ORIGINAL RESEARCH PAPER
Volume - 11 | Issue - 07 | July - 2022 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

STUDY OF MULTIDRUG RESISTANT ACINETOBACTER IN INTENSIVE CARE UNIT (ICU) PATIENTS.

Microbiology

Dr. Sana Farooqui* Assistant professor, Dept of Microbiology, IGGMC, Nagpur *Corresponding Author

Dr. Sharmila Raut Professor and Head of department, Dept of Microbiology, IGGMC, Nagpur

Dr. Sonal Chavan Assistant professor, Dept of Microbiology, IGGMC, Nagpur

Dr. Rajni Tore Associate professor, Dept of Microbiology, IGGMC, Nagpur

Dr. Ravindra Khadse Associate professor, Dept of Microbiology, IGGMC, Nagpur

ABSTRACT

Introduction- Acinetobacter had gained increasing attention as a nosocomial pathogen causing severe, life-threatening hospital infections, especially in intensive care units (ICUs). It is notorious to develop multi drug resistant. Management of multidrug-resistant Acinetobacter spp. infections is a great challenge for physicians and clinical microbiologists. **Objectives:** This study was designed to study the various species of Acinetobacter prevalence and antibiotic susceptibility patterns of Acinetobacter sp. as isolated from patients lodged in intensive care units (ICUs) of a tertiary care hospital in central India. **Material & methods:** The study was carried out in microbiology laboratory of a tertiary care hospital from July 2018 to July 2020. Samples were collected, processed and Acinetobacter isolates were identified by standard microbiological procedures. Antimicrobial susceptibility testing performed by kirby-bauer disc diffusion method as per CLSI guidelines. **Results:** Out of total 200 isolates of Acinetobacter, ACB complex 189 (94.5%) was found to be the most common species isolated. Maximum isolates were obtained from medicine intensive care unit. The most common infection was found to be pneumonia. Maximum isolates were resistant to Cetriaxone, Ceftazidime, Ciprofloxacin etc and least resistance was seen in Imepenem, Piperacillin-Tazobactum, Amikacin,. All the strains were sensitive to Colistin. **Conclusion:** Acinetobacter has emerged as an important nosocomial pathogen showing high degree of resistance to most antimicrobials. Early identification and continued surveillance of their antibiogram is essential for preventing the spread of Acinetobacter in hospital environment.

KEYWORDS

Acinetobacter Sp., Intensive Care Units, Nosocomial Infections, Drug Resistance.

In recent year, Acinetobacter has emerged as an important nosocomial pathogen mainly affecting patients with impaired host defenses in Intensive care unit.[1] Acinetobacter spp. go so quickly from being unknown and unnamed organisms to become among the most dangerous pathogenic organisms of the present time. The history of this organism from being a saprophytic organism to superbug has developed to us to analyze the reason and mechanism of such evolution of "Acinetobacter".[2]

Acinetobacter species are ubiquitous in environment. They are usually free living saprophytes in soil and water.[3] Up to 20% of healthy ambulatory adults exhibit cutaneous colonization by Acinetobacter and are the most common gram negative bacteria carried on the skin of hospital personnel.[4]

Acinetobacter baumannii has emerged as an important nosocomial pathogen, particularly for patients in intensive care units and with invasive indwelling devices. One of the most significant emerging multidrug-resistant (MDR) pathogens is Acinetobacter baumannii.[5]

They have been implicated in a variety of nosocomial infections, including bacteraemia, urinary tract infection, secondary meningitis, but their role as agents of nosocomial pathogen in pneumonia, particularly ventilator associated pneumonia in patients confined to hospital intensive-care units Acinetobacter have been isolated from various opportunistic infections, including skin and wound sepsis, septicaemia, pneumonia, endocarditis, meningitis and UTI.[6,7]

Prior to the 1970s, it was possible to treat Acinetobacter infections with a range of antibiotics, including aminoglycosides, β-lactams.[8] However, resistance to all known antibiotics has now emerged in Acinetobacter species thus leaving the majority of today's clinicians in great dilemma. [9] Unfortunately, at this stage, very little is in the therapeutic pipeline and the new agents with activity against gram-negative organisms are all modifications of existing classes. Novel antibiotic targets and mechanisms of action are urgently required. [10]

MATERIAL AND METHODS

The study is being carried out in the Dept. of Microbiology in a tertiary care hospital from July 2018 to July 2020.

