International Journal of Research in Medical Sciences
Singh BK et al. Int J Res Med Sci. 2026 May;14(5):1922-1926
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20261328

Original Research Article

Prevalence of *Acinetobacter spp.* in lower respiratory tract infections and its antimicrobial susceptibility pattern in a tertiary care hospital

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Received: 27 January 2026
Revised: 05 March 2026
Accepted: 09 April 2026

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ABSTRACT

Background: *Acinetobacter spp.* are regarded as commensal microbes of human skin and respiratory tract; however, they may cause serious infections, such as endocarditis, urinary tract infections (UTI), pneumonia, wound infections, especially in individuals with impaired host defenses. This study aimed to determine the prevalence and antimicrobial susceptibility pattern of *Acinetobacter spp.* isolated from lower respiratory tract (LRT) specimens in a tertiary care hospital in Jaipur, Rajasthan, India.

Methods: A total of 1031 lower respiratory tract (LRT) samples, including sputum, bronchoalveolar lavage (BAL), endotracheal tube (ET)/ aspirate and pleural fluid, were collected from inpatients and outpatients. *Acinetobacter spp.* were isolated and identified using standard microbiological techniques and antimicrobial susceptibility testing was performed.

Results: Out of 801 (77.69%) culture-positive samples, 136 (16.98%) were identified as *Acinetobacter spp.* The highest isolation rate was observed in ET samples (80.15%), followed by sputum (16.91%), BAL (2.21%) and pleural fluid (0.74%). The majority of *Acinetobacter spp.* were isolated from patients in the medical ICU (29.37%) and the critical care unit (26.98%). Antimicrobial susceptibility testing revealed high resistance rates to cefotaxime (99.26%), ceftriaxone (97.79%) and other antibiotics. Colistin was the only antibiotic to which all isolates were susceptible.

Conclusions: The high prevalence of multidrug-resistant *Acinetobacter spp.* in LRT infections poses a significant challenge for clinicians. Implementing strict infection control measures, judicious use of antibiotics and regular monitoring of antimicrobial susceptibility patterns are essential to prevent the spread of these resistant pathogens in healthcare settings.

Keywords: *Acinetobacter spp.*, Antimicrobial susceptibility, Lower respiratory tract infections, Multidrug resistance

INTRODUCTION

Acinetobacter spp. are widespread in the environment and they are commonly found in soil, sewage, water, as well as animal and human samples.[1] *Acinetobacter spp.* are non-lactose fermenting, gram-negative, catalase positive, oxidase negative, saprophytic, coccobacilli and are strictly aerobic.[1,2] *Acinetobacter spp.* are regarded as commensal microbes of human skin and respiratory tract, however, they can cause serious infections, such as endocarditis, urinary tract infections, pneumonia, wound infections, meningitis and septicemia, especially in individuals with impaired host defenses.[3] According to a recent study by Madhavi et al at Karnataka, India, the prevalence of *Acinetobacter spp.* was found to be 8.9% among various clinical samples.[1] *Acinetobacter spp.* have a unique property of survival in hospital settings for a longer time, during which they may acquire resistance to broad spectrum antibiotics.[1,2] Multi-drug resistant Acinetobacter baumannii has emerged as an important nosocomial pathogen associated with various infections, including lower respiratory tract infection (LRTI).[4] Lower

respiratory tract infections are the most common bacterial infections among patients in intensive care units (ICUs), occurring in 10–25% of all ICU patients and resulting in high overall mortality ranging from 22 to 71%.[4] The antibiotic susceptibility pattern of *Acinetobacter spp.* may vary widely geographically and between various units of the same hospital at various time points.[5] The antibiotic resistance of the pathogen mixed with the weakened health of the infected hospitalized patients has resulted in an unusually high mortality rate.[2]

The high prevalence of resistant isolates towards many classes of antibiotics makes initiation of effective empiric treatment challenging.[6] Due to unpredictable multidrug resistance patterns of Acinetobacter spp., it is imperative to know the institutional level prevalent susceptibility profiles.

METHODS

This study was conducted in the department of Microbiology, NIMS Hospital, Rajasthan, India in the period of March 2024 to December 2025. A total number of 1031 lower respiratory samples were included.

All lower respiratory specimens were included and only multiple samples from same patients were excluded. In this study, identification and observation of resistant profile of Acinetobacter species was done, isolated from various samples of LRT such as sputum, BAL, ET tube/aspirate and pleural fluid received from IPD and OPD patients.

