Original Article

Acinetobacter Septicemia in Neonates Admitted to Intensive Care Units

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ABSTRACT

Background: *Acinetobacter* species are gaining importance as potential pathogens in neonatal septicemia because of their frequent isolation and multidrug resistance.

Aims and Objectives: The aim of the present study was to evaluate the role of *Acinetobacter* spp. as important pathogens in neonatal blood stream infection, to identify the associated risk factors, and to evaluate the drug sensitivity pattern.

Materials and Methods: Blood samples of infected neonates were studied bacteriologically. Cases of *Acinetobacter* septicemia were identified. Speciation of *Acinetobacter* species was done. Various risk factors were identified. The drug-sensitivity test was done.

Results: A total of 26 *Acinetobacter* septicemia cases were identified by blood culture. *Acb complex* strains predominated. Institutional birth and preterm birth were identified as the most frequent significant risk factors. 11.3% mortality rate was recorded. *Acb complex* strains exhibited a multi-drug resistant pattern. No carbapenem resistance was observed.

Conclusion: *Acinetobacter* should be added to the list of organisms causing severe nosocomial infection in neonatal intensive care units. Continuous bacteriological surveillance, implementation of infection control policies, careful disinfection of intensive care equipment, and rational antibiotic use are required for control of such infections.

Keywords: *Acinetobacter* septicemia, multi-drug resistance, neonates

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INTRODUCTION

Acinetobacter, once considered as opportunistic pathogen of low virulence, has recently been emerged as an important nosocomial pathogen world over, mostly involving patients with impaired host defence, especially in intensive care units, neonatal units, and surgical wards.[1,2]

Acinetobacter species are the second most commonly isolated nonfermenter in human specimens (*Pseudomonas aeruginosa* is the most common).[3] They rank fourth (after *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *and Klebsiella pneumoniae*) among the most frequent hospital acquired infectious agents.[4]

Septicemia remains a significant cause of morbidity and mortality in the newborns, more so in the developing countries.[5] In India, according to National Neonatal Perinatal Database (NNPD) 2002-03, the incidence of neonatal septicemia has been reported to be 30/1000 live births. Along with other organisms such as *E. coli, Klebsiella* spp., *Staphylococcus aureus*, *Pseudomonas* spp., and *Salmonella* spp., *Acinetobacter* species are gaining importance as potential pathogens in neonatal septicemia because of their frequent isolation and multi-drug resistance.[6]

There are many studies documented wordwide in the literature, emphasizing the *Acinetobacter* as an important nosocomial agent of septicemia in neonatal intensive care units (NICU).[6-11] Early diagnosis and appropriate antimicrobial therapy of septicemia are of utmost importance to prevent morbidity and mortality.

The present study highlights *Acinetobacter* spp. as important pathogens in neonatal blood stream infection**.** Identification of risk factors for *Acinetobacter* septicemia and evaluation of antimicrobial sensitivity results were the other objectives.

MATERIALS AND METHODS

The present study included a total of 240 cases of neonatal septicemia admitted to NICU. All clinical details of these patients were noted. Blood samples of these neonates were collected with strict aseptic precautions. These samples were processed by standard bacteriological procedure for the isolation of *Acinetobacter* species.[3]

Identification of *Acinetobacter* species was made on the basis of phenotypic criteria recommended by Gerner-Smidt.[12] (Gram staining, colony morphology, penicillin susceptibility, oxidase, catalase and urease activity, citrate reduction, gelatin hydrolysis, glucose and lactose fermentation, and growth at 37°C and 44°C).

Antimicrobial susceptibility testing was performed on Muller Hinton agar by disc diffusion method for the following antimicrobial agents according to the Clinical and Laboratory Standards Institutes guidelines (CLSI):[13] amikacin (30 μg), ampicillin (10 μg), cefotaxime (30 μg), ceftazidime (30 μg), ciprofloxacin (5 μg), gentamicin (10 μg), chloramphenicol (30 μg), co-trimoxazole (25 μg), imipenem (10 μg), and meropenem (10 μg). *Escherichia coli* ATCC 25922 and *Pseudomonas aeruginosa* ATCC 27853 were used as quality control strains.

Statistical analysis was done to see the association between various risk factors and *Acinetobacter* septicemia.

RESULTS

A total of 26 *Acinetobacter* species were isolated from blood specimens of 26 septicemia neonates. Thus *Acinetobacter* constituted for 10.8% (26/240) of total cases of neonatal septicemia. Of these, 22 (84.6%) isolates were identified as *Acb complex* strains and 4 (15.4%) isolates as *Acinetobacter lwoffi*.

The various risk factors observed for *Acinetobacter* septicemia are displayed in Table 1.

It is seen from Table 1 that babies born in the hospitals and born before the term are comparatively at higher risk of acquiring *Acinetobacter* infection. A significant association was observed between the different risk factors such as hospital birth, preterm birth, birth weight <1500 g, hospitalization >7 days, and mechanical ventilation. Although utilization of CVC, incubation, and age ≤ 7 days are seen associated with *Acinetobacter* blood stream infection, their association was not proved statistically significant.

A total number of three babies died. The mortality rate was 11.3%. All these babies had grown *Acb complex* strains on blood culture.

The drug-sensitivity results are shown in Table 2.