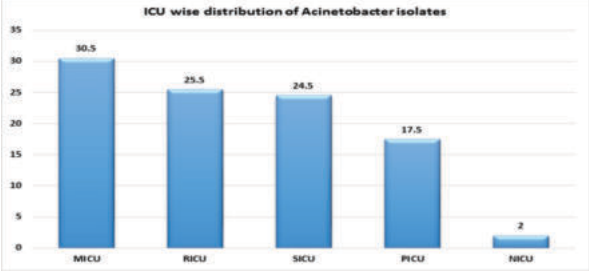
Clinical specimens like sputum, blood, pus, urine, CSF, peritoneal fluid etc. from patients with pneumonia, septicemia, wound sepsis, urinary tract infection, meningitis, peritonitis, endocarditis were received from patients of all age groups and both sex admitted in a various intensive care units (MICU,PICU,NICU,SICU) by standard collection procedures.[11] No specific exclusion criteria envisaged.

Acinetobacter were confirmed by catalase test, Nitrate test, OF test, citrate test, Growth at 44ºC, growth on Macconkey. Further they were speciated by growth at 37ºC, and 44 ºC, Hemolysis, Gelatin hydrolysis, Arginine dihydrolase. Antimicrobial susceptibility testing was performed on Acinetobacter spp. by modified Kirby Bauer method as per the CLSI guidelines 2019.[12] MICs of Colistin were determined by the E-test method according to the manufacturer's guidelines (Hi-media laboratories Pvt.Ltd.Mumbai).[13]

OBSERVATIONS AND RESULTS

This study was hospital based cross sectional observational study which was carried out during period of July 2018 to July 2020 in Department of Microbiology of a tertiary care center. A total of 200 isolates of Acinetobacter spp. obtained from various ICU were included in the present study.

Table 1: ICU wise distribution of Acinetobacter isolates.(n=200)



Out of total 200 Acinetobacter isolates, maximum were from Medical ICU (MICU) 61 (30.5%), followed by Respiratory ICU (RICU) 51 (25.5%), 49 (24.5%) from Surgery ICU (SICU), 35(17.5%) from pediatrics ICU (PICU) while least number of samples were from NICU 4 (2.0%) (Table 1).

Table 2: Infection wise distribution by Acinetobacter isolates

Sr. No	Infections	No of isolates (%)
1.	Pneumonia	91(45.5)
2.	Skin and soft tissue Infection	42(21.00)
3.	Septicemia	36(18.00)
4.	Urinary tract infection	12 (6.00)
5.	Ascites	12(6.00)
6.	Pleural effusion	4 (2.00)
7.	Meningitis	3 (1.5)
	Total	200

Table 2 shows, Acinetobacter isolates obtained from patients suffering from various infections. Out of total 200 isolates majority were of patients of pneumonia 91 (45.5%), followed by skin and soft tissue infection 42 (21%), septicemia 36 (18%). Acinetobacter was also found to be responsible for urinary tract infection 12 (6%), ascites 12 (6%), pleural effusion 4 (2%) and meningitis 3 (1.5%).

Table 3: Species wise distribution of Acinetobacter isolates

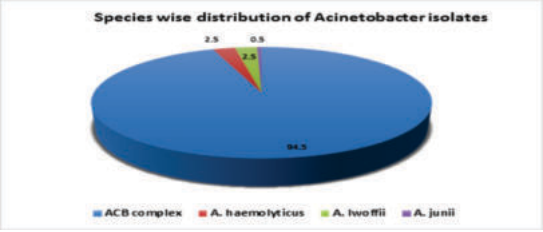


Table 3 shows that, out of total 200, ACB complex (Acinetobacter calcoaceticus–Acinetobacter baumannii complex) 189 (94.5%) was found to be the most common species isolated, followed by A lwoffii and A. haemolyticus 2.5 % each, A. junii 0.5%. ACB complex isolates were significantly higher (94.5%) as compared to other species (5%). This was statistically significant with p value less than 0.001.