The specimen was inoculated on Blood agar, MacConkey agar and incubated overnight at 37°C aerobically in an incubator. After growth on a culture plate smear has been prepared from colonies and biochemical tests have been done for identification and isolation of Acinetobacter species. All isolated species was further inoculated on Mueller-Hinton Agar (MHA) plate for antimicrobial susceptibility testing (AST) according to new Clinical Laboratory Standard Institute (CLSI) guidelines 2023.[7] The strength of antibiotics was used as follows according to CLSI:7 Ceftriaxone 30 µg, Minocycline 30 µg, Cefotaxime 30 µg, Ciprofloxacin 5 µg, Ceftazidime 30 µg, Levofloxacin 5 µg, Cefepime 30 µg, Co-trimoxazole 1.25/23.75 µg, Amikacin 30 µg, Imipenem 10 µg, Gentamicin 10 µg, Meropenem 10 µg, Tobramycin 30 µg, Piperacillin-tazobactam 100/10 µg, Doxycycline 30 µg, Ticarcillin-clavulanic acid 75/10 µg, Tetracycline 30 µg and Colistin 10 µg.[7]

RESULTS

During the study, we observed and analyzed the prevalence and antimicrobial susceptibility pattern of *Acinetobacter spp.* in respiratory tract specimen i.e., Sputum (n=498, 37.73%), BAL (n=70, 6.79%), ET (n=389, 37.73%) and pleural fluid (n=74 7.18%) in NIMS Hospital, Jaipur, Rajasthan a tertiary care hospital. A total no. of 1031 respiratory samples were collected, in which 801 (77.69%) samples were found to be culture positive and 230 (22.30%) samples showed no growth. Among these culture-positive, 768 (95.48%) were monomicrobial and 33 (4.18%) were polymicrobial. Among 801 the culture-positive samples, 136 (16.98%) *Acinetobacter spp.* were isolated and 665 (83.02%) were other isolates.

73.53% of *Acinetobacter spp.* were isolated from male patients and 26.47% from female patients. The male-to-female ratio was 25:9 (M:F). The maximum *Acinetobacter spp.* were isolated in >60 age group of patients (46.32%) followed by 31- 45 year (24.26%), 46-60 year (13.97%), 16-30 year (13.24%) and 0–15-year group of patients shown minimum *Acinetobacter spp.* infection (Figure 1).

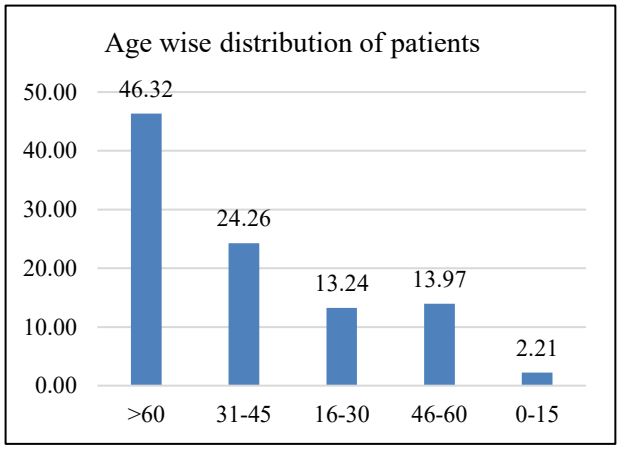

Figure 1: Age wise distribution of patients.

