Original Research Article

Antibiotic susceptibility profile of acinetobacter isolates from various clinical specimens at a tertiary care hospital in South Karnataka

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ABSTRACT

Introduction: Acinetobacter is one of the most common pathogens causing Hospital acquired infections (HAI) and has taken more and more imperative place as an opportunistic, difficult-to-treat pathogen. Development of drug resistance among them during recent years has made treatment of these infections difficult.

Objective: 1) To estimate the prevalence of Acinetobacter isolates among various clinical samples in the study setting. 2) To determine the antimicrobial susceptibility pattern among isolated Acinetobacter species.

Materials and Methods: A descriptive study was conducted over a period of one year from November 2012 to October 2013 in the Department of Microbiology, Mysore Medical College and Research Institute, Mysore among 110 Acinetobacter species isolated from various clinical specimens and antibiotic susceptibility testing was performed using Kirby-Bauer disc diffusion technique. Statistical analysis was done using Microsoft office excel 2010.

Results: Majority of the Acinetobacter species were isolated from patients younger than 1 year, male patients especially inpatients and that too among those admitted to Intensive care units (ICU) and majority were from pus samples. Antimicrobial susceptibility testing showed maximum resistance 93 (84.54%) to cephalosporin and maximum sensitivity 101(91.81%) to Colistin.

Conclusion: This study highlights the need for the surveillance to detect multidrug resistance Acinetobacter species, judicious use of antibiotics and implementation of appropriate infection control measures to control the spread of these strains in the hospital.

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1. Introduction

Acinetobacter is a complex genus and historically, there has been confusion about the existence of multiple species. Worldwide in the past two or three decades, especially since 2005-2006 members of the genus Acinetobacter have emerged from organisms of questionable pathogenicity to pan resistant nosocomial pathogens. Acinetobacter species are gram negative, strictly aerobic, non-fastidious, non-fermenting encapsulated coccobacilli with more than 30 genomic types. It’s most important representative is Acinetobacter baumannii.

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**Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa, and Enterobacter species** to emphasize that they escape the lethal action of antibiotics. 

Acinetobacter species have become resistant to nearly all routinely prescribed antimicrobial agents like aminoglycosides, fluoroquinolones, broad-spectrum β-lactams and also against cephalosporins and carbapenems. The appearance of resistant species is attributed to both inappropriate use of antimicrobials and health care associated transmission of drug-resistant strains among patients and have posed significant challenges for clinicians in their treatment. With this background, the present study was undertaken to study antimicrobial susceptibility pattern among Acinetobacter species in the study setting.

2. Aims and Objectives

1. To estimate the prevalence of Acinetobacter isolates among various clinical samples in the study setting.
2. To determine the antimicrobial susceptibility pattern among isolated Acinetobacter species.

3. Materials and Methods

A descriptive study was conducted over a period of one year from November 2012 to October 2013 in the Department of Microbiology, Mysore Medical College and Research Institute, Mysore among 110 Acinetobacter species isolated from various clinical samples from patients. Ethical clearance was taken from the Ethical clearance committee. Permission was taken from the head of the institution.

3.1. Isolation of acinetobacter species

A total of 2750 culture positive clinical samples such as pus, urine, blood, sputum, CSF, endotracheal aspirate, sputum and other body fluids were inoculated on 5% sheep blood agar and maccnkey agar and incubated overnight aerobically at 37° C. All isolates obtained were further processed and identified by routine microbiological and biochemical tests. In case of urine samples, the isolates were subjected to biochemical tests only if the colony count was significant (>10^5 CFU/ml). Genus Acinetobacter was identified by characteristic colonies (Non Lactose fermenting, glistening, small mucoid colonies), Gram staining pattern as Gram negative coccobiacilli, motility as non-motile, and standard biochemical reactions (catalase, oxidase, oxidation-fermentation test, indole production, citrate utilization, urease activity, reaction in triple sugar iron medium.

3.2. Antibiotic susceptibility testing

Antibiotic susceptibility testing was performed for each isolate by the Kirby-Bauer disc diffusion method. The antimicrobial agents used were- gentamicin (10µg), ciprofloxacin (5µg), cotrimoxazole (25µg), ceftazidime (30µg), ceftriaxone (30 µg), cefo-taxime (30µg), cefoperazone+sulbactam (75 µg/30 µg), amikacin (30µg), Tigecycline (15 µg), aztreonam (30 µg), piperacillin-tazobactam (100mg/10mg), imipenem (10mg), chloramphenicol (30µg), colistin (10µg). Antibiotic susceptibility results were interpreted by measuring the zone diameters produced and correlating them with the CLSI (Clinical and Laboratory Standard Institute) standards.