Table 4 : Antimicrobial Susceptibility pattern of Acinetobacter isolates

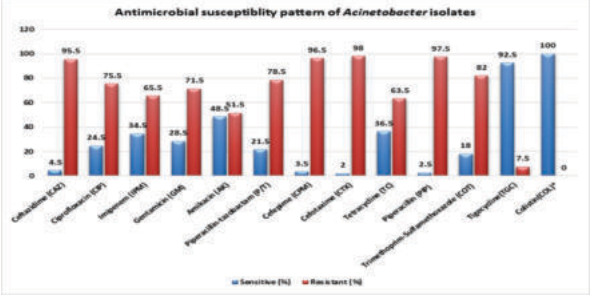


Table 10 shows that the maximum sensitivity of Acinetobacter was seen to Colistin (100%) followed by tigecycline (92.5%), and amikacin (48.5%) while Maximum resistance was observed to cefotaxime (98%), piperacillin (97.5%), cefepime (96.5%), ceftazidime (95.5%), Trimethoprim-Sulfamethoxazole (COT) (82%) and piperacillin-tazobactam (78.5%), Imipenenem (65.5%).

DISCUSSION-

The incidence of Acinetobacter infection in the intensive care unit (ICU) is rising and causes a great concern to worldwide clinicians and intensivists due to their ability to develop resistance to multiple classes of antibiotics.

In the present study out of total 200 Acinetobacter isolates, maximum were from Medical ICU (MICU) 61 (30.5%), followed by Respiratory ICU (RICU) 51 (25.5%),49 (24.5%) from Surgery ICU (SICU), 35(17.5%) from pediatrics ICU(PICU) while least number of samples were from NICU 4 (2.0%) (Table 2).

This study revealed nosocomial infection of Acinetobacter spp in MICU was 30.5% which was comparable with a study done by Neeta B Patwardhan,[14] who found 34.5%. whereas infections in ICUs observed by Mathai AS [15] was on lower side (10%).

In present study infection caused by Acinetobacter in RICU was 25.5%. In various Indian studies showed 29.28%,[16] 34.8%,[17] 41.8%[18] .There can be several reasons for this. The ICU mainly caters to medically critically ill patients. Accordingly, infectious diseases (pulmonary or extrapulmonary) are the most common indication for admission in our ICU followed by respiratory failure, acute severe asthma, exacerbation of chronic obstructive lung disease and a few others.

Infection in SICU in our study was 24.5%. In a study from western Maharashtra 18.08% [19] of Acinetobcter was responsible for nosocomial infection from patients admitted to the SICU.A Study done in north India reported 38.96% [20] andOne such study by Nahar A et al. reported a prevalence of 33.7% in ICU patients.[21] Acinetobacter infection contributed to 17.5% in PICU and 2 % from NICU while a study by shete et al showed 10.8 % of total septicemia cases. [22]

In this study, 91 (45.5%) isolates from pneumonia patients. Mathai AS [15] found Acinetobacter spp in 59 % of patients. Albert et al [23] isolated 45.00% Acinetobacter from VAP which was in concordance to our study whereas Ruiz-Santana et al [24] isolated 38.00%. skin and soft tissue infection due to Acinetobacter spp found to be 42 (21%). Joshi et al [25] reported 27.50%, While Dash et al [26] reported 56.9% respectively. 36 (18%) isolates of Acinetobacter spp were from septicemia cases. Various study ranges from 14-24% in various study [27-30].12(6%) isolates were isolated from UTI cases comparable findings of 5% and 8% were observed by Jaggi et al. [27] and Oberoi et al. [32] respecctively Higher values of 31.60 % isolates were reported by Sands et al. [31] There are reports of Acinetobacter meningitis in various study like Joshi et al [25] reported 0.8%, in 2013 Sinha et al [28] reported 0.71%, in 2014 Islahi et al [29] reported 2.17% isolates from meningitis.

In 200 isolates ACB complex (Acinetobacter calcoaceticus–Acinetobacter baumannii complex) 189 (94.5%) was found to be the most common species isolated, followed by A. lwoffii and A. haemolyticus 2.5 % each, A. junii 0.5%. Idomir et al [33] reported A.baumannii (87%) as commonest species isolated, followed by A.calcoaceticus (11.4%), A. lwoffii (0.93%) and A. haemolyticus (0.93%). Rit et al [34] reported A.baumannii (74.02%), A. lwoffii (14.2%), A. haemolyticus (7.79%) and A. junii (3.81%) in 2012. Species isolated by Tripathi et al [35] were A.baumannii (79.43%), A.calcoaceticus (12.14%), A. lwoffii (3.73%), A. haemolyticus (2.81%) and A. junii (1.89%).