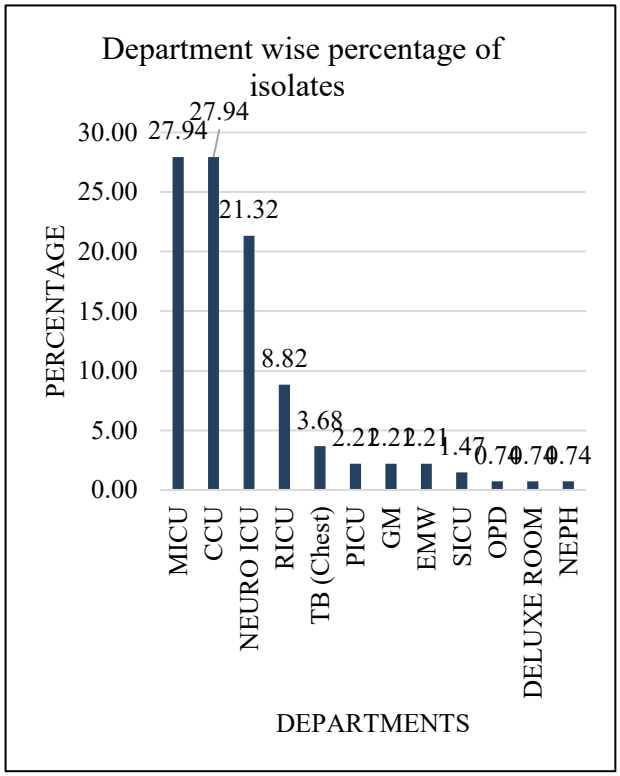

Figure 2: Department wise percentage of isolates.

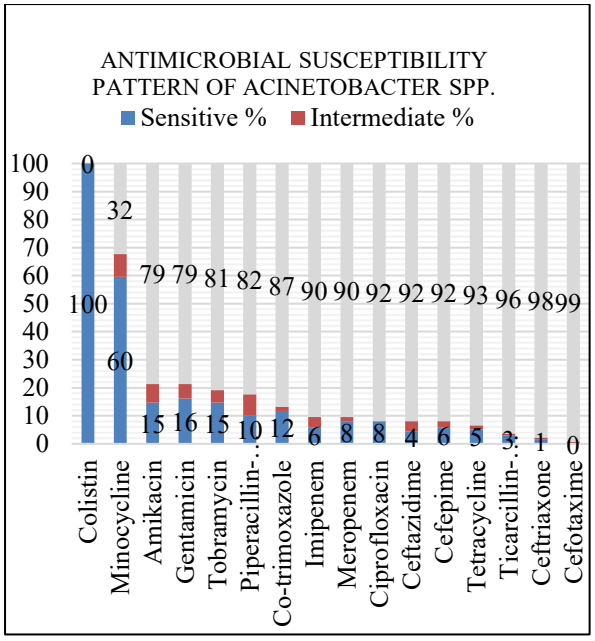

Figure 3: Antimicrobial susceptibility pattern of Acinetobacter spp.

Acinetobacter spp. was predominantly isolated from ET (endotracheal tube/aspirate) sample 109 (80.15%) followed by sputum 23 (16.91%), BAL 3 (2.21%) and pleural fluid 1 (0.74%) (Table 1).

Table 1: Isolation from different clinical samples.

Clinical samples	No. of isolates	(%)
Sputum	23	16.91
ET	109	80.15
BAL	3	2.21
Pleural fluid	1	0.74
Total	136	

In the study, most of the percentage of isolates were from MICU and CCU (27.94% each) department, followed by Neuro ICU 21.32%, RICU 8.82%, TB (Chest) 3.68%, PICU 2.21%, GM (General medicine) 2.21%, EMW 2.21%, SICU 1.47%, OPD, Deluxe Room and Neph Ward (0.74% each) (Figure 2). Antimicrobial susceptibility test was performed which showed highest resistance for Cefotaxime which was found to be 99.26% followed by Ceftriaxone 97.79%, Ticarcillin-clavulanic acid 96.32%, Tetracycline 93.38%, Cefepime 91.91%, Ciprofloxacin 91.91%, Ceftazidime 91.91%, Meropenem 90.44%, Imipenem 90.44% Co-trimoxazole 86.76%, Piperacillin-tazobactam 82.35%, Tobramycin 80.88%, Gentamicin 78.68%, Amikacin 78.68%, Minocycline 32.35% and none of the isolates were resistant to Colistin (Figure 3).

DISCUSSION

Numerous diseases, including nosocomial pneumonia, meningitis, endocarditis, skin and soft tissue infections, urinary tract infections, burn wound infections and bacteremia, have been linked to this opportunistic pathogen.[8] Infection due to *Acinetobacter spp.* is a major challenge within the health care facilities and the community. In general, due to their high drug resistance, even to the highly potent drugs such as Carbapenems.[9]

In the study, 1031 samples were received, out of which 801 (77.69%) samples were culture positive and 230 (22.30%) were culture negative. Out of 801 culture positive, 136 (16.98%) *Acinetobacter spp.* were isolated, which was similar to a study done by Prasad et al in this study prevalence of *Acinetobacter spp.* was 15.68%.[10]

