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Original Research Article:

Unveiling the Resistant Patterns of Acinetobacter Baumannii : A Comprehensive Retrospective Analytical Study across Various Clinical Samples.

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Abstract:

Aim: To study the prevalence of Acinetobacter spp and its antibiotic resistance patterns in a Private hospital, Nashik.
Materials and methods: A retrospective study, including samples from various departments, submitted to the microbiology laboratory from January 2023to December 2023. All the samples were processed according to standard conventional methods, and the Acinetobacter isolates were studied in detail about the demographic characters, speciation, and antibiotic susceptibility pattern. **Results:** Out of the 895 positive isolates, Ninety (7.24 %) were identified as *Acinetobacter* species. Among the Ninety isolates, 81 (90%) were identified as *A. baumannii* and 9 (16.67%) as other *Acinetobacter* species. The demographic data of the specimens yielding growth of *Acinetobacter spp* showed maximum number 30/90 of *Acinetobacter* isolates were recovered from 46-65 years age. Cephalosporins had the highest resistance to the isolates (ceftazidime 85% is more resistant than ceftriaxone 80%), Aminoglycosides, (Gentamicin 74% slightly higher resistance than Amikacin (62%) Fluoroquinolones (Levofloxacin 69% somewhat more resistant than Ciprofloxacin 65%.
Conclusion: The study suggests susceptibility testing to be done to help select the best antimicrobial drugs for therapy, thus helping in judicial use of antibiotics is necessary to prevent the emergence of antimicrobial resistance.

Keywords: Non-fermenters, ICU (Intensive care units), Drug resistance

Introduction:

Gram-negative bacterial (GNB) infections are one of the most crucial health problems not only in the community but also in hospitalized patients. Due to the Lipopolysaccharide layer (LPS), GNB's, are known to cause sepsis at a higher rate and hence increased morbidity and mortality of patients [1].

Two large groups, Enterobacteriaceae and the non-fermenters, are responsible for most clinical isolates from cases of gram-negative infections [2]. Though the proportion of infection with non-fermenters is less when compared to that of Enterobacteriaceae, non-fermenters are of

critical importance given the severity of infections they can cause and intrinsic resistance to most antibiotics [3].
Acinetobacter baumannii, a notorious Gram-negative bacterium, has garnered significant attention in recent years due to its remarkable ability to develop resistance against a wide range of antibiotics. Its resilience poses a substantial challenge in clinical settings, leading to increased morbidity, mortality, and healthcare costs.

In the realm of healthcare, the emergence and spread of multidrug-resistant organisms (MDROs) pose a significant challenge, often complicating treatment modalities and leading to adverse patient outcomes. Among these resilient pathogens, Acinetobacter baumannii stands out as a notorious culprit, notorious for its ability to develop resistance to multiple antimicrobial agents. This retrospective analytical study delves into the intricate resistant patterns of Acinetobacter baumannii, sourced from diverse clinical samples, shedding light on the evolving landscape of antimicrobial resistance.

This retrospective analytical study aims to comprehensively analyze the resistant patterns of Acinetobacter baumannii isolated from different clinical samples. By examining data collected over a substantial period, encompassing diverse patient populations and healthcare settings, the study seeks to provide insights into the prevalence and evolution of antimicrobial resistance in this pathogen.

Material & Methods: The study involves the retrospective analysis of microbiological data obtained from clinical samples collected over a specified timeframe from healthcare facilities. Isolates of Acinetobacter baumannii obtained from various sources, including respiratory specimens, blood cultures, urine samples, and wound swabs, are subjected to antimicrobial susceptibility testing using standardized methods. The resistance profiles of these isolates are meticulously documented and analyzed to discern trends and patterns.

