

“Isolation and identification of Acinetobacter species from various clinical samples with special reference to its antibiotic susceptibility pattern at tertiary care hospital, Kanpur, Uttar Pradesh”

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Abstract:

Introduction: Acinetobacter has emerged as significant hospital pathogen, notoriously known to acquire antibiotic resistance to most of the commonly prescribed antimicrobials. Many risk factors are associated with Acinetobacter infections, especially in patients in intensive care unit (ICU). This study aims to isolate Acinetobacter from various clinical specimens and to determine its antimicrobial sensitivity pattern.

Objective: To find out the factors responsible for causing infection from Acinetobacter species and most effective antibiotic for empirical treatment of infection caused by Acinetobacter species.

Material & Method: An institutional based cross-sectional study was conducted in Department of Microbiology, Rama Medical College Hospital & Research Centre, Kanpur, Uttar-Pradesh, India from January 2022 to December 2023. A total of 1140 clinical samples were collected from different wards of hospital and Intensive Care Unit (ICU) with age group 0-80 years. They were processed by standard microbiological procedures. Isolated organisms were speciated, and antibiotic susceptibility performed as per standard guidelines CLSI 2022.

Result: Among these 1,140 samples, 750 clinical samples from various wards were isolated and ICUs were culture positive and showed growth of different microorganisms. Out of these positive isolates, 40 were identified as Acinetobacter species in which 25 (62.5%) were males & 15 (37.5%) were females and in remaining 710 culture positive samples in which E.coli was more predominant isolate followed by Klebsiella species, Pseudomonas aeruginosa, Candida species, Staphylococcus aureus and Enterococcus species.

Conclusion: Acinetobacter species is an emergent and global hospital-acquired pathogen. Drug resistance pattern of Acinetobacter baumannii is quite alarming in our health care settings, so effective infection control practices and judicious use of antibiotics is mandatory.

Keywords: Endotracheal, Intensive care units and wards, Multidrug-resistant Acinetobacter baumannii, Nosocomial infection.

Introduction

The genus Acinetobacter species is non-fermentative and non-motile, Gram-negative coccobacilli, which comprises 27 known and several unnamed provisional species. Clinically, Acinetobacter baumannii is most often identified as the cause of infection.[1] Acinetobacter baumannii, named after Paul Baumann,[2] is ubiquitous in soil and water. Previously, Acinetobacter baumannii was regarded as a low-virulence commensal bacterium. However, it has become a successful pathogen[3] and has emerged as a major cause of healthcare-associated infections, most of which have occurred in critically ill patients in the ICU setting.[4] In recent decades, infections caused by Acinetobacter baumannii have also occurred outside the ICU or in trauma patients after natural disasters and they have even affected patients with comorbidities in the community.[5]

Reports of community-acquired Acinetobacter infections have increased over the past decade.[6] Several different types of infections, including pneumonia, urinary tract infections, bacteremia, wound infections, and even meningitis, are caused by this organism.[7] These infections often occur in older patients, many of whom have chronic underlying diseases and have previously received antimicrobial treatment.[8,9] The mortality of patients with Acinetobacter baumannii infections in hospitals and in the ICU has ranged from 7.8 to 23% and from 10 to 43% respectively.[10] The risk factors usually constitute underlying diseases, intravascular lines, mechanical ventilation, age, prior treatment with broad-spectrum antibiotics or steroids (including immune-compromised status), prolonged hospitalization, and stay in the ICU. Acinetobacter baumannii is an opportunistic pathogen of emerging importance in the clinical settings and responsible for up to 20% of infections in ICUs around the globe.[11] The majority of reported clinical cases involved ventilator-associated pneumonia/pulmonary infections, bloodstream infections, skin and soft tissue infections, including burn and surgical wound infections, endocarditis, meningitis, and urinary tract infections. Furthermore, infections caused by Acinetobacter are not limited to

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the hospital settings and reports have emerged unfolding cases involving otherwise healthy individuals of all age groups, occurring in community settings, following natural disasters and during wars.[1,11] Treatment of infections due to this pathogen is becoming a serious clinical concern, since *Acinetobacter baumannii* shows extensive resistance to many of the currently used antibiotics, including cephalosporins, aminoglycosides, quinolones, and carbapenems. *Acinetobacter baumannii* is of particular concern due to its predilection to acquire antibiotic resistance determinants.[11] *Acinetobacter baumannii* has the capacity to develop antimicrobial resistance by various mechanisms, which is mostly related to mobile genetic elements, such as insertion sequences, plasmids, and antibiotic-resistant islands.3 Outbreaks in ICUs due to MDR-Ab have been reported to be associated with various types of indwelling medical devices and medical procedures used in patient management, especially for respiratory system.[11,12] Moreover, the resistance of *Acinetobacter baumannii* to common disinfectants and ability to survive for long periods on dry surfaces make it difficult to eradicate from the hospital environment. So, it is imperative to build up new antimicrobial approaches to fight this emerging threat. [11, 13, 14]

