

# NEONATAL INFECTIONS IN GAZI UNIVERSITY NICU BETWEEN 1996-1998

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Gazi Medical Journal 2000; 11: 13-17

## SUMMARY :

**Purpose:** Neonatal sepsis is a well-known cause of morbidity and mortality in neonatal intensive care units. Preterm infants are much more prone to the infections than term babies, and as the length of stay in the hospital increases, the likelihood of having nosocomial infections also increase. The purpose of this study, was to investigate the frequency and the etiology of infections seen in the neonatal intensive care unit of Gazi University between years 1996-1998. **Methods:** Retrospective chart review was performed to gather information about the patients with infection in the NICU during the years 1996, 1997 and 1998. **Results:** Total number of newborns with infections was 102 in all gestational age groups. Thirty eight babies had pneumonia, 54 had sepsis, and 17 had other infections. Length of hospital stay before the onset of infection was similar in septic term and preterm babies. Infectious agents were isolated in 35 septic infants. Community-acquired pneumonia was predominant amongst term infants, whereas ventilator treatment was the etiology of pneumonia in preterm babies. **Discussion:** Length of hospital stay is an important factor for sepsis in our unit. This result should make health care workers taking care of newborns to be more careful about the universal measures for infection control, such as good hand washing.

**Key Words:** Infection, Newborn.

## INTRODUCTION

Neonatal sepsis is a well-known cause of morbidity and mortality in neonatal intensive care units (NICU). The frequency differs from country to country, even from unit to unit, as well as maturation of the infant. Preterm infants are much more prone to infections than term newborns because of intrinsic factors, such as low immunoglobulin levels, decreased

macrophage and complement activity, and incomplete skin barriers (1,2). The rate of neonatal sepsis increases with prematurity and length of hospital stay. The longer the infant stays in the hospital, the higher the likelihood of developing nosocomial infections. The causes of infections are different according to the age of the infant and the care he gets. Within the first 24-72 hours of life, the etiology of sepsis in the newborn is mostly due to the infections acquired from the birth canal such as Group B

streptococcus infection or gram (-) bacilli (2,3). However, as the infant gets older, the infectious agents become the hospital flora which might be staphylococcus species or gram (-) microorganisms like Klebsiella or Pseudomonas. Invasive procedures performed on these infants, such as intubation or mechanical ventilation, and indwelling catheters such as umbilical or central lines increase the risk for nosocomial infections. Prolonged antibiotic regimens for suspected sepsis or pneumonia usually result in increased frequency of blood stream infections caused by resistant bacteria or fungus (4).

The purpose of this study was to investigate the frequency and etiology of infections between the years 1996-1998, in Gazi University, neonatal intensive care unit and extract ideas about the current infection control strategies, as well as about how to improve them.

#### METHODS

A retrospective chart review was performed to investigate the frequency of infections observed in newborns admitted to NICU during 1996, 1997, and 1998. The following information were gathered from the charts and NICU log book:

-Total number of patients admitted to the NICU annually.

-Total number of patients <37 weeks gestational age or >37 weeks gestational age determined by modified Ballard scoring system.

-Number of patients admitted for pneumonia, number of patients with documented or clinical sepsis based on tachypnea; respiratory rate >60/minute, tachycardia; heart rate >180/minute, poor perfusion ; capillary refilling time >3 seconds, and immature to total ratio; >0.2 and number of patients with infections other than pneumonia or sepsis (1,2,5,6).

-Age of the patients at the time of infection, and days spent in the NICU before the onset of infection.

-Microorganisms isolated from patients with culture proven sepsis or other infections, such as urinary tract infections, osteomyelitis, skin lesions, omphalitis or septic arthritis.

SPSS for Windows was used for statistical analysis. The intergroup differences were assessed by Mann Whitney-U test and p value <0.05 was considered significant.

#### RESULTS

Total number of admissions were 230 (181≥37 weeks gestational age (GA), 49<37 weeks GA), 275 ( 204≥37 weeks GA, 71<37 weeks GA, and 296 ( 226≥37 weeks GA, 70<37 weeks GA) in the years 1996, 1997 and 1998, respectively.

