

# Neonatal Nosocomial Infections in Bahrami Children Hospital

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**Abstract. Objective :** Nosocomial infections are one of the most important causes of mortality and morbidity in hospitals. These are major public health problems worldwide, but particularly in developing countries. These infections have the most common frequency in pediatric hospitals—especially in neonatal wards- second to burn hospitals. In the present study, neonatal nosocomial infections have been reviewed in Bahrami Children Hospital from fall of 1999 through fall of 2004. **Methods:** Nosocomial infected patients were defined as all patients who were neither infected nor were in incubation period at the admission time and had positive culture after third day of admission. The incidence of nosocomial infections computed as infections per 100 hospital discharges and infections per 100 hospital days. Chi square test was used for comparison of rates. **Results :** Fifty-two patients had been diagnosed having nosocomial infections. NICU (Neonatal Intensive Care Unit) showed the highest portion of infections (40%) followed by neonatal surgery ward (35%) and neonates ward (25%). Frequencies of nosocomial infection by site were as follows: eyes (27%), septicemia, surgical wounds and location of drain or catheter (each one 21%), CSF (7%) and urinary (2%). The most common pathogenic organisms were *Enterobacter* (27%), *aerues Staphylococcus* (21%), *Klebsiella* (18%), *E.coli* (14%) and epidermis *Staphylococcus* (9%). Total number of hospitalized patients was 5990 and total number of hospitalized days was 39,095 in the five years. Infections per 100 hospital discharges and 100 hospital days by service were as follows, respectively: NICU (2.9, 0.26), neonatal surgery (1.7, 0.18) and neonates (0.3, 0.06). The differences were significantly meaningful (p value<0.001). **Conclusion :** These findings provide useful information for future surveillance in association with prevention programs. Subsequently, surveillance should be focused on high-risk patients in intensive care unit and/or who have undergone surgery and invasive procedures. [*Indian J Pediatr* 2006; 73 (3) : 197-200] E-mail : psalamati@tums.ac.in

**Key words :** Acquired nosocomial infection; Neonatal intensive care unit; Neonates ward; Nosocomial infection; Neonatal surgery ward

Nosocomial infections are one of the most important problems in all hospitals. Sophisticated and accelerated improvements in diagnostic and therapeutic methods have helped significant progress in clinical medicine but with plentiful using of invasive technologies, severe and fatal nosocomial infections cause many damages every day. These infections are common in pediatric hospitals – especially in neonatal wards-second to burn hospitals. Nowadays, a lot of resources spend on controlling hospital –acquired infections. One study showed that the hospital sector in Turkey had to are spent an additional US \$ 48 million in 1995 for medical management of nosocomial infections.<sup>1</sup> The impact of different nosocomial infections has been well documented in several studies.<sup>2-5</sup> In Iran, as in most developing nations, the true magnitude of the problem is not known.<sup>6-9</sup>

The purpose of this study was to estimate the frequency of neonatal nosocomial infections in a university hospital, as well as to determine the high-risk groups for such infections.

## MATERIALS AND METHODS

Bahrami Children Hospital in Tehran, Iran, is a 109-bed, sub specialty hospital that opened in 1958 (the second children hospital in Tehran in that time). There are six inpatient wards in the hospital: NICU, neonates, surgery, neonatal surgery, infectious diseases and internal medicine. Nosocomial infections have been reviewed in NICU, neonates and neonatal surgery wards from fall of 1999 through fall of 2004.

The CDC-NNIS System defines a nosocomial infection as a localized or system condition (1) that results from an adverse reaction to the presence of an infectious agent(s) or its toxin(s) and (2) that was not present or incubating at the time of admission to the hospital.<sup>10</sup> Patients who had not infected or they had not been in incubation period at

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the admission time and had positive culture after third day of admission, were defined as patients with nosocomial infections in the present study. A microbiologist studied bacterial samples in laboratory. Infection control nurse reviewed all positive cultures weekly. The nurse presented all suspicious cases to infection control physician (a pediatric infectious diseases specialist) and after confirming the diagnoses, acquired nosocomial infections were registered. The data included the patients' name, age, gender, ward, admission and infection onset dates, location of infection, organism and final patients' condition in discharge time. The survey sought information on the presence of any suspicious symptoms of infection such as fever, sputum, coughing or diarrhea and so on, and pertinent physical examination and laboratory data, such as cultures, chest X-rays or white cell blood counts. Data were recorded using the patients' chart and/or nursing notes and patients' monitoring records. More details about the patients were obtained from the physician and the nurse of the ward.

The rate of nosocomial infections calculated as the number of infections per 100 hospital discharges and the number of infections per 100 hospital days. Chi square test was used for comparison of rates and p value less than 0.05 was regarded as significant.

**RESULTS**

Of the 52 patients registered in the study, 28(54%) were boys and 24 (46%) were girls. The age distribution of nosocomial infections showed in a histogram (Fig. 1). The fourth day of neonatal period had the most common frequency for nosocomial infections (6 cases).

