

## Clinical and Bacteriological Characteristics of Neonatal Sepsis in an Intensive Care Unit in Kashan, Iran: A 2 Year Descriptive Study

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### ABSTRACT

**Background:** Neonatal sepsis is a serious problem in neonatal intensive care units, as it causes high rates of morbidity and mortality.

**Objectives:** The purpose of this study is to evaluate various etiologic agents, antimicrobial susceptibility, clinical manifestations and the mortality rate in an intensive care unit in Kashan, Iran.

**Patients and Methods:** One hundred and four neonates with documented early onset sepsis in a 2 year period from 2006 to 2008 were enrolled in this descriptive study. The results of blood cultures and antimicrobial susceptibility and clinical manifestations and outcome were collected in questionnaires and subsequently analyzed.

**Results:** We evaluated 104 cases including 63 (61%) males and 41 (39%) females. The most common clinical presentations were respiratory distress in 28 (26.9%), poor feeding in 18 (17.3%), lethargy in 15 (14.5%), fever in 15 (14.5%) and jaundice in 13 cases (12.5%). The most common organisms isolated from blood cultures were *Flavobacterium* (43.3%), *Pseudomonas* (17.3%) and coagulase positive *Staphylococcus* (17.3%). All *Flavobacterium* were resistant to Ampicillin and 100% were susceptible to Amikacin.

**Conclusions:** The most common isolated organism from blood cultures was *Flavobacterium*. Water was causative source of *Flavobacterium*. Later on we found that an outbreak had occurred during our study and these results may not be seen in an ordinary situation.

**Keywords:** Infant, Newborn; Sepsis; *Flavobacterium*; Microbial Sensitivity Tests; Outbreak

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► Implication for health policy/practice/research/medical education:

Neonatal sepsis is one of the most prevalent causes of mortality in neonates. Since the etiologic agents varies depending on the circumstances, continuous surveillance for detecting the more common microorganisms which cause sepsis in a neonatal intensive care unit is critical.

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## 1. Background

Neonatal sepsis is the most serious problem in neonatal intensive care, resulting in significant morbidity and mortality (1). Neonates can present either shortly following birth or later with subtle signs to suggest infection. Despite significant improvements in the care and management of acutely ill infants, septicemia remains one of the top 10 causes of neonatal death (2).

Outbreaks with various microorganisms can occur in some situations with special and sometimes uncommon organisms such as bacillus, *Flavobacterium*, *Enterobacter* etc., which can be as a result of unhygienic equipment or water contamination (3-9). Antimicrobial susceptibility pattern differs based on some factors such as antibiotic use (10).

## 2. Objectives

We evaluated the causative microorganism, antibiotic sensitivity, clinical manifestations and mortality rate of neonates with sepsis in a neonate intensive care unit in Shabihkhani hospital, Kashan, Iran during a 2 year period.

## 3. Patients and Methods

We evaluated 1126 neonates who had born in Shabihkhani hospital in Kashan, Iran in a 2 year period between 2006-2008. Among them, 104 neonates with documented and proven sepsis were enrolled in a prospective descriptive study. All of the neonates with clinical manifestations suggestive of sepsis and with positive blood cultures (2 sets) within the first four days of birth were included in this study. All neonates with suspicious sepsis manifestations without positive blood cultures, late onset sepsis (after the fourth day of birth) and neonates under the ventilator were excluded from the study.

We took 2 sets of blood cultures from all of the neo-

nates suspected of sepsis. We routinely used blood agar for blood cultures and subsequently used specific laboratory tests such as oxidase, katalase, lysin-ornitin and argenin decarboxylate tests for demonstrating the type of gram negative rods. In 45 cases, we found a gram negative rod with yellow colonies, oxidase, catalase, urease negative and gelatinase positive *Flavobacterium spp.* We were suspicious of all of these rods with reduced nitrite that did not produce indoles.

After using routine diagnostic tests in Shabihkhani Hospital, the positive blood cultures suspected to be *Flavobacterium* species were referred to the microbiology department of Kashan University of Medical Sciences for accurate diagnostic laboratory tests. We were correct our assumptions as the bacterium was confirmed.