Total number of infected patients in each year according to GA equal or greater than 37 weeks or GA less than 37 weeks, and types of infections are shown in (Table 1). Twenty-three infants with pneumonia, 17 patients with sepsis, and two patients with other infections were followed in 1996. The number of infants with pneumonia was eight, the number of patients with sepsis was 12 , and the number of patients with other infections were four in 1997. There was no death amongst the infected patients in those two years. In the year 1998, seven patients were admitted for pneumonia, 25 patients were followed with sepsis, and 11 patients were followed for other infections. There were three deaths amongst the patients with sepsis and all were in the premature group.

When pooled together, total number of patients with infection and GA≥37 weeks was 74 out of 611 (12%) admissions in the past three years, and total number of patients with infection and GA < 37 weeks was 35 out of 190 (18 %) admissions in the past three years. All of the term patients with pneumonia were outborns, in contrast to only one preterm baby with pneumonia. Twenty-one of 31 septic term newborns, and five of 23 septic preterm newborns were outborns.

Types of infections, age at onset, days spent in NICU prior to infection, isolated infectious agents, mean GA and (BW) of patients and birth weight are summarized in Table 2, 3. Age at onset of sepsis, and days spent in NICU prior to infection were similar in babies <37 weeks of GA, and ≥37 weeks GA (p> 0.05).

In patients with pneumonia the infectious agents were determined only in four out of 32 patients. Those were the ones who were on mechanical ventilation, for appropriate tracheal aspirate cultures were obtained. However, in babies who were not intubated, the infectious agents for pneumonia were not isolated, because the bronchoalveolar lavage

Table 1 : Infections in NICU in the years 1996-1998.

Infections	1996		1997		1998	
	GA $\geq$ 37 weeks	GA < 37 weeks	GA $\geq$ 37 weeks	GA < 37 weeks	GA $\geq$ 37 weeks	GA < 37 weeks
pneumonia	19	4	5	3	5	2
sepsis	11	6	4	8	16	9
other infections	2	0	3	1	9	2
Total n of patients admitted to NICU	181	49	204	71	226	70

Table 2 : Infections in newborns of  $\geq$  37 weeks gestational age

Types of infections	Age (days) mean $\pm$ SD (range)	Days in NICU prior to infection mean $\pm$ SD (range)	Isolated infectious agent	GA weeks mean $\pm$ SD (range)	BW grams mean $\pm$ SD (range)
<b>pneumonia</b> n= 29	21.41 $\pm$ 6.77 (11.00-30.00)	0.00 $\pm$ 0.00	none	38.83 $\pm$ 1.23 (37.00-41.00)	3374.14 $\pm$ 423.48 (2750.00-4200.00)
<b>sepsis</b> n= 31	12.03 $\pm$ 8.34 (1.00-29.00)	6.32 $\pm$ 7.39 (0.00-28.00)	n=21 staph: 11 pseudomonas:3 klebsiella:4 e.coli: 1 candida: 1 MRSA: 1	38.93 $\pm$ 1.15 (37.00-41.00)	3258.55 $\pm$ 648.40 (1800.00-4700.00)
<b>Others</b> n= 14 UTI: 7 Osteomyelitis: 2 Omphalitis: 3 Meningitis: 2	17.43 $\pm$ 8.22 (5.00-30.00)	2.14 $\pm$ 8.02 (0.00-30.00)	staph: 4 e.coli: 5 klebsiella: 5	39.57 $\pm$ 0.85 (38.00-41.00)	3519.28 $\pm$ 570.95 (2450.00-4670.00)

UTI: Urinary tract infection

MRSA: Methicillin resistant staphylococcus aureus.