NICU showed the highest portion of infections (40%) followed by neonatal surgery ward (35%), and neonates ward (25%) (Fig. 2).

The most common location of nosocomial infections were eyes (15 cases–27%), septicemia, surgical wounds and location of drain or catheter (each one 12 cases–21%), CSF (4 cases–7%) and urinary (1 case–2%) (Fig. 3). Four patients had two nosocomial infections simultaneously.

The most common pathogenic organisms were

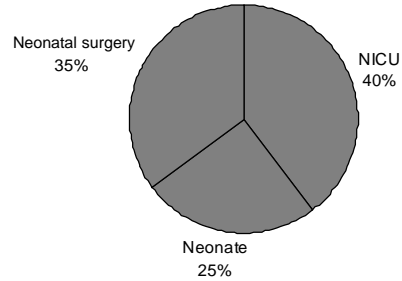


Fig. 2. Number of Nosocomial Infections Among Inpatient Neonatal Wards

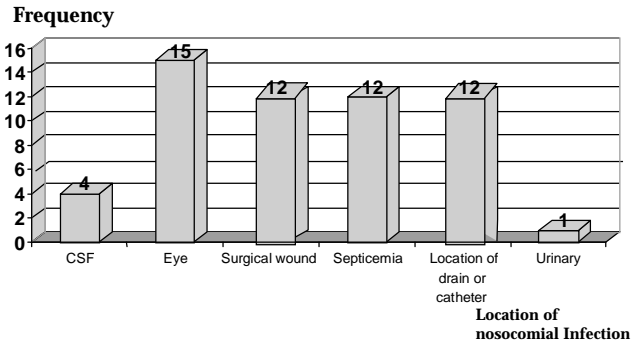


Fig. 3. Number of Nosocomial Infections by Location of Infection

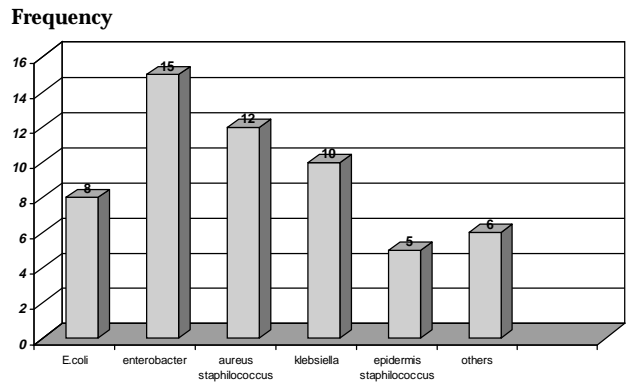


Fig. 4. Number of Nosocomial Infections by Type of Organism

*Enterobacter* (15 cases or 27%), *aureus Staphylococcus* (12 cases – 21%), *Klebsiella* (10 cases–18%), *E. coli* (8 cases–14%), and *epidermis Staphylococcus* (5 cases–9%) (Fig 4).

Ten patients expired with diagnosis or suspicious

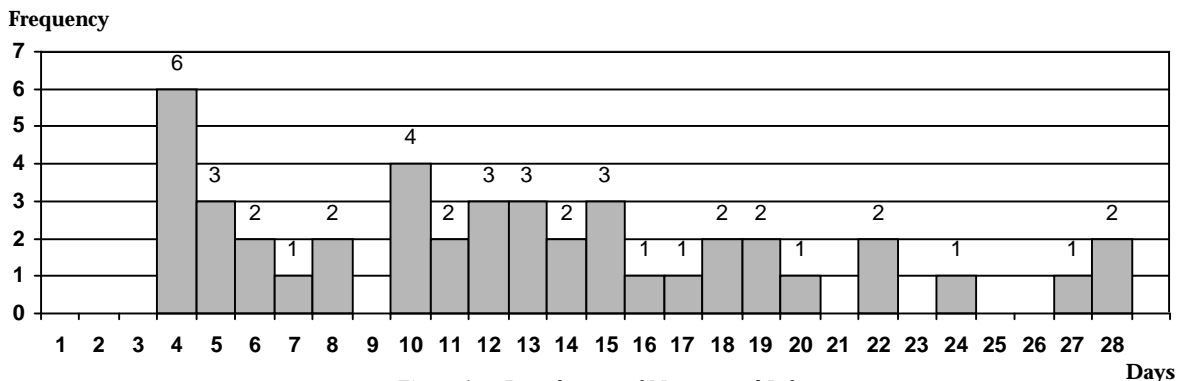


Fig. 1. Age Distribution of Nosocomial Infections

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diagnosis of nosocomial infections. The incidence of nosocomial infections are computed in a variety of ways such as infections per hospital discharges and infections per hospital days. Rates vary by hospital service. Total number of hospitalized patients was 5990 and total number of hospitalized days was 39,095 in the period of five years.

Table 1 shows rates of nosocomial infections in the present study according to different services.

