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Original Research Article

MULTIDRUG RESISTANT ACINETOBACTER SPP. FROM VARIOUS CLINICAL SAMPLES IN INTENSIVE CARE UNIT OF A TERTIARY CARE HOSPITAL, BIHAR, INDIA

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Abstract

Background: There has been recent emergence of Acinetobacter spp. in both developing and developed countries revealing its potential to cause sustained outbreaks within the ICU and resilience to the nosocomial environment. To estimate the extent of the problem in the adult ICU of the tertiary care hospital and also analyze the prevalent situation for possible control measures. **Materials and Methods:** A prospective study was conducted from June 2023 to December 2023. In Department of Microbiology, JLNMC, Bhagalpur, Bihar. We processed 4000 clinical samples from patients from various sources like pus (n=1300), blood (n=1101), urine (n=1200), sputum (n=222) and endotracheal aspirates (n=177). A total of 152 Acinetobacter isolates were isolated and identified by the following method. The samples were sub-cultured onto blood agar, Mac Conkey's agar, and incubated at 37°C. After 24 hours, Gram staining was done from the colonies, which showed presence of gram-negative cocco-bacilli by microscopy. Further identification was done using bio-chemical tests as per standard operating procedures.7 After identification, antimicrobial susceptibility testing was done by the Kirby- Bauer disk diffusion method to determine the drug resistance, as per CLSI guidelines.8 The isolates were tested against ampicillin, amoxicillinclavulunic acid, ceftazidime, ciprofloxacin, amikacin, cotrimoxazole, piperacillin-tazobactum, imipenem, colistin, and polymyxin B. Isolates showing resistance to at least three categories of drugs. **Result:** Out of 152 isolates, 141 isolates were from inpatients (91.84 per cent) and 11 were from outpatients (10 per cent). We found, 52.04 per cent (n=79) isolates were from females, and 47.96 per cent (n=73) were from males. The mean age of the study population was 38.19±22.32 years. In male and female patients it was 49.558±23.29 and 35.30±26.26 years respectively. The proportion of isolates was more in the age group between 20–40 years. **Conclusion:** Antibiotic susceptibility testing is critical in the treatment of infections caused by Acinetobacter, particularly in those with inadequate response to antibiotic therapy.

INTRODUCTION

The intensive care unit (ICU) in a hospital is a unique setting having both patients with compromised immune status and conditions conducive to the growth of microorganisms. On one hand it houses critically ill patients, while at the same time it also provides a suitable environment for proliferation and persistence of several multidrug resistant organisms (MDROs) amidst high antibiotic pressure.[1] Several factors like over the counter antibiotic use, overcrowding in hospitals, imperfect infection control practices, and use of excessive invasive devices contribute to the development of high antimicrobial resistance, especially in developing countries.[2] Additionally, these factors also facilitate easy transmission of MDROs implicated in various healthcare associated infections (HCAI). One such MDRO that has rapidly reached the level of a 'significant pathogen' from commensals of 'little significance' is Acinetobacter spp.[3] The tremendous ability of this organism to accumulate antibiotic resistant determinants in response to antibiotic challenges and resist adverse conditions causing initial colonization and subsequent infection is really bothersome.[4] There has been recent emergence of Acinetobacter spp. in both developing and developed countries revealing its potential to cause sustained

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outbreaks within the ICU and resilience to the nosocomial environment.[5] With worldwide reports of increasing isolation of this organism from the ICU, we performed a laboratory-based audit of HCAI with special reference to Acinetobacter spp. to estimate the extent of the problem in the adult ICU of the tertiary care hospital and also analyze the prevalent situation for possible control measures.

MATERIALS AND METHODS

A prospective study was conducted from June 2023 to December 2023. In Department of Microbiology, JLNMC, Bhagalpur, Bihar. We processed 4000 clinical samples from patients from various sources like pus (n=1300), blood (n=1101), urine (n=1200), sputum (n=222) and endotracheal aspirates (n=177). A total of 152 Acinetobacter isolates were isolated and identified by the following method.

The samples were sub-cultured onto blood agar, Mac Conkey's agar, and incubated at 37°C. After 24 hours, Gram staining was done from the colonies, which showed presence of gram-negative cocco-bacilli by microscopy.

Further identification was done using bio-chemical tests as per standard operating procedures.7 After identification, antimicrobial susceptibility testing was done by the Kirby- Bauer disk diffusion method to determine the drug resistance, as per CLSI guidelines.[8]

The isolates were tested against ampicillin, amoxicillinclavulunic acid, ceftazidime, ciprofloxacin, amikacin, cotrimoxazole, piperacillin-tazobactum, imipenem, colistin, and polymyxin B. Isolates showing resistance to at least three categories of drugs i.e. penicillin's and cephalosporin's, fluroquinolones, and amino glycosides, were considered multi-drug resistant.1,3,9 Extensive drug resistant (XDR) Acinetobacter were isolates displaying resistance to carbapenems in addition to resistance to penicillin's and cephalosporin's, fluroquinolones, and aminoglycosides.[3] Pan-resistant Acinetobacter spp. was defined as Acinetobacter isolate that is resistant to the whole panel of antibiotics tested.[3]

RESULTS

Out of 152 isolates, 141 isolates were from inpatients (91.84 per cent) and 15 were from outpatients (10 per cent). We found, 52.04 per cent (n=79) isolates were from females, and 47.96 per cent (n=73) were from males. The mean age of the study population was 38.19±22.32 years. In male and female patients it was 49.558±23.29 and 35.30±26.26 years respectively. The proportion of isolates was more in the age group between 20–40 years [Table 1].

