ORIGINAL RESEARCH PAPER
Volume - 13 | Issue - 05 | May - 2024 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

PREVALENCE AND ANTIBIOTIC SUSCEPTIBILITY PATTERN OF ACINETOBACTER ISOLATES IN A TERTIARY CARE HOSPITAL IN SOUTHERN RAJASTHAN

Microbiology

Dr. Fina Franklin John Resident Doctor, Department of Microbiology, RNT Medical College, Udaipur, Rajasthan

Dr. Sushil Kumar Sahu Professor and Head, Department of Microbiology, RNT Medical College, Udaipur, Rajasthan

ABSTRACT

Acinetobacter species are saprophytic organisms and have emerged as an important nosocomial pathogen. High rate of antimicrobial resistance, along with their endurance and survival ability, has made them a serious threat to hospital environments. This study aims to determine the prevalence and antibiotic susceptibility pattern of *Acinetobacter* species isolated from various samples. Hospital based cross-sectional study was done from January 2023 to December 2023 in the Microbiology Department, RNT Medical College, Udaipur and a total of 14,081 samples were included for the study. A total of 456 (3.23%) *Acinetobacter* species were identified using various phenotypic methods. Majority of the *Acinetobacter* species isolated were sensitive to Levofloxacin [324(71.05%)] followed by Doxycycline [204(44.74%)] and Cotrimoxazole [163(35.75%)]. Resistance was most commonly observed with Cefotaxime [432(94.74%)], followed by Ceftriaxone [422(92.54%)] and Ceftazidime [418(91.67%)]. 321 (70.39%) of the isolates were found to be multidrug resistant (MDR) and 303 (66.45%) were found to be extensively drug resistant (XDR).

KEYWORDS

Acinetobacter Species, Antibiotic Susceptibility, Multidrug Resistant, Extensively Drug Resistant

INTRODUCTION

Acinetobacter species are saprophytic, ubiquitous organisms that are distributed throughout the environment in soil and water.[1] They have emerged as an important nosocomial pathogen due to their ability to survive in the hospital environment, on a wide range of dry and moist surfaces.[2] They are the second most commonly isolated non-fermenter organisms (*Pseudomonas aeruginosa* being the most common) in human specimens [3] and ranks fourth (after *P. aeruginosa, Staphylococcus aureus,* and *Klebsiella pneumoniae*) among the most frequent agent causing hospital-acquired infections.[4]

Acinetobacter baumannii is one of most common *Acinetobacter* species that can cause human infections. In 2004, the Centre for Disease Control (CDC) reported that *A. baumannii* accounts for approximately 80% of all reported *Acinetobacter* infections.[5,6] This species has been declared by WHO as one of the most serious organisms among ESKAPE pathogens (*Enterococcus faecium, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa, and Enterobacter species*).[7]

Acinetobacter species are strictly aerobic, nonmotile, Gram-negative, non-fermentative, oxidase-negative, and catalase positive organisms.[8] Human infections caused by *Acinetobacter* species include pneumonia, which is most often related to endotracheal tubes or tracheostomies, endocarditis, meningitis, skin and wound infections, peritonitis in patients receiving peritoneal dialysis, UTI (Urinary Tract Infection) and bacteremia.[2,9]

The infections caused by *Acinetobacter spp.* are difficult to control due to their ability to survive in the hospital environment and their multi-drug resistance properties.[10] They are noted for their intrinsic resistance to antibiotics and for their ability to acquire genes encoding resistance for the production of beta-lactamases and aminoglycoside-modifying enzymes.[11] Multidrug efflux pumps, target modification, permeability defects and enzymatic degradation of drugs are important mechanisms of acquired resistance against a wide range of antibiotics.[12]

There is an increase in incidence of not only *Acinetobacter* infections over the past two decades but also the emergence of multidrug resistant *Acinetobacter* spp.[13] Critically ill patients with prior antimicrobial exposure or patients with comorbidities are particularly vulnerable to infection with multidrug resistant organisms, which can increase mortality, hospitalization costs and length of hospital stays.[14]

Antibiotic susceptibility pattern of *Acinetobacter* spp. could differ extensively in nature and between different units of the same hospital at different points of time.[2] Due to changes in multidrug resistance patterns of clinical strains of *Acinetobacter*, it is essential to know its susceptibility pattern in a hospital setting. Also, very few studies have been published on antibiotic susceptibility pattern of *Acinetobacter* species in our region.

Hence, this study was conducted to determine the prevalence and antibiotic susceptibility patterns in *Acinetobacter* species isolated from various clinical samples.