Material and methods

This study was carried out at the Department of Microbiology, Rama Medical College Hospital & Research Centre Kanpur, Uttar Pradesh January 2022 to December 2022. All clinical samples from patients who were admitted (IPDs) in various wards and ICUs were included. A total of 1140 nonrepetitive samples received in the lab from various wards and ICUs were processed. Samples were collected with universal precautions by prescribed sterile techniques and transported to the laboratory as soon as possible maintaining optimum transportation conditions. Variable samples were collected, which included blood, urine, sputum, endotracheal tip secretions, suction tip secretions, pus, swabs, body fluids, etc. Routine microscopy of samples was done before processing with the help of Gram's staining. All culture media were obtained from Hi-Media Laboratories, Mumbai, India. Primary inoculation was done on blood agar and MacConkey agar culture media as per standard protocols and incubated for 18 to 24 hours at 37°C aerobically. Cultures were then identified by standard techniques based on colony morphology, Gram staining, hanging drop preparation for motility, and various biochemical tests for indole test, citrate utilization test, urease test, triple sugar iron agar test, oxidase test, phenylalanine deaminase test, and specific tests for species level as oxidative/fermentation glucose test, gelatin hydrolysis test, and growth at 42°C.[15] Antimicrobial susceptibility of the isolate was carried out on Mueller-Hinton agar (HiMedia Laboratories, Mumbai, India) modified by Kirby Bauer disk diffusion technique by inoculating with the test organism (0.5

McFarland standards) to get a semi-confluent growth as per recommendations of Clinical and Laboratory Standards Institute 2022.[15,16]

Inclusion criteria: The study included all *Acinetobacter* species isolated from various specimens of all ages.

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

Data recorded on the case report form and structural proforma were subsequently entered into a spreadsheet. Data management and analysis were performed using Microsoft excel.

Ethical consideration

The ethical committee clearance certificate was taken before starting of study by institutional medical ethical committee.

Results

Out of 1,140 cases, 780 samples showed growth in which 40 cases were culture positive for *Acinetobacter* species. Infection caused by *Acinetobacter* species was more common in males 25(62.5%) belonging to the 51-60 years of age followed by females 15(37.5%) belonging to the years of age group followed by 31-40 years of age. Maximum number of isolates was recovered from endotracheal (ET) secretions, sputum, pus swab c/s, and urine & blood. Maximum number of *Acinetobacter baumannii* strains was recovered from ICU & Neuro ICU Ward. The *Acinetobacter* species isolates in various clinical samples showed 100% sensitivity towards Polymixin-B, Colistin, Aztreonam, & Tigecycline.

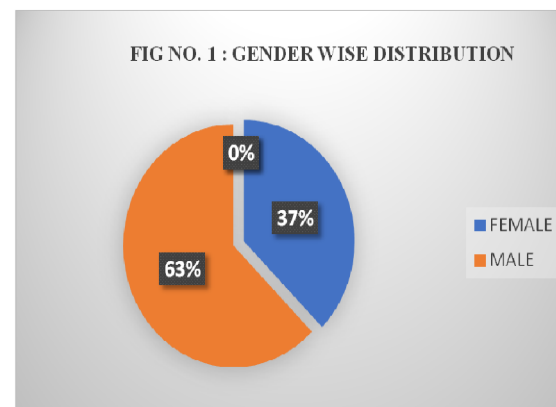


Figure no 1: shows gender wise distribution of infected patients in which males are commonly affected than females.

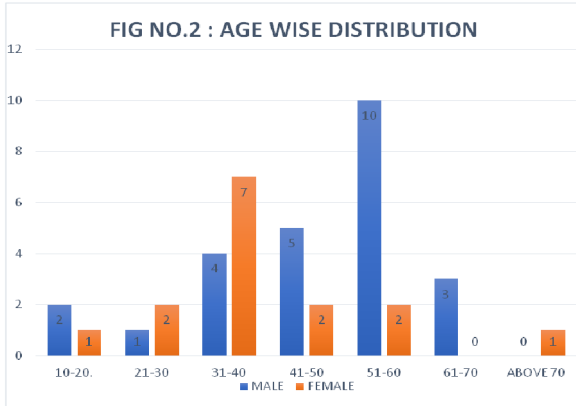


Figure no 2: shows age wise distribution in which males of age group 51-60 is highly infected and females of age group 31-40 years of age.

