Original Article

Frequency and antimicrobial susceptibility of Acinetobacter species isolated from blood samples of paediatric patients

Ayisha Javed[1], Aizza Zafar[2], Hasan Ejaz[3], Muhammad Zubair[4]

ABSTRACT

Objective: *Acinetobacter* species is a major nosocomial pathogen causing serious infections in immuno-compromised and hospitalized patients. The aim of this study was to determine the frequency and antimicrobial susceptibility pattern of *Acinetobacter* species in blood samples of paediatric patients.

Methodology: This cross sectional observational study was conducted during January to October, 2011 at The Children's Hospital and Institute of Child Health, Lahore. A total number of 12,032 blood samples were analysed during the study period. *Acinetobacter* species were identified using API 20E and their antimicrobial susceptibility pattern was studied using Kirby-Bauer disc diffusion method.

Results: The blood cultures showed growth in 1,141 cultures out of which 46 (4.0%) were *Acinetobacter* species. The gender distribution of *Acinetobacter* species was 29 (63.0%) in males and 17 (37.0%) in females. A good antimicrobial susceptibility pattern of *Acinetobacter* species was seen with sulbactam-cefoparazone (93.0%), imepenem and meropenem (82.6% each) and piperacillin-tazobactam (78.0%). The antimicrobial susceptibility of cefixime (19.5%), co-amoxiclav and cefotaxime (23.9% each), cefuroxime (26.0%), ceftazidime and ceftriaxone (30.4%) was poor.

Conclusion: The results of the present study shows high rate of resistance of *Acinetobacter* species with cephalosporins in nosocomial infections. The sulbactam-cefoperazone, carbapenems and piperacillin-tazobactam showed effective antimicrobial susceptibility against *Acinetobacter* species.

KEY WORDS: Antimicrobial susceptibility, *Acinetobacter* species, Paediatric blood samples.

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INTRODUCTION

Acinetobacter is a major cause of nosocomial infections. It is an opportunistic pathogen which can cause meningitis, bactermia or both and is a multi-drug resistant organism.[1] *Acinetobacter* species are short Gram negative rods, measuring in size from 1.0 to 2.5um. They belong to gamma proteobacteria group and are non-motile, non-fermentative, oxidase negative and catalase positive. They are widely distributed in hospital environment where they infect the patients. Up to 20% of hospital floor swabs and 27% of hospital sink traps contains *Acinetobacter* species.[2]

Sporadic cases of *Acinetobacter* species are most frequently isolated from intensive care units. Clinical isolates of *Acinetobacter* species form biofilms on the different clinical instruments. These biofilms play an important role in spreading blood stream infections because of their ability to cover the surface of medical devices.[3] *Acinetobacter* species also cause nosocomial pneumonia, skin and soft tissue infections, meningitis, bactermia and urinary tract infections.[4]

Infections with *Acinetobacter* species has become one of the major threats to the health care system. It is a major cause of high mortality rate in patients due to nosocomial infections. It has developed resistance against a number of broad spectrum drugs and is considered as multi-drug resistant (MDR) bacteria.[5] The increasing numbers of MDR *Acinetobacter* strains are responsible for higher mortality and morbidity. The immunocompromised patients are at more risk of various life threatening infections which are difficult to treat because of high resistance.[6]

The aim of this study was to evaluate the frequency and antimicrobial susceptibility of *Acinetobacter* species among the hospitalized paedriatic patients so that the panel of antibiotics being used to treat *Acinetobacter* infections may be revised in paediatric patients.