Present study was carried out in a 100 bedded hospital, with 4 ICUs (medical, surgical, paediatric and neonatal), located in Nashik, Maharashtra.
This is a retrospective study carried out over one year from January 2023 to December 2023. All the samples submitted to the microbiology laboratory for culture and antibiotic susceptibility during this one year were included in the study. All samples were subjected to routine microscopy, Gram staining and inoculated onto Blood agar and MacConkey agar for primary isolation and incubated aerobically at 37°C for 18-24 hours. Identification of isolates was performed by standard conventional methods based on the colony morphology, preliminaries like gram staining, catalase, oxidase, motility. Various biochemical tests were used to identify genus *Acinetobacter* like indole, citrate utilization test, urease test, triple sugar iron agar test, phenylalanine deaminase test. Identification of *Acinetobacter baumanni* species was made conventionally using specific tests like oxidative/fermentation glucose test, Arginine decarboxylation, and growth at 42°C [4]. Antibiotic susceptibility testing was performed by the Kirby Bauer disc diffusion method on Mueller-Hinton agar plates and interpreted according to the CLSI guidelines [5].
All the *Acinetobacter* isolates were tested for their antibiotic susceptibilities for various classes of antimicrobials using the following antibiotic discs: Cephalosporins (ceftazidime, ceftriaxone), Aminoglycosides, (Gentamicin, Amikacin), Fluoroquinolones (Levofloxacin, Ciprofloxacin), beta-lactam and beta-lactamase inhibitor combination drugs (Ampicillin + Sulbactam, Piperacillin + Tazobactum), [6].
Inclusion criteria: The study included all *Acinetobacter species* isolated from various specimens of all ages and different wards, including ICU and non-ICU settings.
Exclusion criteria: specimens with incomplete Patient demographics, antimicrobial

susceptibility testing reports that did not comply with Clinical and Laboratory Standards Institute guidelines (CLSI) were excluded.

Statistical Analysis: All the Data was statistically analysed using SPSS Software (Version 26.0). Chi-square test and descriptive statistics were used to calculate the prevalence of *Acinetobacter species. P-values* less than 0.05 were considered statistically significant.

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Results:

Out of the 895 positive isolates, ninety (7.24 %) were identified as *Acinetobacter* species. Among the ninety isolates, 81 (90%) were identified as *A. baumannii* and 9 (16.67%) as other *Acinetobacter* species. The demographic data of the specimens yielding growth of *Acinetobacter spp* showed maximum number 30/90 of *Acinetobacter* isolates were recovered from 46-65 years age group, followed by 26-45 year age group (19/90). It also reveals that male to female ration was 2:1. Male were 60(67%) and female were 30(33%) **(Figure 1 & Figure 2).**

The distribution of various samples which yielded *Acinetobacter* isolates is discussed in fig 2, with endotracheal secretions 36% being the significant proportion. Other specimens are blood (28 %), pus (20%), sputum (7%), urine (4%), CSF (3%) & bone (2%). **(Figure 3).**

Figure 4 reveals Antibiotic susceptibilities. Overall resistance percentages of *Acinetobacter Spp* for various classes of antibiotics the resistance patterns are as described. Cephalosporins had the highest resistance to the isolates (ceftazidime 85% is more resistant than ceftriaxone 80%), Aminoglycosides, (Gentamicin 74% slightly higher resistance than Amikacin (62%) Fluoroquinolones (Levofloxacin 69% somewhat more resistant than Ciprofloxacin 65%. When tested for beta-lactam and beta-lactamase inhibitor combination drugs, isolates showed slightly more resistance to Ampicillin + Sulbactam (61%) than Piperacillin + Tazobactum (55%).. Almost all the isolates showed resistance to any one of the classes of antibiotics mentioned above.

Figure 1:Distribution of study subjects according to age.