Acinetobacter baumannii have proven to be among the most important pathogens frequently involved in serious hospital infection outbreaks.

The emerging resistance in today's world has created a major public health dilemma. Within the gram-negative bacilli, the non-fermentative bacilli occupy an important place and among them Acinetobacter.

In our study maximum sensitivity was found to be 100% to colistin and 92.5% tigecycline , study conducted by behera et al [37] and Khan ID et al [38] reported the same while islahi et al [29] noted lower sensitivity of 80.33% to colistin. Whereas 48.5% of Acinetobacter isolates were found to be sensitive to Amikacin which was comparable with study done by Tripathi et al [35] who noted 55.14% sensitivity to this drug.

carbapenems were considered as the gold standard for treating Acinetobacter sp. infections, but unfortunately, carbapenem resistance toward Acinetobacter sp. is becoming common. [25, 36] we recorded 65.5% resistance to imipenem similar findings were reported by Kaur et al. [40]

It is well known that this organism is rapidly developing resistance to various groups of antimicrobials including 3rd generation cephalosporins, flororoquinolones, Aminoglycosides and carbapnems indicating high prevalence of MDR strains.[22,28] In the present study, maximum resistance was seen to cefotaxime followed by piperacillin, cefepime and ceftazidime i,e 98%, 97.5%,96.5% and 95.5% respectively, Which are quite comparable with various other studies.[28,35,38]

Summary

Acinetobacter once considered non-virulent has been the documented cause of broad range of severe nosocomial infections. They cause a significant proportion of infections, especially in critically-ill patients receiving care in the intensive care unit (ICU) settings.. The iatrogenic factors i.e. overuse of broad spectrum antibiotics and high-risk patients with advanced age, history of alcohol intake, smoking, severity of illness,etc. Along with inherent and/or easily acquired mechanisms of

resistance makes this pathogen one of the most significant microbial challenges of the current era. Despite the majority of A.baumannii strains still being susceptible to carbapenems, many institutions around the world are faced with the challenging issue of pandrug resistance, leaving only limited therapeutic option. As a clinicians, microbiologists, and scientists must think broadly about approach to antimicrobial drug development, as novel targets will no doubt provide the most reward for afflicted patients. A combination of control measures is often required to eradicate these organism from the hospital environment. Continued surveillance in ICUs along with awareness of the need to maintain good housekeeping and control of the environment, including equipment decontamination, strict attention to handwashing and isolation procedures, and control of antibiotic usage, especially in high-risk areas, appears to be the combination of measures most likely to control the previously unabated spread of Acinetobacter spp. in hospitals.