Table 3 : Infections in newborns of < 37 weeks gestational age

Types of infections	Age days mean $\pm$ SD (range)	Days in NICU prior to infection mean $\pm$ SD (range)	Isolated infectious agent	GA weeks mean $\pm$ SD (range)	BW grams mean $\pm$ SD (range)
<b>pneumonia</b> n=9	14.44 $\pm$ 9.47 (2.00-30.00)	7.22 $\pm$ 10.58 (0.00-30.00)	n=4 staph:1 pseudomonas:2 xanthomonas:1	30.88 $\pm$ 2.89 (26.00-35.00)	1714.44 $\pm$ 620.22 (1030.00-2840.00)
<b>sepsis</b> n=23	11.09 $\pm$ 9.50 (1.00-37.00)	8.27 $\pm$ 9.98 (0.00-37.00)	n=14 staph: 5 a hem strep:1 candida:2 pseudomonas:1 klebsiella:5	30.45 $\pm$ 6.59 (26.00-36.00)	1852.50 $\pm$ 483.56 (1030.00-2750.00)
<b>others</b> n=3 omphalitis: 2 septic arthritis:1	11.33 $\pm$ 8.39 (6.00-21.00)	11.33 $\pm$ 8.39 (6.00-21.00)	n=2 klebsiella:1 staph:1	33.66 $\pm$ 1.53 (32.00-35.00)	2090 $\pm$ 578.62 (1670.00-2750.00)

fluids were not cultured. In newborns with sepsis, infectious agents were isolated in 35 out of 53 patients. None of them had meningitis. With the exception of one baby in whom hemolytic streptococci in blood culture were isolated, the infectious agents were all hospital acquired.

## DISCUSSION

Despite major improvements in neonatal care and increased survival of newborns over the past three decades, infection still continues to be a major problem for physicians taking care of newborn babies. Diagnosis of an infection is very difficult in the neonate for the signs are usually subtle and nonspecific. Sepsis definitions used for pediatric patients usually do not apply to neonates, due to the fact that they rarely get febrile, and their vital signs are affected by several reasons other than infection such as cold, stress, hypoglycemia, pain and hypoxia.

Therefore sepsis is usually suspected in a newborn just based on poor feeding or a state of not being well, observed by the care giver (1,2) or sometimes just based on major or minor risk factors in the history. On the other hand, neonates are very prone to become infected by fatal nosocomial microorganisms if they are hospitalized and if invasive procedures such as intubation, catheterization are performed which is usually the case for preterms. Lack of ability of the newborn to localize infections puts them into risk of becoming septic even with minor focal infections, which therefore necessitates systemic antibiotic treatment even for simple omphalitis. The absence of well-defined criteria and laboratory methods for the diagnosis of sepsis gives rise to inappropriate antibiotic usage which later on results in antibiotic resistance and fungal infections (4). In our patient population, the incidence of infection was 12% for term infants and 18% for preterm infants which is consistent with the literature. Term patients with pneumonia were considered to have community acquired disease, whereas preterms had hospital acquired pneumonia. The incidence of sepsis was 5% for term newborns and 13% in preterm newborns. The incidence of sepsis in preterms is similar to what is reported in the literature (7). All preterm infants received broad spectrum antibiotics starting from admission and continued for at least

7-10 days. Eleven out of 23 preterm babies with sepsis had indwelling catheters, and all of the ones who had pneumonia were intubated. Mortality was observed in year 1998 and three of nine preterm babies died of septicemia, the mortality rate being consistent with the literature (1-4). However, our rate of sepsis in term newborns was higher than expected, because they were considered to be at low risk for infection. This could be due to prolonged hospital stay and inappropriate antibiotic use. The age at which sepsis was diagnosed, and days spent in NICU prior to onset of infection were similar in term and preterm babies, which suggests that time spent in NICU has an important role in the development of sepsis. Our results suggest that blood stream infections occur after six to seven days spent in our NICU both in term and preterm infants. Although prevention of sepsis is inevitable in most cases, it should be a warning for the personnel working in the NICU to reconsider their infection control measures. Good hand washing is still invaluable for the prevention of all kinds of hospital infections, and it should be emphasized periodically particularly with the change of groups taking care of babies. In addition to hand washing, meticulous attention to sterility during invasive procedures such as intubation or central catheter insertion is important in prevention of infections as well as maintenance of sterility of infusion fluids.

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