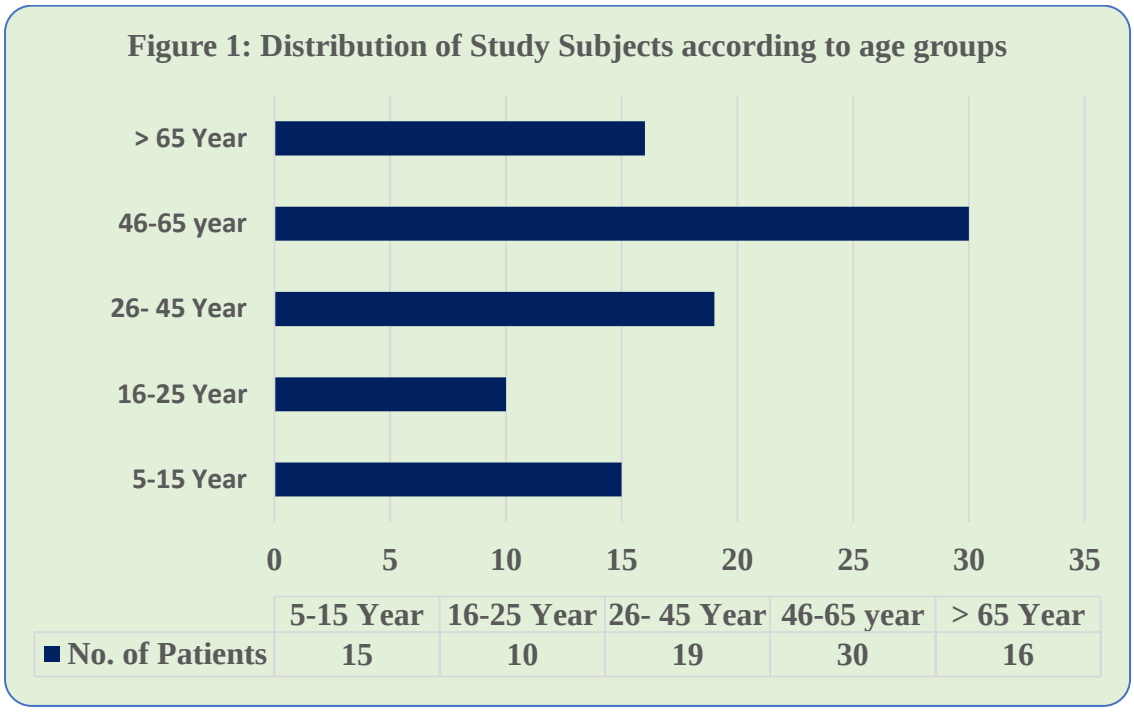


Figure 2: **Distribution of study subjects according to gender.**

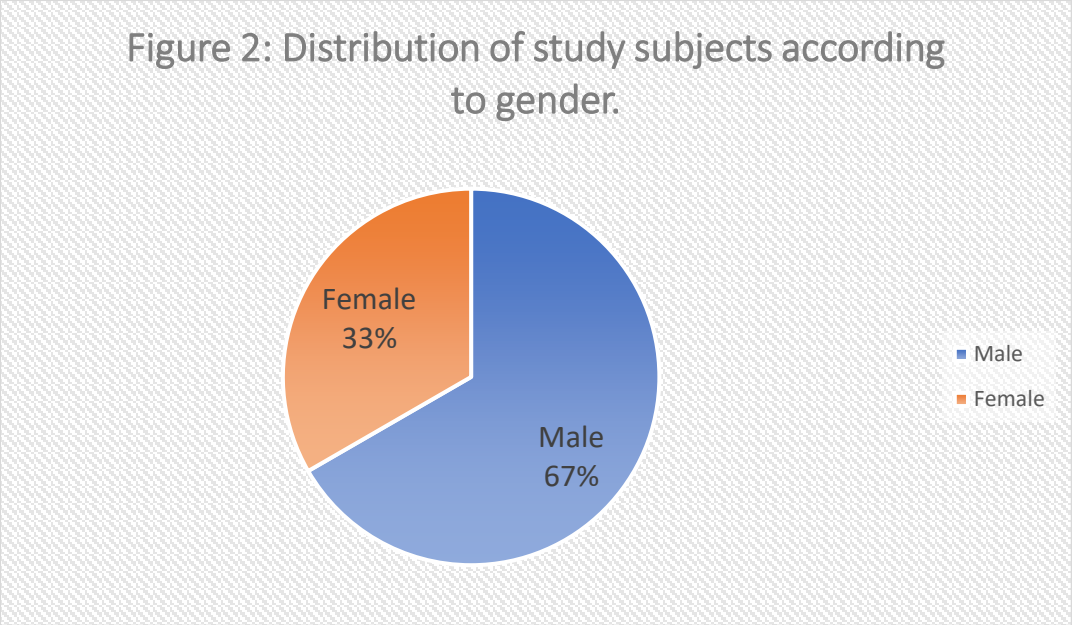


Figure 3: Percentage distribution of various clinical specimens which yielded Acinetobacter.