MATERIALS AND METHODS

Hospital based cross-sectional study was done from January 2023 to December 2023 in the Microbiology Department, RNT Medical College, Udaipur, Rajasthan. Clinical samples of patients, admitted in various wards and ICUs, were included for the study. A total of 14,081 non-repetitive samples received in the laboratory were processed during the study period. Samples such as blood, urine, sputum, tracheal aspirate, pus, wound swabs, body fluids, etc. were included for the study. Samples with incomplete data or other unacceptable specimens were excluded. They were collected under strict aseptic precautions and processed as per standard guidelines.

Primary inoculation was done on Blood agar and MacConkey agar. For blood samples, BHI broth was used and for urine samples, UTI CHROMagar was used in addition to MacConkey agar. The plates were incubated aerobically at 37^0C for 18-24hrs. Identification of isolates was done by using conventional identification methods. Genus *Acinetobacter* was identified based on colony morphology, gram staining, motility (by hanging drop preparation) and biochemical tests such as catalase test, oxidase test, indole test, citrate utilization test, urease test and triple sugar iron agar test. Speciation of *Acinetobacter* was done on the basis of glucose oxidation, gelatin liquefaction, beta hemolysis, growth at 37°C and 42°C, arginine hydrolysis and susceptibility to chloramphenicol. Antimicrobial susceptibility testing of the isolates was done by standardized Kirby-Bauer disc diffusion method on Mueller-Hinton agar plate as per the CLSI 2023 recommendations.[15]

"MDR *Acinetobacter* spp." was defined as the acquired non susceptibility to atleast one agent in three or more classes of antimicrobial agents such as all penicillin and cephalosporins (including inhibitor combinations), fluroquinolones, and aminoglycosides, "XDR *Acinetobacter* spp." was defined as the non-susceptibility to at least one agent in three classes of antimicrobials described above (MDR) and shall also be resistant to carbapenems.[16,17,18]

RESULTS

Out of total 14081 samples tested, 5089 (36.14%) was found to be gram negative bacilli. Of the gram-negative organisms, 456 (9%) were *Acinetobacter* species. Out of total 14081 samples, 456(3.23%) was

found to be *Acinetobacter* species.

There was a higher incidence of infection among males (57%) as compared to females (43%).

Table 1: Sample wise distribution of *Acinetobacter* spp.

Type of Sample	Total Acinetobacter spp. isolated	Percentage (%)
Blood	221	48.46
Tracheal aspirate	115	25.22
Pus	47	10.31
Sputum	33	7.24
Urine	11	2.41
Wound swab	10	2.19
Pleural fluid	8	1.75
CSF	4	0.88
Ascitic fluid	3	0.66
Peritoneal fluid	2	0.44
Gastric lavage	1	0.22
ICD drain tube	1	0.22
Total	456	100

292(64.04%) of the isolates were from ICU. Majority of *Acinetobacter* isolates were from blood samples (48.46%), followed by tracheal aspirate (25.22%) and pus samples (10.31%) (Table 1).

Antibiotic susceptibility pattern of *Acinetobacter* isolates (Figure 1) showed that the most susceptible drug Levofloxacin (71.05%), followed by Doxycycline (44.74%) and Cotrimoxazole (35.75%). Maximum resistance was observed against Cefotaxime (94.74%) followed by Ceftriaxone (92.54%), Ceftazidimem (91.67%), Imipenem (88.60%), Cefepime (88.82%), Meropenem (86.40%), Gentamicin (83.33%), Piperacillin / Tazobactam (83.55%), Amikacin (80.92%), Ciprofloxacin (78.73%), Tetracycline (67.76%), Cotrimoxazole (63.82%), Doxycycline (53.29%) and Levofloxacin (22.59%) . (Figure 1)

Out of total 456 *Acinetobacter* species isolated, 321 (70.39%), showed multidrug resistance and 303 (66.45%) showed extensive drug resistance. (Figure 2)

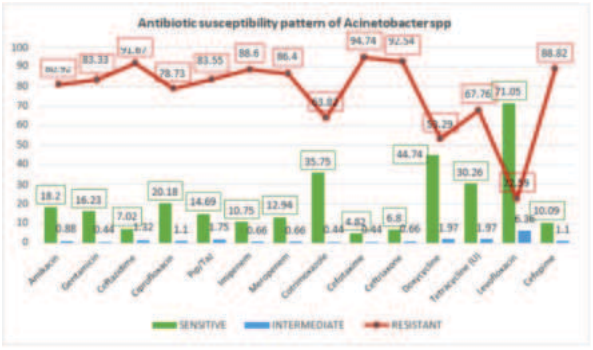

Figure 1: Antibiotic susceptibility pattern of *Acinetobacter* spp.