Since *Flavobacterium* was detected in a significant number of patients, we tried to detect the source of contamination by taking some environmental samples such as serum set, distilled water and from the hands of the health workers.

Data including gender, vaginal delivery or cesarean, preterm and terms, birth weight, results of blood cultures and antibiograms were recorded in questionnaires and cases followed up until mortality or recovery rate was calculated. Data analyzed by SPSS version 13.

## 4. Results

One hundred and four neonates with early onset proven sepsis (among 1126 neonates born in Shabihkhani hospital during 2006-2008) were enrolled in the present study. The incidence of sepsis was 9.2% during the period of this study. Sixty three (61%) neonates with sepsis were male and 41 cases (39%) were female.

Fifty eight (55.7%) of the neonates were preterm whereas 46 (44.3%) were term. 65.5% of them were born by cesarean section. The birth weight was under 2500 grams in 42.1% of cases, 2500-4000 grams in 52% and over than 4000 grams in 5.9%.

**Table 1.** Isolated Microorganisms and Mortality Rate

Microorganism	Total Patients, No. (%)	Female, No. (%)	Male, No. (%)	Mortality, No. (%)
<i>Flavobacterium spp.</i>	45 (43.3)	22 (53.6)	23 (37.7)	8 (17.7)
<i>Pseudomonas spp.</i>	18 (17.3)	5 (12.1)	13 (21.3)	4 (22.2)
Coagulase positive <i>staphylococcus</i>	18 (17.3)	8 (19.5)	10 (16.3)	3 (16.6)
Coagulase negative <i>staphylococcus</i>	6 (5.9)	2 (4.8)	4 (6.5)	0
<i>Enterobacter</i>	4 (3.8)	1 (2.4)	3 (4.9)	0
<i>Escherichia coli</i>	4 (3.8)	1 (2.4)	3 (4.9)	1 (25)
Non hemolytic <i>streptococcus</i>	3 (2.9)	1 (2.4)	2 (3.2)	0
<i>Diphtheroids</i>	2 (1.9)	1 (2.4)	1 (1.6)	0
<i>Klebsiella</i>	2 (1.9)	0	2 (3.2)	0
<i>Listeria</i>	2 (1.9)	0	2 (3.2)	0

The most common clinical presentation in the cases was respiratory distress which was presented in 28 (26.9%) of the neonates. Eighteen (17.3%) had poor feeding, 15 (14.5%) had lethargy, 15 cases (14.5%) had fever and 13 (12.5%) cases had presented with jaundice. The other signs were vomiting in 6 (5.7%), irritation in 3 (2.9%), cyanosis in 3 (2.9%), seizure in 2 (1.9%) and hyporeflexia in 1 (0.9%).

Isolated microorganisms and mortality rate have been revealed in Table 1. Sixteen (15.4%) neonates died and the others recovered.

*Flavobacterium* were 100% resistant to Ampicillin whereas all of strains were susceptible to Amikacin. Ten percent of strains were resistant to Ceftriaxone, 47% resistant to Ceftazidime and 24% were resistant to gentamycin. The reference laboratory confirmed the contamination of distilled water with *Flavobacterium*.

Ninety three point four percent (93.4%) of the isolated *Pseudomonas* strains were susceptible to Ceftazidim. However, susceptibility to Gentamycin, Amikacin and Ceftriaxone was 55.6%, 60% and 57.1%, respectively. Among isolated coagulase positive *staphylococcus* strains, 75% were resistant to Cloxacillin whereas all of them were susceptible to Vancomycin.

## 5. Discussion

Neonatal sepsis is one of the most significant causes of mortality in neonates. Since the etiologic agents differ according to circumstance, continuous surveillance for detecting more common microorganisms which cause sepsis in a neonatal intensive care unit is critically important.

