

Minocycline For Treatment of Infections by Pan-Resistant *Acinetobacter baumannii* in An Indian ICU

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Abstract

Introduction: *Acinetobacter baumannii* is a non-fermentative, Gram-negative bacterium that belongs to the *Acinetobacter* genus within the family Moraxellaceae. This pathogen has emerged as a significant cause of healthcare-associated infections (HAIs), particularly in intensive care units (ICUs) and among critically ill patients. *A. baumannii* is responsible for a wide array of infections, including ventilator-associated pneumonia (VAP), bloodstream infections, urinary tract infections, and wound infections, particularly in patients with compromised immune systems, those undergoing surgery, or those with underlying conditions such as diabetes.

Aims: To assess high doses of minocycline's safety and effectiveness in treating nosocomial infections brought on by pan-resistant *A. baumannii* in an intensive care unit in India.

Materials & Methods: The present study was a prospective study. This Study was conducted from One year at Department of critical Kailash Hospital & Heart Institute. Total 100 patients were included in this study.

Result: In our study, 22% patients had Head Injury, 22% patients had COPD, 18% patients had Polytrauma, 18% patients had Post-operative, 8% patients had Chest Trauma, 6% patients had Pneumonia and 6% patients had Sepsis Syndrome. The value of z is 3.2606. The value of p is 0.00112. The result is significant at $p < 0.05$.

Conclusion: *Acinetobacter baumannii* is a serious nosocomial pathogen that can cause wound infections, bloodstream infections, and pneumonia. It is a global healthcare concern due to its capacity to thrive in hostile circumstances and quickly acquire antimicrobial resistance, particularly extensively drug resistance (XDR) and multidrug resistance (MDR).

Keywords: *Acinetobacter*, *Baumannii*, ICU and Cure.

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Introduction

Acinetobacter baumannii is a non-fermentative, Gram-negative bacterium that belongs to the *Acinetobacter* genus within the family Moraxellaceae. This pathogen has emerged as a significant cause of healthcare-associated infections (HAIs), particularly in intensive care units (ICUs) and among critically ill patients. *A. baumannii* is responsible for a wide array of infections, including ventilator-associated pneumonia (VAP), bloodstream infections, urinary tract infections, and wound infections, particularly in patients with compromised immune systems, those undergoing surgery, or those with underlying conditions such as diabetes. The aerobic, pleomorphic, non-motile bacillus *Acinetobacter baumannii* is Gram-negative. *A. baumannii* is an opportunistic infection that is highly prevalent in immunocompromised people, especially those who have had a lengthy hospital stay (> 90 days). [1] It is frequently found in aquatic settings and has been demonstrated to colonize the

skin in addition to being isolated in large quantities from the respiratory and oropharyngeal secretions of sick people. [2] Its wide range of antibiotic resistance has led to its designation as a "red alert" human pathogen in recent years, which has alarmed the medical community. [3] In relation to nosocomial and community-acquired illnesses, the emergence of multidrug-resistant (MDR) microorganisms has grown to be a major issue. [4] Antimicrobial resistance has, in fact, lately been named by the World Health Organization (WHO) as one of the top three issues affecting human health. The abbreviation "ESKAPE," which stands for *Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, and *Enterobacter* spp., encompasses the most prevalent and dangerous MDR pathogens. [5] Although it is believed that *A. baumannii* was susceptible to the majority of antibiotics in the 1970s, the pathogen now seems to

show widespread resistance to the majority of first-line antibiotics. More recently, *A. baumannii* has emerged as a significant source of worry in war areas. It has garnered recognition in the recent desert battles in Iraq, where it has been dubbed "Iraqibacter." Specifically, after Operation Iraqi Freedom (OIF), there have been increased rates of MDR bacteremia (bloodstream infections) among US Army personnel. [6] Interest from the scientific community over the past 15 years has led to significant advances of our understanding of this organism. To assess high doses of minocycline's safety and effectiveness in treating nosocomial infections brought on by pan-resistant *A. Baumannii* in an intensive care unit in India.

Material of Methods

Study Type (Design): This is an open label prospective study over a period of 6 months, done on 50 pts.

Study Setting: Department of critical Kailash Hospital & Heart Institute.

Study Period: One year.

Sample Size: 100.

Inclusion Criteria: All patients above 18 year of age of either gender. All patients are intubated and on mechanical ventilation.

Exclusion Criteria: Patient below 18 year of age. Patients with hypersensitivity to tetracyclines or any of its formulation components.