TABLE 1. Average Rates of Nosocomial Infection

Service	Rate	
	Infections per 100 Hospital Discharges	Infections per 100 Hospital Days
NICU	2.9	0.26
Neonates	0.3	0.06
Neonatal surgery	1.7	0.18

The difference in the rate of infections per 100 hospital discharges among different services was significant ( $X^2=60.928$ ,  $df=2$ ,  $p$  value $<0.001$ ). Similar results were obtained for infections per 100 hospital days.

### DISCUSSION

Infection control is an integral part of pediatric practice. Nosocomial infections prolong hospital stays by an average of 10-15 days per infection and contribute significantly to the morbidity, mortality and costs of hospitalization. Infection is a major cause of death in immunocompromised persons with multiple organ failure, burn victims and persons who undergo major surgical procedures. Nosocomial infections often form the basis for litigation against physicians, nurses and hospitals. Nosocomial infections can occur in both the well-baby and special care nurseries, but the incidence is considerably higher in the latter. The incidence of hospital-acquired infections in the healthy term infant who is discharged within 48 hours from the well-baby nursery is very low as compared with that in preterm and sick infants in neonatal intensive care units. Technologic advances and surfactant replacement therapy have improved the survival rate of infants with very low birth weights and simultaneously created risks for nosocomial infection.<sup>11</sup> The frequency of these infections has increased in recent decades as a result of this increased survival of low-birth-weight infants. NICU-acquired infections are associated with increased mortality rates, prolonged duration of hospitalization in survivors and increased cost of neonatal health care.

In this study, the most common age of onset of nosocomial infections was the fourth day of neonatal period and NICU showed the highest portion of infections. Infections occurring in the nurseries are

commonly superficial. In our study, the most common location of nosocomial infections were eyes. The second leading categories of nosocomial infections were bloodstream infections, followed by surgical wounds, drains or catheters, CSF and urinary infections. More than 40% of nosocomial infections in adults are urinary tract infections and surgical site infections.<sup>12</sup> The relatively infrequent occurrence of urinary tract infections in newborns may reflect less reliance on urinary catheters in this population. Cutaneous sites are also more likely to be involved in neonates.<sup>13</sup> The use of surgical procedures increase risk in many ways. Skin is incised and tissues are exposed to airborne, handborne and instrument borne agents. The use of catheters and tubes drastically increases the risk of infections. They bypass normal host defenses and give microbes direct access to host tissues. Not all catheters carry the same risk of infection. Higher rates of infection correlate with a longer duration of catheterization and increased manipulation of the catheter.

Bacteria, viruses, fungi and parasites are potentially nosocomial pathogens. In pediatric units, viruses are major causes of hospital-acquired infections. Nosocomial bacterial pathogens vary by age group. The most common nosocomial isolate recovered from adults is *E. coli*, which is less common in children than adults because urinary tract infections are less common in children. Nosocomial pathogens vary by season. The source of a child's hospital-acquired infection frequently is a visitor with a community-acquired infections.<sup>14</sup>

In the present limited study, bacterial pathogens were reported and the most common pathogen was *Enterobacter* followed by *aurues Staphilococcus*, *Klebsiella*, *E. coli* and *epidermis Staphilococcus*.

In the present study, bacterial infections per 100 hospital discharges and 100 hospital days by service were as follows, respectively : NICU (2.9,0.26), Neonatal surgery (1.7, 0.18) and neonates (0.3,0.06). There are few data on infection rates in normal nurseries where the infant is healthy and the hospital stay is short. Reported rates are low, ranging from 0.3 to 1.7 per 100 newborns.<sup>15,16</sup> In the National Nosocomial Infection Surveillance (NNIS) system, the infection rate ranged from 0.9% in non-teaching hospitals to 1.7% in large teaching hospitals in 1984. In contrast to the relatively low incidence of infections in term nurseries, the incidence of nosocomial infections in NICU is often high. Reported infection rates in the NICU vary from 1.8 to 39.8 per 100 admissions or discharges.<sup>12</sup>

There is some variability in the reported rates due to methodological differences and the proportion of infants with severe underlying disease. The age range, methods for diagnostic infection and types of infections reported (e.g., whether viral infections included) may all have a significant impact on the reported incidence of nosocomial infections.

Although NICU had forty percent of our nosocomial infections but because its bed was smaller than two other

wards (1/3 of neonates ward and 1/2 of neonatal surgery ward), rates of nosocomial infections - as infections per hospital discharges and infections per hospital days- were standardized and the differences were significantly meaningful (p value <0001).

The present study had several limitations. In this retrospective study, we reviewed bacterial nosocomial infections. Viruses, fungi and parasites were not reported due to the medical equipment defects. In addition, the authors didn't follow healthy discharged patients. Because some cases show their clinical and laboratory manifestations after discharge, we couldn't know them. The authors recommend further research concerning incidence and type of micro -organism causing nosocomial infections in different hospitals. These findings provide useful information for future surveillance in association with prevention programs. Subsequently, surveillance should be focused on high-risk patients in intensive care unit and/or who have undergone surgery and invasive procedures.

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