A total of 152 Acinetobacter isolates were analysed, out of which 114 (75 per cent) were multi-drug resistant. Of these MDR isolates, 30 (19.9 per cent) were pan-resistant. Acinetobacter spp. was isolated from different wards in our hospital. Most of the MDR isolates, 70.9 per cent (n=79), were from the intensive care units (ICU) and general surgery [Table 2].

Acinetobacter spp. was isolated from various clinical samples like pus, endotracheal (ET) aspirate, urine, blood, sputum, and other body fluids. Pus samples showed the greatest isolation rate of 35.82 per cent, followed by endotracheal aspirate at 24.09 per cent.

Antibiotic susceptibility testing was carried out by the Kirby- Bauer disc diffusion method. More than 90 per cent of isolates displayed resistance to ampicillin, amoxicillinclavulunic acid, ceftazidime, and amikacin [Table 3]. Resistance to gentamicin, co-trimoxazole and ciprofloxacin were also common. Least resistance was seen to piperacillin-tazobactam and imipenem.

Table 1: Age-wise distribution of Acinetobacter isolates

Age groups	Number of patients (%)
< 5 years	19 (12.29%)
5—20 years	12 (4.91%)
20—40 years	48 (34.42%)
40—60 years	38 (26.22%)
> 60 years	33 (22.13%)

Table 2: Distribution of Acinetobacter isolates in hospital wards.

Ward	Number of non- MDR isolates (n=38)	Number of MDR3 isolates (n=114)
ICU	9	41
General Surgery	8	27
Obstetrics and Gynaecology	6	19
Orthopaedics	2	8
General Medicine	5	4
Paediatrics	2	0
Urology	1	4
Out patients	5	11

Table 3: Comparison of antibiotic resistance pattern of MDR and non-MDR Acinetobacter isolates

Drug	Non-MDR (n=35)	MDR (n=114)
Ampicillin	20	91
Amoxycillin – clabulanic acid	12	91
Ceftazidime	7	89

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Amikacin	1	66
Gentamicin	1	77
Co trimoxazole	3	74
Ciprofloxacin	7	82
Piperacillin - tazobactam	2	50
Imipenem	1	35

DISCUSSION

Acinetobacter has emerged as an important nosocomial pathogen, especially in the ICU set-up.6 In our study prevalence was more among the inpatients (91.06 per cent), which clearly reflect the nosocomial origin of this pathogen. Similar prevalence was observed in other studies.[1,3] We found no gender difference in Acinetobacter infections.

Among 152 isolates, 114 (75 per cent) isolates displayed resistance to three or more categories of antibiotics; 30 (19.9 per cent) of MDR isolates were resistant to all antibiotics tested (pan-resistant). Increased isolation of this organism was seen in ICU (52 per cent). This finding is comparable to other studies.[1,3,10,11]

Abbo et al stated that isolation was more from respiratory tract, which was 32 per cent, followed by wound (19.5 per cent), urine (9 per cent), and blood was (16 per cent).1 In our study increased isolation was from pus samples (35.82 per cent) followed by endotracheal aspirates, which was 24.09 per cent and urine 16.97 per cent. Percentage of isolation from blood was only 5.73 per cent, which was contrary to the findings in a study done by Mastofi et al, which showed high isolation rates from blood.[10]

Acinetobacter is resistant to many antibiotics with more isolation from areas under increased antibiotic pressure such as ICUs. This has decreased the therapeutic options available to treat them.[3,6,12] Our isolates showed high resistance to ampicillin (91 per cent), amoxicillin– clavulanic acid (85 per cent), ceftazidime (75.4 per cent), amikacin (56.1 per cent%), gentamicin (66.6 per cent), cotrimoxazole (58.9 per cent), and ciprofloxacin (66.9 per cent). Similar findings were reported in a study done in Tehran from three different hospitals.[10]

In the present study, the least resistance was shown to piperacillin-tazobactum and imipenem, 33.9 per cent and 22.6 per cent, respectively. Another study reports a resistance percentage of 73.3 per cent to imipenem, increased resistance to piperacillin-tazobactum, and high resistance to third-generation cephalosporins.[13]

The above findings clearly show the emerging resistance to co-trimoxazole and ciprofloxacin followed by imipenem and piperacillin-tazobactum, which remain the main stay of treatment for these infections. This is comparable to another study done by Valentia et al.[6] Hence, stringent infection control measures and judicious use of antibiotics are essential for treatment and prevention of Acinetobacter infections.

Emerging resistance to antibiotics could not be ascertained by determining the minimum inhibitory concentration (MIC) for the drugs tested. Risk factor assessment for the MDR Acinetobacter could not be evaluated. Only 10 isolates could be tested for susceptibility to Colistin and were found to be sensitive. This was due to non-availability of the disc for testing. These were the major limitations of this study.

CONCLUSION

Multi-drug resistant Acinetobacter has emerged as an important nosocomial pathogen, especially in critical care units. A significant proportion of the isolates were multidrug resistant. Antibiotic susceptibility testing is critical in the treatment of infections caused by Acinetobacter, particularly in those with inadequate response to antibiotic therapy.

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