METHODOLOGY

This cross sectional observational study was conducted in the Microbiology Department of The Children's Hospital and Institute of Child Health Lahore, Pakistan, from January to October, 2011. The blood samples were collected in Brain Heat Infusion broth. After overnight incubation the sample were sub-cultured on daily basis on Blood and MacConkey agar plates to isolate the bacterial growth. The negative cultures were discarded after seven days. *Acinetobacter* species were identified on the basis of colony morphology, Gram's stain, oxidase and API 20E. A seven digit number generated on the basis of various biochemical reactions of API 20E system was checked by API 20E software which confirmed the *Acinetobacter*.[7]

The isolated *Acinetobacer* species were processed for antimicrobial susceptibility testing to various antibiotics *in vitro* using the Kirby-Bauer disc diffusion method. A suspension of each bacterial strain was made according to the 0.5 McFarland turbidity standard and two petri plates (90mm) of Muller Hinton agar were used for antimicrobial susceptibility testing of each strain. The antibiotic discs of amikacin (30 µg), aztreonam (30 µg), cefepime (30µg), cefixime (5 µg), cefotaxime (30 µg), ceftazidime (30 µg), cefuroxime (30 µg), ciprofloxacin (5 µg), co-amoxiclav (20/10 µg), co-trimoxazole (1.25/23.75 µg), gentamycin (10 µg), meropenem (10 µg), imepenem (10 µg), piperacillin-tazobactam (100/10 µg) and sulbactam-cefoperazone (75/30 µg) were placed on the Mueller-Hinton agar (Oxoid) plates and incubated at 37°C overnight. After overnight incubation the diameter of each zone of inhibition was measured in mm. The susceptibility testing results were noted according to the Clinical and Laboratory Standards Institute (CLSI) guidelines.[8]

RESULTS

During the study period, total of 12,032 blood samples were analysed for culture and susceptibility testing. There were 1,141 culture positive samples, out of which 46 (4.0%) were *Acinetobacter* species and 1,095 (96.0%) were other bacteria. The frequency of *Acinetobacter* species in male and female patients was 29 (63.0%) and 17 (37.0%), respectively.

Table-I: Antimicrobial susceptibility pattern of Acinetobacter species

Antibiotics	*Susceptible n (%)*	*Resistant n (%)*
Amikacin (30µg)	24 (52.0)	22 (47.0)
Co-amoxiclav (20/10µg)	11 (23.9)	35 (76.0)
Aztreonam (30µg)	23 (50.0)	23 (50.0)
Cefepime (30µg)	31 (67.4)	15 (32.6)
Cefixime (5µg)	9 (19.5)	37 (80.0)
Cefotaxime (30µg)	11 (23.9)	35 (76.0)
Ceftazidime (30µg)	14 (30.4)	32 (69.6)
Ceftriaxone (30µg)	14 (30.4)	32 (69.6)
Cefuroxime (30µg)	12 (26.0)	34 (73.9)
Ciprofloxacin (5µg)	26 (56.5)	20 (43.5)
Gentamycin (10µg)	23 (50.0)	23 (50.0)
Imepenem (10µg)	38 (82.6)	8 (17.4)
Meropenem (10µg)	38 (82.6)	8 (17.4)
Piperacillin-tazobactam (100/10µg)	36 (78.0)	10 (21.7)
Co-trimoxazole (1.25/23.75µg)	20 (43.5)	26 (56.5)
Sulbactam-cefoperazone (75/30µg)	43 (93.0)	3 (6.5)

An effective antimicrobial susceptibility pattern of *Acinetobacter* species was seen with sulbactam-cepeparazone (93.0%), imepenem and meropenem (82.6% each) and piperacillin-tazobactam (78.0%). The less effective antimicrobial susceptibility pattern was seen with cefepime (67.4%), ciprofloxacin (56.5%), amikacin (52.0%), aztreonam and gentamycin (50.0% each) and co-trimoxazole (43.5%). Least antimicrobial susceptibility was noted with cefixime (19.5%), co-amoxiclav and cefotaxime (23.9% each), cefuroxime (26.0%), ceftazidime and ceftriaxone (30.4% each) (Table-I).