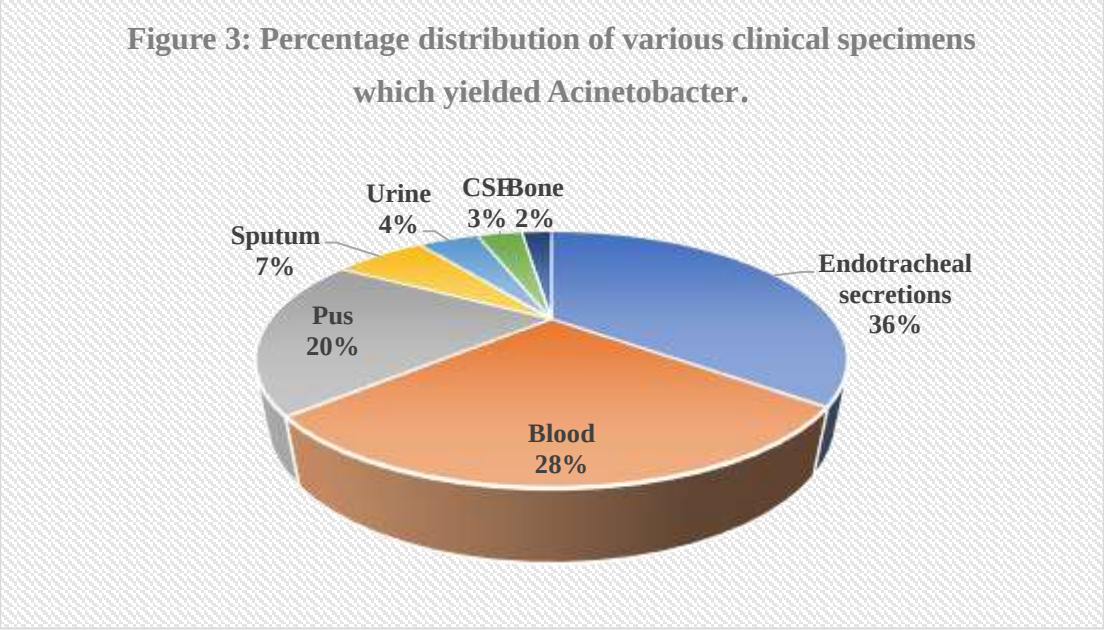
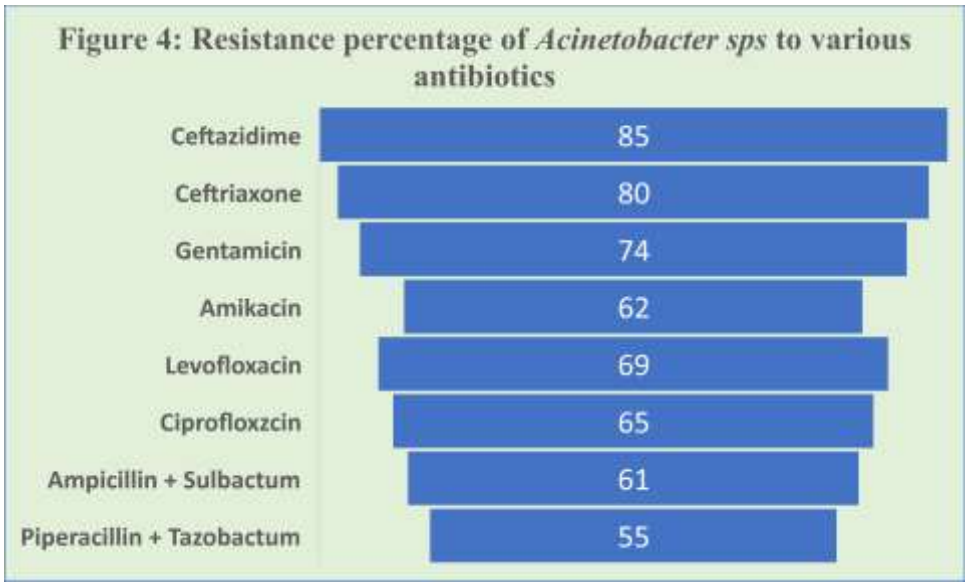