Parameters Studied

- CBC
- LFT
- PT

Cure Rate

- * Clinical Cure
- * Microbiological Cure
- * Radiological Cure

Methods

- Open-label prospective study
- 50 adult patients of either sex
- 12 months period
- Routine investigations

Cultures

BAL/Blood / Urine / Drains Surgical site

48 hrs; Day 5, 7 & on Clinical Cure

Upon isolation of *A. Baumannii*: Minocycline 200mg as i/v infusion over 60 min every 12 hrs Continued till resolution of pathology

Statistical Analysis: For statistical analysis, data were initially entered into a Microsoft Excel spreadsheet and then analyzed using SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism (version 5). Numerical variables were summarized using means and standard deviations, while categorical variables were described with counts and percentages. Two-sample t-tests, which compare the means of independent or unpaired samples, were used to assess differences between groups. Paired t-tests, which account for the correlation between paired observations, offer greater power than unpaired tests.

Chi-square tests (χ^2 tests) were employed to evaluate hypotheses where the sampling distribution of the test statistic follows a chi-squared distribution under the null hypothesis; Pearson's chi-squared test is often referred to simply as the chi-squared test. For comparisons of unpaired proportions, either the chi-square test or Fisher's exact test was used, depending on the context. To perform t-tests, the relevant formulae for test statistics, which either exactly follow or closely approximate a t-distribution under the null hypothesis, were applied, with specific degrees of freedom indicated for each test. P-values were determined from Student's t-distribution tables. A p-value ≤ 0.05 was considered statistically significant, leading to the rejection of the null hypothesis in favour of the alternative hypothesis.

Result

Table 1: Isolation Sites

BAL	88%
Surgical Site	8%
Drain	2%
Blood	2%

Table 2: Cure Rates

	Number	2-tailed Significance
Radiological Cure	44	P< 0.001*
Microbiological Cure	50	P<0.001*
Clinical Cure	46	P<0.001*

Table 3: Patient Characteristics

Diagnosis	%
Head Injury	22%
COPD	22%
Polytrauma	18%
Post-operative	18%
Chest Trauma	8%
Pneumonia	6%
Sepsis Syndrome	6%

Table 4: Length of stay & Duration of therapy (Days, mean + SD)

Length of stay in ICU	10.4 ± 2.5
LOS on ventilator	7.3 ± 2.4
No. of days on Minocycline	8.4 ± 1.1

In our study, 88% patients had BAL, 8% patients had Surgical Site, 2% patients had Drain and 2% patients had Blood.

The value of z is 12.2235. The value of p is < 0.00001. The result is significant at $p < 0.05$.

In our study, 44 patients had Radiological Cure. This was statistically significant ($p < 0.001$).

In our study, 50 patients had Microbiological Cure. This was statistically significant ($p < 0.001$).

In our study, 46 patients had Clinical Cure. This was statistically significant ($p < 0.001$).

In our study, 22% patients had Head Injury, 22% patients had COPD, 18% patients had Polytrauma, 18% patients had Post-operative, 8% patients had Chest Trauma, 6% patients had Pneumonia and 6% patients had Sepsis Syndrome.

The value of z is 3.2606. The value of p is 0.00112. The result is significant at $p < 0.05$.

In above table showed that the mean Length of stay in ICU (mean±s.d.) of patients was 10.4 ± 2.5 .

In above table showed that the mean LOS on ventilator (mean±s.d.) of patients was 7.3 ± 2.4 .

In above table showed that the mean No. of days on Minocycline (mean±s.d.) of patients was 8.4 ± 1.1 .

Discussion

We found that, most number of patients had BAL 88%. It was statistically significant ($p < 0.00001$), ($z=12.2235$).

Roca I et al [7] (2012) showed that for severe infections caused by multidrug-resistant *A. baumannii*, the combination of colistin and rifampicin appears to be a safe and successful treatment, as evidenced by the clinical and microbiological response seen in 22 out of 29 cases (76%).

We showed that, majority of the patients had Microbiological Cure [50] and it was statistically significant ($p < 0.001$)

We observed that, significantly higher of patients had Head Injury and COPD Diagnosis 22%. ($p=0.00112$), ($z=3.2606$)

Elbehiry A et al [8] (2023) observed that long hospital admissions and intensive care unit stays are the source of infections brought on by this bacterial pathogen, which are linked to higher rates of morbidity and death.

In our study, the mean Length of stay in ICU of patients was [10.4 ± 2.5].

Conclusion

Acinetobacter baumannii is a serious nosocomial pathogen that can cause wound infections, bloodstream infections, and pneumonia. It is a global healthcare concern due to its capacity to thrive in hostile circumstances and quickly acquire antimicrobial resistance, particularly extensively drug resistance (XDR) and multidrug resistance (MDR).

Strong antimicrobial stewardship, improved infection control procedures, and novel treatment strategies—such as bacteriophage therapy and vaccine development—are all necessary to counter this danger. Fighting its spread requires an understanding of its virulence factors and resistance mechanisms. *A. baumannii* will continue to pose a major risk to patient safety and public health globally unless immediate action is taken.

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