DISCUSSION

Acinetobacter species are commonly present in the hospital environment and cause cross contamination, which sometimes results in life threatening infections. This study provides the current data about the frequency and antimicrobial susceptibility of *Acinetobacter* species, isolated from blood samples of paediatric patients. According to our study the frequency of *Acinetobacter* species was 4.0% among the culture positive blood samples. *Acinetobacter* species were less frequent in blood samples as compared to other bacteria causing blood stream infections. A study conducted in paediatric intensive care unit (PICU) of a tertiary care teaching hospital reported 8.6% frequency of *Acinetobacter* species isolated from blood samples.[9] Another study done in National Cheng Kung University, Tainan reported the similar result of 9.9% for *Acinetobacter* species.[10] The frequency of *Acinetobacter* in our study was lower than the other studies. This could be due to clean hospital environment and hygienic conditions. In our study, the frequency of *Acinetobacter* species was 63.0% in males and 37.0% in females. The rate of incidence of *Acinetobacter* infections was higher in males as compared to females. A study from India reported the *Acinetobacter* infections in 58.0% males and 42.0% females.[11]The reason for this is not known but may be the parents bring more male children to the hospital than the female.

Acinetobacter in our study showed good antimicrobial susceptibility to sulbactam-cefoparazone, imepenem, meropenem and piperacillin-tazobactam 93.0%, 82.6%, 82.6% and 78.0% respectively. The reason of this good sensitivity may be because of limited use of these expensive injectable antibiotics. Less exposure of these drugs did not aid the pathogen to develop resistance against these drugs. It was noted in another study that sulbactam-cefoparazone was one of the best option for the cure of infections caused by *Acinetobacter* species. *Acinetobacter* species were found susceptible to sulbactam-cefoparazone (73.8%), piperacillin-tazobactam (73.0%) and carbapenems (64.3%).[12,13] A study conducted in Taiwan reported 99.0% sensitivity of *Acinetobacter* species to carbapenems.[9] A recent study done in an Italian hospital reported that *Acinetobacter* species developed some resistance against carbapenems.[14] These observations are also in line with our results.

We observed the antimicrobial susceptibility of *Acinetobacter* species to conventional antibiotics like cefepime (67.4%), amikacin (52.0%), gentamycin (50.0%), co-trimoxazole (43.5%), ceftriaxone (30.43%), cefuroxime (26.0%), co-amoxiclav and cefotaxime (23.9% each) and cefixime (19.5%). A study conducted in Argentinean hospital reported the sensitivity pattern of *Acinetobacter* to ceftriaxone (70.0%), cefepime (36.7%) and amikacin (35.0%).[15] In a study done in Latin America antimicrobial susceptibility pattern to *Acinetobacter* species isolated from blood stream infections showed the antimicrobial susceptibility to ciprofloxacin (42.5%), gentamycin (43.8%), co-trimoxazole (41.5%), cefuroxime (37.8%), co-amoxiclav (35.1%), cefotaxime (35.2%) and cefixime (33.0%).[16]

Acinetobacter species were found susceptible to ciprofloxacin (56.5%), aztreonam (50.0%) and ceftazidime (30.43%) respectively. A study reported the combination of aztreonam, ceftazidime, ciprofloxacin with amikacin against *Acinetobacter* species showed antimicrobial sensitivity of 40.9%, 56.0% and 86.4% respectively.[17] The prolonged exposure of these antibiotics to *Acinetobacter* species can be a reason to develop resistance against these antibiotics. A number of studies emphasized on proper and prescribed use of antibiotics against *Acinetobacter* species. *Acinetobacter* infections are the emerging threat to the health care institutes now a days. This organism spreads through person to person contact, medical devices, hospital environment, sinks or medical care staff. The university of Chicago press published their work few years back and reported that environmental cleaning, contact isolation; hospital staff education programmes can improve these conditions.[18]

In conclusion there should be some educational programmes for the hospital staff, personal hygienic awareness guides for patients and attendants to avoid the incidence of *Acinetobacter* infections. This can be helpful to reduce the incidence of *Acinetobacter* infections among the hospitalized patients. The frequency of *Acinetobacter* species in

our study was low as compared to the other studies. Sulbactam-cefoparazone, imepenem, meropenem and piperacillin-tazobactam were found to be most effective antibiotics against *Acinetobacter* species but they should remain as reserved drugs and only be prescribed whenever needed after culture and antimicrobial susceptibility testing.

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