Acinetobacter Septicemia in Neonates Admitted to Intensive Care Units

Vishal B Shete, Dnyaneshwari P Ghadage¹, Vrishali A Muley¹, Arvind V Bhore¹

Departments of Microbiology, B.J. Medical College and Sassoon General Hospital, ¹SKN Medical College and General Hospital, Pune, Maharashtra, India

Address for correspondence: Dr. Muley Vrishali Avinash, E-mail: vamuley@rediffmail.com

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

DOI: 10.4103/0974-2727.59704

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 worldwide 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.[13] (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), cefazidime (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 *Aeb 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 *Aeb complex* strains on blood culture.

The drug-sensitivity results are shown in Table 2.

The multi-drug resistant pattern was observed with *Aeb complex* strains. Meropenem, imipenem, and amikacin are found to be the most effective drugs against *Aeb complex* strains. *A. lwoffi* 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.[11]

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...
been implicated in many outbreaks of neonatal sepsis in NICU. The isolation rate of Acinetobacter species from blood samples of septicemic neonates in the Indian literature ranges from 8.3% to 15.2%. 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. 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.

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. 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. had reported the similar findings.

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

In recent years, multiple antibiotic-resistant Acinetobacter have been widely reported from ICUs. 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.

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 lactamas, and the loss of porins. However, no carbapenem resistance is encountered with the Acinetobacter strains in the current study.

**REFERENCES**

1. Bergogne-Berezin E, Towner KJ. Acinetobacter species as nosocomial pathogens: Microbiological, clinical, and epidemiological features. Clin Microbiol Rev 1996;9:148-65.
2. Melamed R, Greenberg D, Porat N, Karpus M, Zmora E, Golan A, Karplus M, Zmora E, Golan A, Melamed R, Greenberg D, Porat N, Karpus M, Zmora E, Golan A, Karplus M. Successful control of an Acinetobacter baumannii outbreak in a neonatal intensive care unit. J Hosp Infect 2005;53:31-8.
3. Koneman EW, Allen SD, Janda WM, Schreckenberger PC, Winn Jr WC. Color Atlas and textbook of diagnostic microbiology. 5th ed. Lippincott Williams and Wilkins; 1997. p. 253-320.
4. Aktas O, Ozbek A. Prevalence and in-vitro antimicrobial susceptibility patterns of acinetobacter strains isolated from patients in intensive care units. J Int Med Res 2003;31:272-80.
5. Khatua SP, Das AK, Chatterjee BD, Khatua S, Ghose B, Saha A. Neonatal septicemia. Indian J Pediatr 1986;53:509-14.
6. Vinodkumar CS, Neelagund YF. Acinetobacter septicemia in neonates. Indian J Med Microbiol 2004;22:71.
7. Touati A, Achour W, Cherif A, Hmida HB, Al Afifi AS, Jarousha AA, Shete, et al.: Acinetobacter septicemia

**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. 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.
Shete, et al.: Acinetobacter septicemia

2008;37:107-12.

10. Yhu-Chering SH, Wu LH, Leu TL, Hsieh HS, Wu-Shiun MD, Tung-Mei LC, et al. Outbreak of Acinetobacter baumannii bacteraemia in a neonatal intensive care unit: Clinical implications and genotyping analysis. Pediatr Infect Dis J 2002;1:1105-9.

11. Arora U, Jaitwani J. Acinetobacter spp.: An emerging pathogen in neonatal septicemia in Amritsar. Indian J Med Microbiol 2006;24:81.

12. Gerner-Smidt P, Tjernberg I, Ursing J. Reliability of phenotypic tests for identification of Acinetobacter species. J Clin Microbiol 1991;29:277-82.

13. Clinical and Laboratory Standards Institutes 2004: Performance standards for antimicrobial susceptibility testing; Fourteenth informational supplement M100-S14 Vol.24 No.1 Pennsylvania USA 2004.

14. McDonald LC, Walker M, Loretta C, Matthew A, Sonia G, et al. Outbreak of Acinetobacter spp. bloodstream infections in a nursery associated with contaminated aerosols and air conditioners. Pediatr Infect Dis J 1998;17:716-22.

15. von Dolinger de Brito D, Oliveira EJ, Abdallah VO, da Costa Darini AL, Filho PP. An outbreak of Acinetobacter baumannii septicemia in a neonatal intensive care unit of a university hospital in Brazil. Braz J Infect Dis 2005;9:301-9.

16. de Brito VD, Oliveira EJ, da Costa Darini AL, Abdallah VO, Gontijo-Filho PP. Nosocomial outbreaks due to Pseudomonas aeruginosa and Acinetobacter baumannii in a Neonatal Intensive Care Unit (NICU) of the Uberlândia Federal University Hospital. Braz J Microbiol 2003;34:27-8.

17. Mondal GP, Raghvan M, Vishnu B, Srinivasan S. Neonatal septicemia among inborn and outborn babies in a referral hospital. Indian J Pediatr 1991;58:529-33.

18. Pillay T, Pillay DG, Adhikari M, Pillay A, Sturm AW. An outbreak of neonatal infection with Acinetobacter linked to contaminated suction catheters. J Hosp Infect 1999;43:299-304.

19. Wang SH, Sheng WH, Chang YY, Wang LH, Lin HC, Chen ML, et al. Healthcare associated outbreak due to pan-drug resistant Acinetobacter baumannii in a surgical intensive care unit. J Hosp Infect 2003;53:97-102.

20. Cisneros JM, Reyes MJ, Pachon J, Becerril B, Caballero FJ, Garcia-Garmendia JL, et al. Bacteremia due to Acinetobacter baumaninii: Epidemiology, clinical findings, and prognostic features. Clin Infect Dis 1996;22:1026-32.

Source of Support: Nil, Conflict of Interest: None declared.