Figure 4: Resistance percentage of *Acinetobacter sps* to various antibiotics.



Discussion:

Acinetobacter spp accounts for 7.24 % of all the positive cultures obtained from various specimens, similar to studies from Morocco [7] showing 6.94%, an international study compiling data of 75 countries [8]. showing (8.8%), studies from Rajasthan [9]. (6.42%) and Nepal [10] showing 11.4%, whereas studies from Punjab [11]. 9.6%. Among the 90 isolates, 81 (90%) were identified as A. baumannii and 9 (16.67%) as other Acinetobacter species similar to other studies where Acinetobacter baumanni was the most common species [12,13]. Kaur et al (91.6%) [11]. whereas W. Nageeb et al. [14] proved that A.baumannii was the only species isolated in clinical samples.

Out of the specimens that yielded Acinetobacter, 67% were from males, similar to studies by Uwingabaye et al. [7] and Ayenew Z et al. [15], showing 64.4 % & 60% respectively

And is in contrast to a study by Kaur et al. [11] where there is a female preponderance. The predominance of male patients infected with Acinetobacter has also been shown in other studies [16, 17]. The maximum number of isolates(30) were recovered from the 45-64 years age group, similar to a study by Uwingabaye et al. [7] with a similar age group of 42-68 years. In contrast, a study by Ayenew Z et al. [15] had a slightly younger population with a mean age of 30.79 as the most affected group.

Samples that yielded Acinetobacter isolates were mostly 36% endotracheal secretions followed by blood 28%, similar to a study done by Uwingabaye et al. [7] and Rajesh et al. [9], where all the studies showed ET secretion as the major proportion. On the other hand, Kaur et al. [11] had shown urinary isolates to be the most common, in contrast to the present study. In the present study, 30% of the isolates were recovered from ICU patients. In contrast, a lower percentage, 11.4%, were isolated from ICU, as reported by Kaur et al. [11], and a higher percentage was reported by Rajesh et al. [9] Xia et al. [18]. and Tahseen and Talib [19]. The variation in these percentages could be due to the varying prevalence rates of Acinetobacter spp in different hospital settings and geographical areas.

In the present study higher percentage of 85% of resistance was shown to the cephalosporin group of drugs which is similar to Kaur et al. [11]. and Saha S et al. [20]. About 73.3% of

isolates showed resistance to aminoglycosides which is similar to studies by Raj kumari et al. [10]. 74.6%, and Taneja et al (72.8%) [21]. Levofloxacin(69%) is slightly more resistant than Ciprofloxacin 65%, which is similar to Kaur et al. [11].

Implications for Clinical Practice: The implications of these findings are profound for clinical practice, underscoring the urgent need for vigilant antimicrobial stewardship and infection control measures. Clinicians must be cognizant of the prevalent resistance patterns of Acinetobacter baumannii when selecting empiric antibiotic therapy, considering factors such as local epidemiology and individual patient characteristics. Furthermore, the study highlights the importance of continued surveillance to monitor resistance trends and guide therapeutic decision-making

Conclusion : This retrospective analytical study offers valuable insights into the resistant patterns of Acinetobacter baumannii across diverse clinical samples. By elucidating the prevalence and trends of antimicrobial resistance in this pathogen, the study contributes to our understanding of the complex dynamics underlying multidrug-resistant infections. Moving forward, concerted efforts are warranted to address the formidable challenge posed by Acinetobacter baumannii and to safeguard the efficacy of antimicrobial therapy in clinical practice.

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