiotic target sites and efflux pumps, the elimination of the porin channel. Additionally, it seems to be a factor in beta-lactam drug resistance. [7] *A. baumanii* has several antibiotic resistances, making it challenging to treat serious infections brought on by this organism. [6] In order to prevent further difficulties and start the right medications, it is imperative to identify these drug-resistant microorganisms and their resistance patterns in patients with burns that are infected with them. *A. baumannii* infections are frequently treated with carbapenems, particularly imipenem. However, significant degrees of resistance have arisen, leading to therapeutic failure. [9] The most frequent reason for carbapenem resistance is the emergence of carbapenemases type enzymes in *A. baumannii*. [10-11]

Material and method

The current study was carried out by the Microbiology Department at the Hind Institute of Medical Sciences in Lucknow, Uttar Pradesh, India. The investigation was conducted From June 2022 to May 2023 and 368 isolates of *A. baumannii* from burned patients were used. A burn team composed of skilled surgeons, infectious disease experts, dieticians, psychiatrists, and physical therapists made daily visits to all patients. All study participants provided their written informed permission. Using the 2013 version of MS Excel, the results were statistically analyzed in terms of numbers and percentages.

Collection and processing of samples

Each suitable clinical sample that satisfied the predetermined inclusion criterion was obtained independently. All patients had regular wound cultures performed 24 hours following a burn injury. Depending on the clinical judgment at various periods throughout the hospitalization, it would be repeated to culture the wounds. Following accepted collection procedures, all wound swab samples were taken. Only those patients who had a strong suspicion of being infected were given blood cultures and other regular cultures, such as those of urine, bronchial secretions, faeces, and the centrally placed CV line. The entirety of the clinical sample that was obtained at the microbiology lab underwent tests for AST, identification, and isolation by using standard microbiology protocol. There were no duplicate clinical samples among the 870 clinical samples from which we obtained 368 *Acinetobacter baumannii* isolates over the course of a year. These *Acinetobacter* isolates were recognized using traditional techniques in accordance with accepted microbiology laboratory protocol, and they were subsequently recognized by examining the cultural characteristics on standard lab culture medium. Manual biochemical test methods were utilized to identify the species, and then pure isolates of the *Acinetobacter spp.* were employed for further research. For the isolation and identification of bacteria, standard operating procedure was followed. [12]

Antibacterial Drug Susceptibility Testing The established Kirby-Bauer method was used to assess the isolates' sensitivity to various antibiotics in accordance with CLSI guidelines. Inhibition zone was interpreted according to standard guidelines. The susceptibility profile of clinical isolates was evaluated using the Standard Antibiotic disc (Hi-Media laboratories, Mumbai, India).

Statistical Analysis

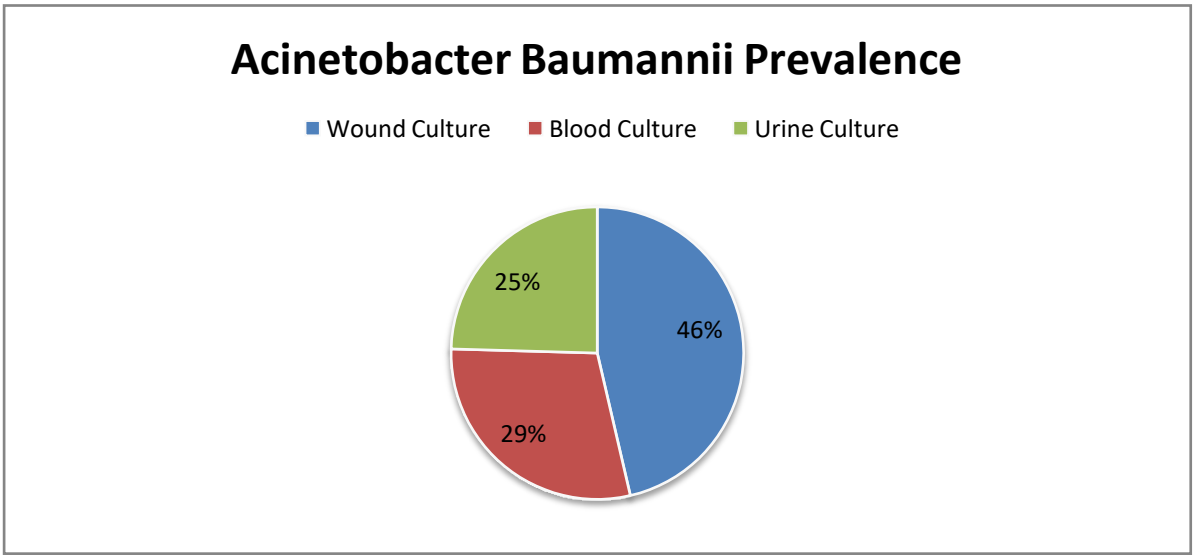
Using SPSS 16, statistical analysis was performed on the collected data. A significant or highly significant result was defined as a p value of less than 0.05 or less than 0.01.