3.3. Data collection

A pretested and semi structured proforma was used to collect data like name, age, sex, clinical presentation, predisposing factors, history of treatment as well as results of antibiotic susceptibility testing for all Acinetobacter isolates.

3.4. Statistical analysis

Statistical analysis was performed using Microsoft Excel 2010.

4. Results

1. Out of 2750 culture positive samples in the present study, 110 were found to be positive for Acinetobacter species thereby making a prevalence of 4%.
2. Table 1 illustrates distribution of Acinetobacter isolates according to some variables.
   i. Out of 110 isolates studied, maximum number i.e. 29 (26.36%) of isolates were from infants, followed by 19 (17.27%) in 20 - 29 year age group and 18 (16.36 %) in 40 - 49 years. Also 14 (12.72%) samples were among elderly aged >60 years as seen in the table.
   ii. Majority i.e. 60 (54.54%) of Acinetobacter species were found among males and the male: female ratio was 1.2:1.
   iii. Majority i.e.103 (93.60%) were inpatients.
   iv. Maximum number of the specimens i.e. 67(60.90%) were recovered from various wards (Medical, Surgical, ENT, OBG, Pediatrics wards etc) and nearly one third i.e. 36 (32.72%) from Intensive Care Units.
3. Table 2 demonstrate distribution of various clinical samples positive for Acinetobacter species. Pus with 51 (46.36%) samples and blood with 42 (38.18%) of samples accounted for significant contributors to Acinetobacter species in the present study.
4. Table 3 shows antibiotic susceptibility pattern of Acinetobacter species. In the present study among 110 Acinetobacter isolates, highest resistance i.e. 93 (84.54%) was seen against 3rd generation cephalosporins followed by chloramphenicol 89 (80.90%), cotrimoxazole 80 (72.72%), ciprofloxacin 76 (69.09%) and gentamicin 72 (65.45%).
Table 1: Distribution of Acinetobacter isolates according to variables (n = 110)

| Variable          | Classification | Number of isolates | Percentage (%) |
|-------------------|----------------|--------------------|----------------|
| Age in years      |                |                    |                |
| <1                | 29             | 26.36              |                |
| 1-9               | 4              | 3.63               |                |
| 10-19             | 8              | 7.27               |                |
| 20-29             | 19             | 17.27              |                |
| 30-39             | 12             | 10.9               |                |
| 40-49             | 18             | 16.36              |                |
| 50-59             | 6              | 5.45               |                |
| ≥ 60              | 14             | 12.72              |                |
| Gender            |                |                    |                |
| Male              | 60             | 54.54              |                |
| Female            | 50             | 45.45              |                |
| Department        |                |                    |                |
| Outpatients       | 7              | 6.4                |                |
| General           | 67             | 60.9               |                |
| NICU              | 19             | 17.27              |                |
| Wards             |                |                    |                |
| ICU               | 17             | 15.45              |                |
| OPD               | 7              | 6.36               |                |

5. Discussion

The prevalence of Acinetobacter isolates in the present study was 4% which is comparable with other studies. However, many other studies have reported higher prevalence rates. This variation could be due to differences in study settings, study design, method of isolation, sampling technique as well as differences in the profile of patients.

Majority i.e. 29 (26.36%) of isolates were from infants similar to the findings of study done by Madhu Sharma et al. and contrary to few other studies. The

Table 2: Distribution of Acinetobacter isolates according to clinical samples (n = 110)

| Specimen            | No. of isolates | Percentage (%) |
|---------------------|-----------------|----------------|
| Pu                 | 51              | 46.36          |
| Blood              | 42              | 38.18          |
| Urine              | 08              | 7.27           |
| Endotracheal aspirate | 6              | 5.45           |
| Sputum             | 3               | 2.72           |
| Total              | 110             | 100            |

male: female ratio was 1.2:1 which corroborates with other studies. Acinetobacter isolates were more 103 (93.60%) from inpatients in confirmation with other studies. Similarly, maximum isolates were from wards 67 (60.90%) in line with another study. This could be probably due to invasive diagnostic procedures; greater quantity of broad spectrum antimicrobials used and prolonged duration of stay in hospital among inpatients. Majority i.e. 51 (46.36%) of Acinetobacter species were isolated from pus samples, which is in agreement with the results reported previously in other studies.