The multi-drug resistant pattern was observed with *Acb complex* strains. Merpoenem, imipenem, and amikacin are found to be the most effective drugs against *Acb complex* strains. *A. lwoffii* had shown comparatively sensitive pattern. All *Acinetobacter* strains showed 100% sensitivity to imipenem and meropenem.

DISCUSSION

Acinetobacter is an emerging important nosocomial pathogen, which particularly affects critically ill patients in intensive care units (ICUs), neurosurgery, burn, and haemodialysis units.[1]

Although classically described as nosocomial pathogen in adults, *Acinetobacter* is also an important pathogen in neonates hospitalized in ICUs.[14] Increasing rates of *Acinetobacter* infections may be due to lapses in infection-control practices. In these situations, "colonization pressure", which is a function of the proportion of patients already colonized or infected with *Acinetobacter*, can affect the likelihood of cross-transmission between patients.[15] *Acinetobacter* has

Table 1: Risk factors associated with *Acinetobacter* septicemia neonates

Risk factors	No. of neonates (n = 26) (%)	χ^2 value	*P* value degree of freedom = 1	Association
Hospital birth	21 (80.7)	4.03	$P < 0.05$	Significant
Preterm birth	18 (69.2)	4.78	$P < 0.05$	Significant
Birth weight <1500 g	17 (65.3)	6.4	$P < 0.05$	Significant
Age ≤ 7 days (EOS)	15 (57.6)	0.5	$P > 0.05$	Not significant
Hospitalization > 7 days	10 (38.4)	3.9	$P < 0.05$	Significant
Utilisation of CVC	9 (34.6)	0.4	$P > 0.05$	Not significant
Incubation	26 (100)	0.03	$P > 0.05$	Not significant
Mechanical ventilation	14 (53.8)	8.7	$P < 0.05$	Significant

EOS - Early onset septicemia; CVC - Central venous catheter

Table 2: Resistance percentages of *Acinetobacter species* against various antimicrobial agents

Antibiotic	Resistant percentage	
	Acb complex (n = 22) (%)	*A. lwoffii (n = 4)*
Amikacin	9 (40.9)	1 (1/4)
Ampicillin	19 (86.3)	2 (1/2)
Cefotaxime	18 (81.8)	2 (1/2)
Ceftazidime	19 (86.3)	2 (1/2)
Chloramphenicol	16 (72.7)	2 (1/2)
Ciprofloxacin	17 (77.2)	1 (1/4)
Cotrimoxazole	15 (68.1)	1 (1/4)
Gentamicin	16 (72.7)	1 (1/4)
Imipenem	0	0
Meropenem	0	0

been implicated in many outbreaks of neonatal sepsis in NICU.[7,10,16] The isolation rate of *Acinetobacter* species from blood samples of septicemic neonates in the Indian literature ranges from 8.3% to 15.2%.[6,11,17] In the present study, *Acinetobacter* contributed to 10.8% of total septicemia cases. *Acb complex* strain was the most predominant strain encountered in neonatal septicemia accounting for 84.6% of total cases of *Acinetobacter* septicemia.

The risk factors associated with nosocomial infections due to this microorganism include mechanical ventilation, surgery, and trauma.[15] Septicemia due to *Acinetobacter* spp. are common in babies with predisposing factors such as intravascular catheterization, endotracheal intubation, parenteral nutrition, broad spectrum antibiotic therapy, and artificial ventilation.[6]

In the present study, various risk factors identified for *Acinetobacter* septicemia are tabulated in Table 1. Institutional birth and preterm birth are identified as the most frequent risk factors. This might be because of multi-drug resistant strains jerking in the hospital environment.[11] We observed a significant association between *Acinetobacter* blood stream infection and following risk factors: Hospital birth, preterm birth, birth weight <1500 g, hospitalization >7 days, and mechanical ventilation. Denise von Dolinger de Brito *et al*.[15] had reported the similar findings.

In all the documented studies of *Acinetobacter* septicemias in neonates, the mortality rate ranges from 13.9% to 83%.[14,18] We recorded 11.3% mortality (3-26) in the present study.

In recent years, multiple antibiotic-resistant *Acinetobacter* have been widely reported from ICUs.[1] Outbreaks due to multiple resistant strains have been difficult to control, especially in ICUs. It is documented that the prior use of third-generation cephalosporins (especially ceftazidime), fluoroquinolones, and carbapenems is associated with the subsequent development of MDR *A. baumannii*.[19]

Acb complex strains have exhibited the multi-drug resistant pattern in the present study. *A. lwoffii* strains have shown comparatively a sensitive pattern. Cephalosporin resistance is observed in 81-86% *Acinetobacter* strains. Mechanisms of acquiring resistance to cephalosporins and carbapenems described for *A. baumannii* are altered penicillin-binding proteins, the presence of metallo-beta lactamases, and the loss of porins.[15] However, no carbapenem resistance is encountered with the *Acinetobacter* strains in the current study.

CONCLUSION

Acinetobacter should be added to the list of organisms causing severe nosocomial infection in neonatal intensive care units. Multi-drug resistant nosocomial *Acinetobacter* septicemia may cause severe clinical disease in neonates that is associated with a high mortality.[20] The increase in the infection rate due to a particular pathogen may be due to lapses in infection-control measures, resulting in an increase in cross-transmission between patients. Therefore, continuous bacteriological surveillance, implementation of infection control policies, careful disinfection of intensive care equipment, and rational antibiotic use are required to control such infections.

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