We evaluated the etiologic agents as well as antimicrobial susceptibility, clinical manifestations and mortality rate in an intensive care unit in this study. However, our results were skewed since an outbreak had occurred during our study. It is unlikely our results would be the same in a more ordinary situation.

The majority of studies show that sepsis in male neonates occurs more frequently than in female neonates (11). In our study, male neonates were more susceptible to sepsis than females (61% versus 39%).

In a study in another part of Kashan, preterm neonates were particularly vulnerable since 73% of preterm neonates had sepsis (12). The relationship between low birth weight and neonatal sepsis has been reported in the Trotman study (13). In our study, 42.1% of the sepsis cases were under 2500 grams.

The most common presentation of the neonates in our study (26.9%) was respiratory distress followed by poor feeding, lethargy, fever and jaundice. Martin showed that the most common presentation was poor feeding in 25.6% and thereafter jaundice in 16.2%, following by lethargy in 10.1% (14).

In our study, the most common isolated microorganism from blood cultures was *Flavobacterium* (45 cases, 43.3%).

Following that, *Pseudomonas* (17.3%) and coagulase positive *Staphylococcus* (17.3%) were the most common organisms. Although our results are similar to the majority of similar investigations in which gram negatives were the most common organisms to cause neonatal sepsis, the type of gram negatives differed in the different regions of one country (4, 15-18).

Some investigations differed from our results. For instance, in a study in India, *Staphylococcus aureus* were the most common isolated organisms in neonates with sepsis (19).

*Flavobacterium*, the most common isolated organism in the present study, is a nosocomial infection, therefore we evaluated possible reservoirs and found that the distilled water was the source of the contamination. In Hogue's study, which studied an outbreak of *Flavobacterium*, some of his results are similar to our findings (3).

Although *Flavobacterium* spp. are essentially resistant to beta lactams including carbapenems and aminoglycosides (20), however all isolated *Flavobacterium* strains in our investigation were resistant to Ampicillin while 100% were susceptible to amikacin. Inversely, in a study in Taiwan in 1996-1999, all isolated *Flavobacterium* were resistant to aminoglycosides (21) and in Malaysia, isolated *Flavobacterium* were resistant to Ampicillin, Amikacin and Gentamycin (22). It would seem that the pattern of antimicrobial susceptibility is different in various areas.

Mortality rate also varies in different regions. In our study, 16 cases (15.4%) died. The mortality rate has been reported as high as 37% in Bangladesh (14). There are some limitations in our study. Our study was designed as a descriptive study. Further analytic studies with a higher number of cases are necessary for conclusions that are more accurate.

In conclusion, continuous surveillance for the detection of common microorganisms which cause sepsis is highly recommended for neonatal intensive care units. When an uncommon nosocomial infection such as *Flavobacterium* is the most common reason for newborn sepsis, the evaluation of probable reservoirs including equipment and water is necessary. Since etiologic agents and antimicrobial susceptibility vary from region to region and even various places within one country, this surveillance should be conducted in every region and at least every couple of years.