REFERENCES

1. Seifert, H., Strate, A., & Pulverer, G. Nosocomial bacteremia due to Acinetobacter baumannii. Clinical features, epidemiology, and predictors of mortality. Medicine, 74(6) 340–349. https://doi.org/10.1097/00005792-199511000-00004. seifert1995.pdf. 1995;
2. Bergogne-Berezin E.Introduction and pespectives. In:Bergogne -Berrezin E,Friedma H,Bendeinelli M,editors. Infectious agents and pathogenesis Acinetobacter biology and pathogenesis. Springer Sci. 2008;xiii–xvi.
3. Wong D, Nielsen TB, Bonomo RA, Pantapalangkoor P, Luna B, Spellberg B. Clinical and pathophysiological overview of Acinetobacter infections: A century of challenges. Clin Microbiol Rev. 2017;30(1):409–47.
4. Al-Khoja MS, Darrell JH. The skin as the source of Acinetobacter and Moraxella species occurring in blood cultures. J Clin Pathol. 1979;32(5):497–9.
5. Geisinger E, Huo W, Hernandez-Bird J, Isberg RR. Acinetobacter baumannii : Envelope Determinants That Control Drug Resistance, Virulence, and Surface Variability . Annu Rev Microbiol. 2019;73(1):481–506.
6. Reboli AC, Houston ED, Monteforte JS, Wood CA, Hamill RJ. Discrimination of epidemic and sporadic isolates of Acinetobacter baumannii by repetitive element PCR-mediated DNA fingerprinting. J Clin Microbiol. 1994;32(11):2635–40.
7. Salama MF. Characterization of Multiresistant Acinetobacter baumannii Strain Causing a Large and Sustained Hospital Outbreak in ICU. 2006;15(3):483–92.
8. Howard A, O'Donoghue M, Feeney A, Sleator RD. Acinetobacter baumannii An emerging opportunistic pathogen. Virulence. 2012;3(3):5.
9. Asif M, Alvi IA, Ur Rehman S. Insight into acinetobacter baumannii: Pathogenesis, global resistance, mechanisms of resistance, treatment options, and alternative modalities. Infect Drug Resist. 2018;11:1249–60.
10. Brisou, J., and A. R. Prevot. 1954. Studies on bacterial taxonomy. X. The revision of species under Achromobacter group. Ann. Inst. Pasteur (Paris) 86:722–728. Vol. 21. 2008. 538–582 p.
11. Collee J, Marr W. Specimen collection, culture containers and media. In: Collee JG, Fraser AG, Marmion BP, Simmons A, editor: Mackie & McCartney practical medical microbiology. 14th ed. Newyork: Churchill Livingstone; 1999. 95–112 p.
12. CLSI 2019: Performance standard for antimicrobial susceptibility testing; eighteenth informational supplement; M100-29th ed. Clinical and laboratory standard institute. Wayne, PA, USA 2019.
13. Gales AC, Reis AO, Jones RN. Contemporary assessment of antimicrobial susceptibility testing methods for polymyxin B and colistin: review of available interpretative criteria and quality control guidelines. J Clin Microbiol. 2001 Jan;39(1):183-90.
14. Pradhan NP, Bhat SM, Ghadage DP. Nosocomial infections in the medical ICU: a retrospective study highlighting their prevalence, microbiological profile and impact on ICU stay and mortality. J Assoc Physicians India. 2014;62(10):18-21.
15. Mathai AS, Oberoi A, Madhavana S, Kaur P, Acinetobacter infections in a tertiary level intensive care unit in northern India: Epidemiology, clinical profiles and outcomes Journal of Infection and Public Health 2012; 5: 145—152
16. Mahendra M, Jayaraj BS, Lokesh KS, et al. Antibiotic Prescription, Organisms and its Resistance Pattern in Patients Admitted to Respiratory ICU with Respiratory Infection in Mysuru. Indian J Crit Care Med.2018;22(4):223-230.doi:10. 4103/ijccm. IJCCM_409_17
17. Agarwal R, Gupta D, Ray P, Aggarwal AN, Jindal SK. Epidemiology, risk factors and outcome of nosocomial infections in a Respiratory Intensive Care Unit in North India. J Infect. 2006 Aug;53(2):98-105. doi: 10.1016/j.jinf.2005.10.021. Epub 2005 Dec 15. PMID: 16343637.
18. Prashanth K, Badrinath S. Nosocomial infections due to Acinetobacter species: Clinical findings, risk and prognostic factors. Indian J Med Microbiol. 2006;24:39–44.
19. Baviskar AS, Khatib KI, Rajpal D, Dongare HC. Nosocomial infections in surgical intensive care unit: A retrospective single-center study. Int J Crit Illn Inj Sci. 2019;9(1):16-20. doi:10.4103/IJCIIS.IJCIIS_57_18