Results

The 870 clinical specimens yielded a total of 594 pathogenic bacteria, giving the clinical specimen a 68.3% culture positivity rate. *A. baumannii* had 368 isolated cases, which corresponds to a 62% prevalence rate. Each isolate's identification as *Acinetobacter baumannii* was made possible by the results of the biochemical assays. As demonstrated in (Table-1) and diagram No.1, wound samples consistently produced the highest percentage of positive *A. baumannii* cultures. These samples were taken from patients with various clinical conditions.

Table 1Showing the Positive Culture Frequency Depending on Culture Type.

Culture Type			
Wound Culture	674	493(73.1%)	328(66.5%)
Blood Culture	126	67(53.1%)	28(41.7%)
Urine Culture	70	34(48.5%)	12(35.2%)
Total	870	594	368



From 0.8% for colistin to 100% for piperacillin- tazobactam, *Acinetobacter spp.* exhibited varying degrees of resistance to the employed antibiotics. Considering the high levels of resistance (93 to 96%), some of these antibiotics, including ampicillin, imipenem, and meropenem, were essentially worthless in vitro against *Acinetobacter spp*. Due to their high levels of resistance to fluoroquinolones (93%), cephalosporins (92%–96%), penicillins (97%), carbapenems (93%–94%), beta-lactams, and beta-lactamase inhibitors (82%–100%), All *Acinetobacter species*, it could be argued, were MDR. *Acinetobacter spp.* was showing least resistance against colistin i.e. 99% .According to demographic distribution most of the

infections occurred in male patients (77.4%) as compared to female patients (22.6%) which was shown in diagram No.2.