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## Authors' Contribution

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## References

1. Wu J-H, Chen C-Y, Tsao P-N, Hsieh W-S, Chou H-C. Neonatal Sepsis: A 6-Year Analysis in a Neonatal Care Unit in Taiwan. *Pediatr Neonatol.* 2009;**50**(3):88-95.
2. Robinson DT, Kumar P, Cadichon SB. Neonatal Sepsis in the Emergency Department. *Clin Pediatr Emerg Med.* 2008;**9**(3):160-8.
3. Hoque SN, Graham J, Kaufmann ME, Tabaqchali S. Chryseobacterium (Flavobacterium) meningosepticum outbreak associated with colonization of water taps in a neonatal intensive care unit. *J Hospital Infect.* 2001;**47**(3):188-92.
4. Tresoldi AT, Padoveze MC, Trabasso P, Veiga JFS, Marba STM, von Nowakowski A, et al. Enterobacter cloacae sepsis outbreak in a newborn unit caused by contaminated total parenteral nutrition solution. *Am J Infect Control.* 2000;**28**(3):258-61.
5. Adler A, Gottesman G, Dolfin T, Arnon S, Regev R, Bauer S, et al. Bacillus species sepsis in the neonatal intensive care unit. *J Infect.* 2005;**51**(5):390-5.
6. Lahbabi MS, Wafi M, Benbachir M, Benomar S, Nejari C. Infections néonatales à Enterococcus faecalis: analyse de 29 observations Enterococcus faecalis neonatal infection: analysis of 29 cases. *Réanimation Urgences.* 2000;**9**(3):169-75.
7. Ceyhan M, Yildirim I, Tekeli A, Yurdakok M, Us E, Altun B, et al. A Chryseobacterium meningosepticum outbreak observed in 3 clusters involving both neonatal and non-neonatal pediatric patients. *A J Infection Control.* 2008;**36**(6):453-7.
8. Booth J, Enna SJ, David BB. *xPharm: The Comprehensive Pharmacology Reference.* 2007; p. 1-4
9. Macias AE, de Leon SP, Huertas M, Maravilla E, Romero C, Montoya TG, et al. Endemic infusate contamination and related bacteremia. *Am J Infect Control.* 2008;**36**(1):48-53.
10. Sader HS, Jones RN. Antimicrobial susceptibility of uncommonly isolated non-enteric Gram-negative bacilli. *Int J Antimicrob Agents.* 2005;**25**(2):95-109.
11. Avery G, Fletcher M, MacDonald M. Neonatology: pathophysiology and management of the newborn. *Lippincott Williams & Wilkins.* 1994.
12. Mosayebi Z, Movahedian A, Moniri R. Profile of Bacterial Sepsis in Neonates from Kashan in Iran. *J Infect Dis Antimicrob Agents.* 2003;**20**(2):97-102.
13. Trotman H. The neonatal intensive care unit at the University Hospital of the West Indies: The first few years' experience. *West India Med J.* 2006;**55**:75-9.
14. Weber M, Carlin J, Gatchalian S, Lehmann D, Muhe L, Mulholland E. Predictors of neonatal sepsis in developing countries. *Pediatr Infect Dis J.* 2003;**22**(8):711.
15. Tekerekoglu M, Durmaz R, Ayan M, Cizmeci Z, Akinci A. Analysis of an outbreak due to Chryseobacterium meningosepticum in a neonatal intensive care unit. *New Microbiol.* 2003;**26**(1):57-63.
16. Parry M, Hutchinson J, Brown N, Wu C, Estreller L. Gram-negative sepsis in neonates: a nursery outbreak due to hand carriage of Citrobacter diversus. *Pediatrics.* 1980;**65**(6):1105.
17. Cordero L, Sananes M, Ayers L. Bloodstream infections in a neonatal intensive-care unit: 12 years' experience with an antibiotic control program. *Infect Control Hospital Epidemiol.* 1999;**20**(4):242-6.
18. Osrin D, Vergnano S, Costello A. Serious bacterial infections in newborn infants in developing countries. *Current Opin Infect Dis.* 2004;**17**(3):217.
19. Karthikeyan G, Premkumar K. Neonatal sepsis: Staphylococcus aureus as the predominant pathogen. *India J Pediatr.* 2001;**68**(8):715-7.
20. Green BT GK, Nolan PE. Myroides odoratus cellulitis and bacteraemia: case report and review. *Scand J Infect Dis.* 2001;**33**:932-4.
21. Chiu C, Waddington M, Greenberg D, Schreckenberger P, Carnahan A. Atypical Chryseobacterium meningosepticum and meningitis and sepsis in newborns and the immunocompromised, Taiwan. *Emerg Infect Dis.* 2000;**6**(5):481.
22. Tekerekoglu M, Durmaz R, Ayan M, Cizmeci Z, Akinci A. Analysis of an outbreak due to Chryseobacterium meningosepticum in a neonatal intensive care unit. *New Microbiol: Offic J Italia Soci Med Odontoiat ClinMicrobiol (SIMMOC).* 2003;**26**(1):57.