20. Multidrug Resistant Acinetobacter Infection in Surgical Intensive Care Unit in a Tertiary Care Center in North India Shugufta Roohi1 , Lubna Samad1 , Saba Wani2 , Bashir A Fomda3 , Mohd Suhail Lone1 , Junaid Ahmad1 , Akeela Fatima1 , Abiroo Jan1
21. Nahar A, Anwar S, Saleh AA, Miah MRA. Isolation of Acinetobacter species and their antimicrobial resistance pattern in an Intensive care unit (ICU) of a tertiary care hospital in Dhaka, Bangladesh. Bangladesh J Med Microbial. 2016;10:18-21.
22. Shete VB, Ghadage DP, Muley VA, Bhore AV. Acinetobacter septicemia in neonates admitted to intensive care units. J Lab Physicians. 2009;1(2):73-76. doi:10.4103/0974-2727.59704.
23. Albert S, Kirchner J, Thomas H, Behne M, Schur J, Brade V. Role of quantitative cultures and microscopic examinations of endotracheal aspirates in the diagnosis of pulmonary infections in ventilated patients. J Hosp Infect 1997;37:25-37.
24. Ruiz-Santana S, Garcia-Jimenez A, Esteban A, Guerra L, Alvarez B, Corcia S et al. ICU pneumonias: a multi-institutional study. Crit Care Med 1987;15:930-2.
25. Joshi SG, Litake GM, Satpute MG, Telang NV, Ghole VS, Niphadkar KB. Clinical and demographic features of infection caused by Acinetobacter species. Indian J Med Sci 2006;60:351-60.
26. Dash M, Padhi S, Pattnaik S, Mohanty I, Misra P Frequency, risk factors, and antibiogram of Acinetobacter species isolated from various clinical samples in a tertiary care hospital in Odisha, India, Avicenna J Med. 2013 Oct-Dec; 3(4): 97–102.
27. Jaggi N, Sissodia P,Sharma L, Acinetobacter baumannii isolates in a tertiary care hospital: Antimicrobial resistance and clinical significance 3 J Microbiol Infect Dis Vol 2, No 2, June 2012
28. Sinha M, Srinivas, Macaden R. Antibiotic resistance profile and extended spectrum beta-lactamase (ESBL) production in Acinetobacter species. Indian J Med Res 2007;126:63-7.
29. Islahi S., Ahmad F., Khare V., Yaqoob S., Shukla P., Singh Y. Incidence and risk factors associated with Acinetobacter species infection in hospitalised patients in a tertiary care hospital in North-India. J. Commun. Dis. 2015;46:10–12.
30. Mindolli PB, Salmani MP, Vishwanath G, Hanumanthapa AR. Identification and speciation of Acinetobacter and their antimimicrobial susceptibility testing. Al Ameen J Med Sci. 2010;3:3459.
31. Sands M, McCarter Y, Sanchez W. Synergy testing of multidrug resistant Acinetobacter baumanii against tigecycline and polymyxin using an E-test methodology. Eur J Clin Microbiol Infect Dis 2007;26:521–2.
32. Oberoi A, Aggarwal A, Lal M. A decade of underestimated nosocomial pathogen-Acinetobacter in a tertiary care hospital in Punjab. JK Sci. 2009;11:24–6.
33. Idomir M, Nemet C, Pascu A, Ardeleanu M. Acinetobacter spp.: pathogenic role and resistance to antibiotics. Bulletin of the Transilvania University of Brasov 2009;2:55-8.
34. Rit K, Saha R. Multidrug-resistant Acinetobacter infection and their susceptibility patterns in a tertiary care hospital. Niger Med J. 2012;53:126–8.
35. Tripathi PC, Gajbhiye SR, Agrawal GN. Clinical and antimicrobial profile of Acinetobacter spp.: An emerging nosocomial superbug. Adv Biomed Res 2014;3:13.
36. Walsh TR, Toleman MA, Poirel L, Nordmann P. Metallobetalactamases: The quiet before the storm? Clin Microbiol Rev 2005;18:306-25.
37. Behera B, Mathur P, Rayner CR, Nation RL. Evaluation of susceptibility testing methods for polymyxin. Int Infect Dis. 2010;596-601.
38. Khan ID, Basu A, Kiran S, Trivedi S, Pandit P, Chattoraj A. Device-Associated Healthcare-Associated Infections (DA-HAI) and the caveat of multiresistance in a multidisciplinary intensive care unit. Med J Armed Forces India. 2017 Jul;73(3):222-231.
39. Patwardhan RB, Dhakephalkar PK, Niphadkar KB, Chopade BA. A study on nosocomial pathogens in ICU with special reference to multiresistant Acinetobacter baumannii harbouring multiple plasmids. Indian J Med Res 2008;128:178-87.
40. Kaur, Tanvir & Putatunda, Chayanika & Oberoi, Aroma & Vyas, Ashish & Kumar, Gaurav. (2018). Prevalence and drug resistance in acinetobacter sp. Isolated from intensive care units patients in Punjab, India. Asian Journal of Pharmaceutical and Clinical Research.