Higher isolation of *Acinetobacter spp.* from ET samples was observed in the study of Jayashree et al, Guddeti et al and Trilokhy et al 21%, 50% and 48% respectively, as our study shows the higher isolation of *Acinetobacter spp.* in ET samples with a striking rate of 80.15% followed by sputum 16.91%, bronchoalveolar lavage (BAL) 2.21% and pleural fluid 0.74%.[11-13] This result varies in the study of Rajkumari S. et al (2020), where the predominant isolation of *Acinetobacter spp.* was from sputum instead of ET.[14]

Age wise distribution of *Acinetobacter spp.* in the study shows that higher respiratory tract infection were present in older age group i.e., >60 years which was found to be 46.32% and lesser infection in 0-15 year age group, which was found to be only 2.21% and this was similar to a study conducted by Gupta N et al, where higher infection were present in age group >50 (28%), apart from this study similar finding was observed in the study of Chesta Rani et al, where the finding shows higher infection in the age group of 61-70 (22.58%).[3,5]

In the study, the majority of the isolates were found in MICU 27.94% and CCU 27.94% followed by Neuro ICU 21.32%, slightly variable results have been reported by Rajkumari et al in their study, 2.90% of isolates were obtained from Neuro ICU which is similar to the study.[14] The study found the higher resistance toward Cefotaxime 99.26%, Ceftriaxone 97.79%, Cefepime 91.91%, Ceftazidime 91.91%, Ciprofloxacin 91.91%, Meropenem 90.44% and Imipenem 90.44% similar resistance pattern was observed in a study done by Sohail et al. In another study done by Rajkumari et al also showed similar resistance toward a few drugs.[14,15]

A higher resistance rate for Ticarcillin clavulanic acid (99%) was observed in a study done by Jabeen et al which is similar to the study, which is 96.32% resistance for Ticarcillin clavulanic acid.[16] In the study, the resistance rate for Gentamicin and Amikacin was observed to be 78.68%, which was similar to a study done by Yadav et al where the resistance rate was 75% for Gentamicin and 73.3% for Amikacin.[17] The study showed 82.35% resistance for Piperacillin-tazobactam, similar results were shown in the study of Peymani et al and Dimple et al where resistance toward Piperacillin-tazobactam was 89% and 83% respectively.[18,19] The study done by Dimple et al also shown high resistance toward Trimethoprim-

sulfamethoxazole (Co-trimoxazole) 83%, which is comparable to our study which is % 86.76%.[19] Among all these drugs, only Colistin was 100% sensitive in our study, which is in accordance with the study done by Prasad et al, Saghir et al and Tewari et al.[20-22]

The study has certain limitations it was based on conventional phenotypic identification and testing of antimicrobial susceptibility pattern without molecular characterization which could have provide better understanding of genetic basis antimicrobial resistant pattern. It was conducted in a single tertiary care hospital which may limit the generalizability of the finding in another region.

CONCLUSION

Acinetobacter spp. poses a significant threat to hospitalized patients. This bacterium is a major cause of hospital-acquired infections, often leading to treatment failures due to its resistance to multiple antibiotics. Infections with these resistant strains can have poor or even fatal outcomes. Acinetobacter's inherent resistance to many antibiotics and its frequent development of further resistance due to the misuse of antibiotics create a major challenge. Both clinicians and hospital management must work together to prevent the spread of *Acinetobacter spp.* within the facility and curb the rise of antibiotic resistance. This information should be readily available to both doctors (clinicians) and hospital administrators.

By doing this, we can reduce the spread of antibiotic resistance within the hospital. Help patients recover faster by tailoring antibiotic treatment to the specific bacteria they are infected with. Minimize the length of hospital stays for patients.

The findings indicate that Gentamicin, Minocycline and Colistin are the most effective drugs against *Acinetobacter spp.* Additionally; to reduce the spread of MDR Acinetobacter, stringent control of the hospital environment, rigorous hand hygiene and optimized antibiotic use are recommended. Regularly monitoring the antibiotic susceptibility patterns of *Acinetobacter spp.* is crucial.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Singh BK, Darryl G, Kumari S, Bagul K. Prevalence of *Acinetobacter spp.* in lower respiratory tract infections and its antimicrobial susceptibility pattern in a tertiary care hospital. Int J Res Med Sci 2026;14:1922-6.