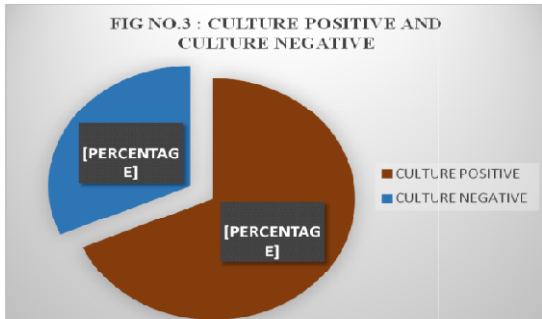


Figure no 3: shows the culture positive and culture negative cases.

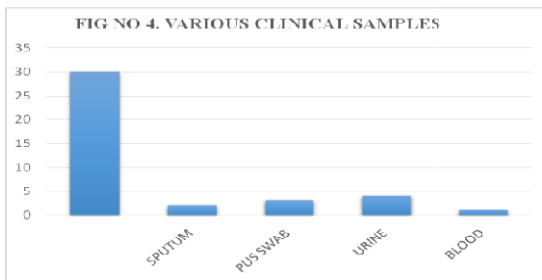


Figure no 4: shows various clinical samples in which Acinetobacter species was more commonly isolated in the Endotracheal secretion.

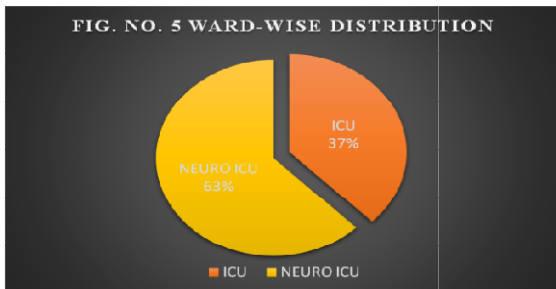


Figure no 5: shows ward wise distribution in that more patients are from Neuro ICU.

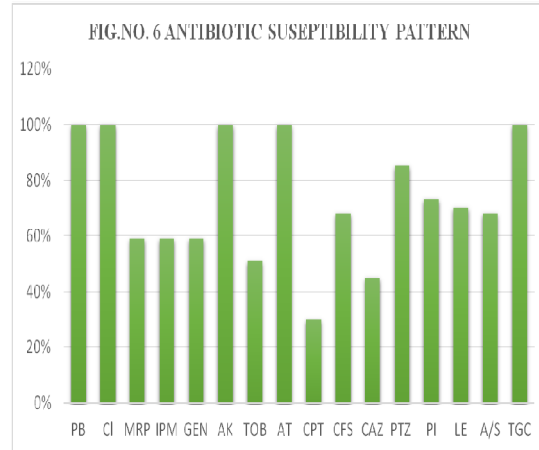


Figure no 6: shows antibiotic susceptibility pattern of Acinetobacter species in which Colistin, Polymyxin -B, aztreonam and tigecycline was 100% sensitive.

Discussion

Multidrug-resistant Gram-negative pathogens are associated with high morbidity and mortality. Multidrug resistant Acinetobacter spp. has been reported worldwide and has now emerged as one of the hardest healthcare associated infections to control and treat. Patients admitted in burn unit, ICU, and those wards with central intravenous catheters and respiratory devices are the main targets of this organism.[12,17] Delay in receiving adequate empirical antimicrobial therapy has an adverse effect on clinical outcomes in hospital-acquired infections caused by Acinetobacter baumannii. [18] Acinetobacter-associated nosocomial infections in critically ill patients are on the rise.[19,20] In the present study number of positive culture is similar to the study done by Rakesh K Sharma [21]. In the present study, the percentage of Acinetobacter species in male and female is found to be approximately similar in the studies done Rakesh et al[21], Fayyaz et al[22] and higher than the studies by Tahseen and Talib[23] and Saleem et al.[24]

In the present study, the maximum frequency of Acinetobacter isolates from respiratory tract intubated patients (ET samples) followed by sputum, pus swab c/s, urine, and blood, which is similar to the study done by Rakesh et al [21]& higher than in the studies by Chim et al,[25] Markogiannakis et al,[20] and Alvarez-Lerma et al. [26]

In the present study, the maximum frequency of Acinetobacter baumannii isolates was recovered from ICUs compared with wards, which is found to be similar in the studies by Rajesh et al [21], Xia et al[12] and Tahseen and Talib[23]

Conclusion

In this study we concluded that Acinetobacter species is an emergent and global nosocomial pathogen. Infections in IPD patients (wards and ICUs) are caused

by *Acinetobacter* species in positive cultures in our setup. *Acinetobacter baumannii* is the most prevalent among *Acinetobacter* spp. Maximum frequency of *Acinetobacter baumannii* isolates was recovered from ICUs compared with wards. Colistin, polymyxin-B, aztreonam, tigecycline was the 100% sensitive antibiotic to which of the tested isolates.

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