However, several other studies have stated higher isolation rates from clinical samples like urine, blood and respiratory secretions. In the present study, Acinetobacter species were found to be resistant to most commonly used antibiotics. The highest resistance was seen in third generation cephalosporins 93 (84.54%) which was similar to the findings of other studies. Resistance to Imipenem recorded was 57 (51.81%) whereas lower resistance was reported by other studies. The results of the present study are compared with previously published studies in Table 4.

Table 3: Distribution of Acinetobacter isolates according to their antibiotic susceptibility pattern (n=110)

| Antibiotic          | Antibiotic susceptibility | Resistant No. (%) |
|---------------------|---------------------------|------------------|
| Cefazidime          | 17 (15.45)                | 93 (84.54)       |
| Ceftriaxone         | 17 (15.45)                | 93 (84.54)       |
| Cefotaxime          | 17 (15.45)                | 93 (84.54)       |
| Chloramphenicol     | 21 (19.09)                | 89 (80.90)       |
| Cotrimoxazole       | 30 (27.27)                | 80 (72.72)       |
| Ciprofloxacin       | 34 (30.9)                 | 76 (69.09)       |
| Gentamicin          | 38 (34.54)                | 72 (65.45)       |
| Piperacillin+Tazobactam | 40 (36.36)            | 70 (63.63)       |
| Cefoperazone+Sublicbactam | 51 (46.36)           | 59 (53.63)       |
| Imipenem            | 53 (48.18)                | 57 (51.81)       |
| Aztreonam           | 56 (50.9)                 | 54 (49.09)       |
| Amikacin            | 64 (58.18)                | 46 (41.81)       |
| Tigecycline         | 85 (77.27)                | 25 (22.72)       |
| Colistin            | 101 (91.81)               | 9 (8.18)         |

Table 4: Comparison of antibiotic sensitivity of various studies with the present study

| Study series       | G     | CF    | CE    | CA    | CI    | CO    | AK    | PT    | CFS   | TGC   | I     | AO    | CL    | C     |
|--------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Lone R, et al.     | 13.40 | 30.80 | 34.20 | -     | 38.20 | -     | -     | -     | 88.50 | -     | 95.80 | -     | -     | -     |
| Mindol I PB et al. | 43.50 | 22.00 | 51.00 | -     | 56.50 | 83.00 | -     | -     | 84.45 | -     | -     | -     | -     | 09    |
| Parandekar PK et al. | 9.00 | 18.10 | 22.70 | -     | 00    | 27.20 | -     | -     | -     | 86.30 | -     | -     | -     | -     |
| Tripath I PC et al.| 13.00 | 15.00 | 00    | 13.00 | 55.14 | 13.18 | -     | -     | 57.00 | -     | -     | -     | -     | -     |
| Oberoi A et al.    | 8.5   | 0.8   | -     | -     | 0.8   | 14.6  | -     | -     | 2.30  | -     | 0.8   | -     | -     | -     |
| Maryam A et al.    | 31.33 | 32.60 | 11.00 | 3.33  | 8.70  | 61.66 | -     | -     | 63.00 | 100   | -     | -     | -     | -     |
| Single P, et al.   | 29.87 | -     | 25.90 | -     | 85.71 | 81.80 | -     | -     | 94.80 | -     | -     | -     | 12    | -     |
| Shareck PS, et al. | -     | 28.00 | 12.20 | 28.00 | 10.50 | 22.80 | 24.50 | 21.00 | 33.33 | 61.40 | 24.50 | 14.00 | -     | -     |
| Present study      | 29.09 | 27.20 | 10.90 | 10.90 | 10.90 | 54.54 | 27.27 | 41.81 | 68.18 | 40.00 | 45.45 | 91.81 | 19.09 | -     |
study showed an increased prevalence of resistance of the Acinetobacter species against piperacillin/tazobactam combination with only 40(36.36%) isolates being sensitive. This is in accordance with studies done both within and outside India.4,30,34 Similarly, Acinetobacter isolates showed maximum sensitivity to colistin 101(91.81%) in corroborations with other studies 3,4,13,15,19,30,32,34,35 and sensitivity to tigecycline was 75 (68.18%) which corroborates with other studies.4,15,34

6. Conclusion
The present study shows that the significance of Acinetobacter has increased as a nosocomial pathogen in various wards of the hospital because of high potential of this genus to develop multidrug resistance and highlights the need for its surveillance, judicious use of antibiotics and implementation of appropriate infection control the spread of these strains in the hospital.

7. Source of funding
None.

8. Conflict of interest
None.

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