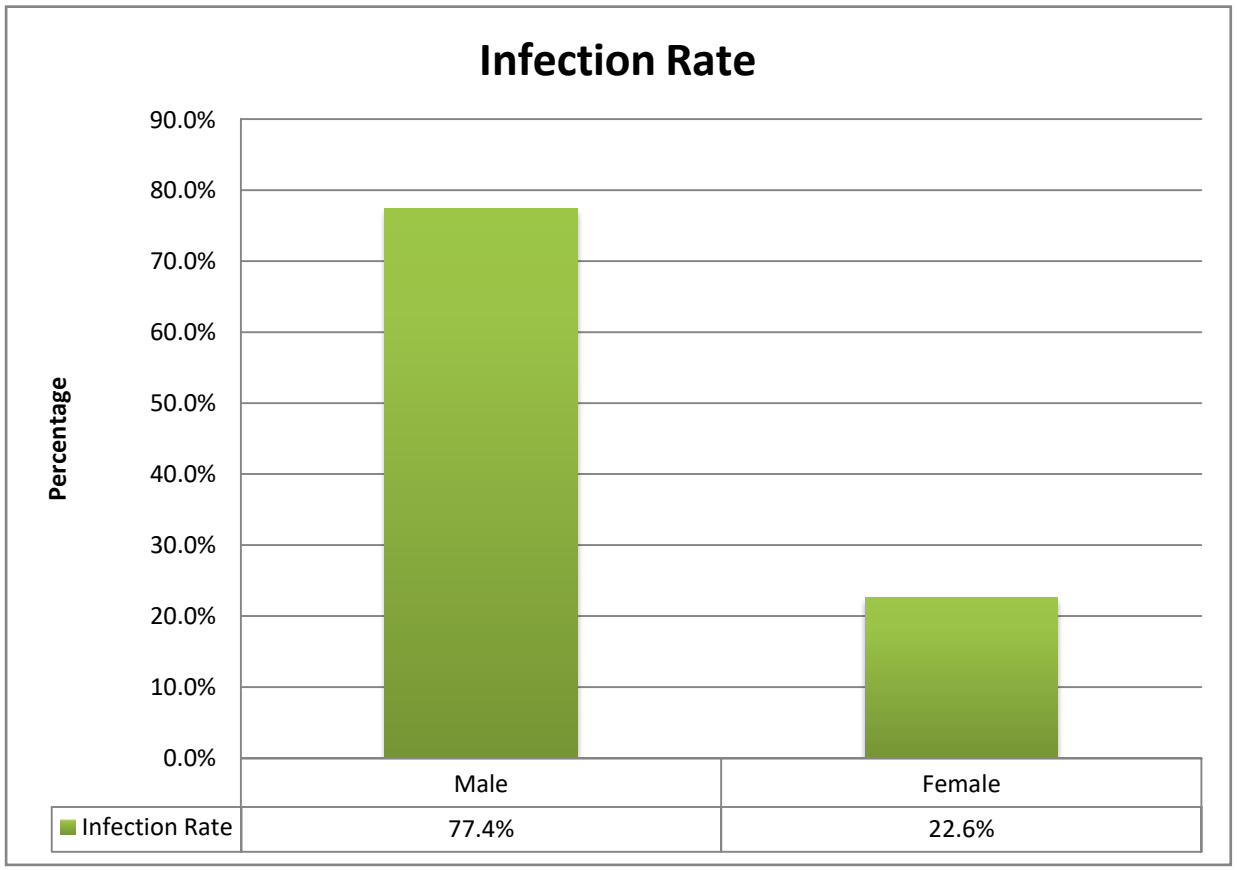


Table2: *Acinetobacter baumannii's* resistance profile to various antibacterial agents.

Antibiotics	**Resistant**	**Intermediate**	**Sensitive**
Fluroquinolones			
Ciprofloxacin	329(93.2%)	6(1.7%)	18(5%)
Cephalosporins			
Cefepime	285(92.5%)	4(1.3%)	19(6.2%)
Cefotaxime	158(95.1%)	0(0)	8(4.8%)
Ceftazidime	261(96%)	2(0.7%)	9(3.3%)
Penicillins			
Ampicillin	249(96.1%)	0(0)	10(3.8%)
Aminoglycosides			
Gentamicin	205(57%)	4(1.1%)	151(42%)
Amikacin	212(82.8%)	15(5.9%)	29(11.3%)
Polymyxins			
Colistin	02(0.8%)	0(0)	246(99.1%)

Carbapenems			
Imipenem	205(93.1%)	2(0.9%)	13(5.9%)
Meropenem	213(94.2%)	2(0.8%)	11(4.9%)
Betalactamase inhibitors			
Piperacillin	23(82.1%)	5(17.8%)	0(0)
Piperacillin-tazobactam	14(100%)	0(0)	0(0)

Discussion

In our investigation, *Acinetobacter baumanii* was the organism that was most frequently isolated from burn wounds. In India, *Pseudomonas aeruginosa* and *Acinetobacter spp.* are two more prevalent isolates from burn wounds. [14] Numerous researches revealed that *Staphylococcus aureus* predominately causes burn wound infection. [15-16] In recent years, particularly in burn patients and ICUs, *A. baumannii* infections have emerged as the primary factor in patients admitted to hospitals who have the highest morbidity. [17] *A. baumanii* is a resilient pathogen linked to significant fatality rates, particularly in hospitalized patients. Since *Acinetobacter spp*. were shown to be the main bacterial isolates in burn wounds, the antimicrobial resistance pattern's findings are quite concerning. Because *Acinetobacter species* have a high level of beta-lactam resistance, for severe infections brought on by *A. baumanii*, carbapenems have recently been the drug of choice, and however strains resistant to it are emerging rather quickly. The emergence of beta-lactamases that hydrolyze carbapenem with porin mutations is by far the most important factor contributing to carbapenem resistance in *A. baumanii*, however other contributing variables also play a role. [18] In contrast to earlier research, our investigation found a much greater incidence of drug resistance to Meropenem (94.2%), Imipenem (93.1%), Amikacin (82.8%), and Ciprofloxacin (93.2%). [19-22] The outer membrane's structure is disrupted by Colistin, making it an inactive target for antibiotic activity. Our analysis revealed that the tested isolates had great susceptibility to Colistin (99%) and Gentamicin (almost 50%), Moreover, their results agreed with those of Sarhaddi *et al*. [23] the research carried out by Gupta *et al.* has shown the higher resistance (12.95%) against Colistin as compared to our study. [24] The differing medical methods in various geographical places have been blamed for the variety in isolated bacteria found in burn sites.

Conclusion

There is an urgent need for diligent microbiological monitoring everywhere in clinical settings due to the lack of new antibiotics currently being developed and the rise of bacteria that are multidrug resistant and pan drug-resistant. Knowing whether there are bacteria present and their resistance pattern will surely assist the clinician select the best drugs, especially in countries with limited resources. It also helps in the development of recommendations for empirical antibiotic therapy to avoid infections.

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