DISCUSSION

Infections caused by multidrug resistant organisms are currently a major threat to public health worldwide.

The emergence and spread of multidrug resistant *Acinetobacter* species and its association with healthcare infections is an area of great concern.

In this study, out of total 14,081 samples tested, 5089(36.14%) were gram negative bacilli. Among them, 456 (8.96%) were *Acinetobacter* species. The isolated *Acinetobacter* species constituted 3.23% of total samples tested.

Similar results were obtained from the study conducted by Gupta N et al[2] and Chandra P et al[19] where 3.36% and 2.8% *Acinetobacter* species were isolated respectively.

The present study also showed a higher incidence of infection among males (57.24%) as compared to females (42.76%). This was similar to the results of the study conducted by Rajkumari S[20] and Chandra P et al[19] where 59% and 60% males were affected respectively.

Majority of the isolates were from ICU (64.4%). This was similar to that observed in study conducted by Pattanaik A et al[21] and Raina et al[22] where 63.2% and 58.5% isolates were from ICU.

Majority of *Acinetobacter* isolates were from blood samples (48.46%), followed by tracheal aspirate (25.22%) and pus samples (12.5%). Similar findings were obtained in the study conducted byChandra P et al[19] (2016) wherein maximum number of isolates were from blood (33.3%). In another study conducted by Wajid et al (2020)7, the maximum number of isolates were from tracheal aspirate (33%) followed by blood (28%) and pus (24%).

On comparing the antibiotic resistance pattern in *Acinetobacter* species, maximum resistance was observed against third generation cephalosporins such as Cefotaxime (94.74%) followed by Ceftriaxone (92.54%) and Ceftazadime (91.67%). Also, there was 88.82% resistance against cefepime (fourth generation cephalosporin) and 88.6% resistance against Imipenem.

The study conducted by Wajid M et al[23], also showed high level of resistance against third generation cephalosporins [Ceftazadime (82.5%) and Ceftriaxone (78%)]. Also, there was a significant resistance noted against Imipenem (61.4%) but it was lower than the percentage noted in the present study.

Similar results were obtained in the study conducted by Kaur R et al[24] (2019) where there was 88.6% resistance against Ceftazidime and 88.1% resistance against Ceftriaxone and in the study conducted by Chandra P et al[19] (2016) there was 90.58% resistance to Ceftazidime and 87.69% resistance to Ceftriaxone.

The least resistant drug in the current study was Levofloxacin (22.59%) followed by doxycycline (53.29%) and Cotrimoxazole (63.82%). In a similar

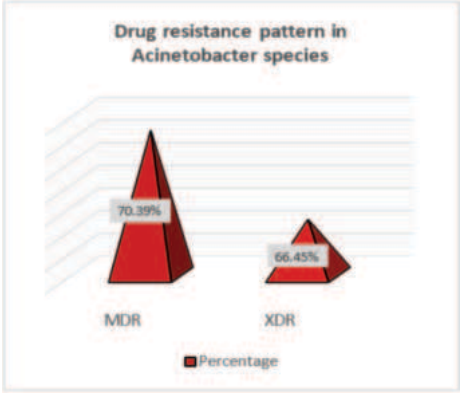

Figure 2 : Drug resistance pattern in *Acinetobacter* species

study conducted by Rajkumari S et al [20] (2019) the least resistant drug was found to be Levofloxacin (42.75%) which was similar to that of our study. In another study conducted by Chandra P et al[19] (2016) there was 53.6% resistance against Doxycycline and also in the study conducted by Sandhu R et al[25] (2016) the least resistant drug was found to be Doxycycline (33.33%).

In our study, 70.39% isolates showed multidrug resistance. This was similar to the findings of the study conducted by A. S. Mathai et al[26] (2009) where 70% MDR was reported and Sivaranjani V et al[27] (2015) where 71.31% MDR isolates were obtained.

CONCLUSION

Acinetobacter species are the second most common non fermentative gram-negative bacteria isolated from clinical specimens. The emergence of *Acinetobacter* infections in hospital settings has increased recently, especially among critically ill patients in intensive care units. One of the great challenges in its treatment is the emergence of multidrug resistant *Acinetobacter* species. This is probably due to indiscriminate use of antibiotics in healthcare setting.

In our study, *Acinetobacter* species were found to be resistant to most of the commonly used antibiotics. Levofloxacin, Doxycycline and Cotrimoxazole have shown promising results in our study. The organism showed maximum resistance to Cephalosporins.

Stringent infection control practices and antimicrobial stewardship are required for the effective control of these infections.

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