

Epidemiology of nosocomial infections in a pediatric intensive care unit (PICU)

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ABSTRACT

Background: Nosocomial infections (NI) are major concerns in the management of patients in hospitals and are growing problem in developing and developed countries because of increased mortality and morbidity rates and corresponding costs.

Patients and methods: This cross sectional study was carried out on all patients hospitalized for more than 48 hours in pediatric intensive care unit (PICU) of Rasul Akram hospital in Tehran. Nosocomial infection was defined according to the criteria of National Nosocomial Infections Surveillance (NNIS) system.

Results: During the study period, 102 patients were hospitalized of whom 15 (14.7%) proved to have NI. The mean duration of PICU stay was 16.1 days for NI group and 8.9 days for non-NI group ($p < 0.05$). Mortality rate was significantly higher among NI group (40%) when compared with non-NI group (11.5%) (OR=5.13, 95%CI:1.29-20.60, $p < 0.05$). Age under 2 years was a risk factor for NI (OR=4.44, 95%CI:1.23-16.67). The most common causative organisms for nosocomial infections in PICU were coagulase-negative staphylococci (CONS), followed by Klebsiella and Pseudomonas aeruginosa. Pneumonia was the most common nosocomial infection, followed by urinary tract infection and sepsis.

Conclusion: The calculated NI rate in our study (14.7%) is higher than usual rates reported from PICU in other societies. Meanwhile, long stay in PICU and age less than 2 years are the main risk factor for NI and subjects with NI are 5.13 times more likely to die.

Keywords: Nosocomial infection, Pediatric intensive care unit (PICU), Pneumonia.
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INTRODUCTION

The management of children with severe and life-threatening conditions is carefully considered in pediatric intensive care unit (PICU). The incidence of nosocomial infections (NI) in PICU due to use of mechanical ventilation, indwelling catheters and invasive monitoring is higher than

other wards (1-4). In a prospective study of 20 units in eight European countries during 6 months, the incidence of NI was 23.6% in PICU and the proportion of lower respiratory tract infection was 53% (3). This study had not only observed the highest rate of NI in PICU, but also found a high frequency of multi resistant bacteria in PICU (3). A study in Paris underlined the necessity to limit the anti microbial therapy in children and adults (4). Another study in Saopaulo reported an

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incidence of 18.3% for NI in PICU setting (5), lower than what reported from India (27.3%) (6). Coagulase negative staphylococcus (CONS) was the main pathogen in a study in PICU in Barcelona (7), however, it was responsible for 37% of infections in European study group (5). In a meta analysis among 50 hospitals in the United States the NI rate was calculated 13.9 in 1000 day-stay in PICU (8). The study of bacterial nosocomial infections in PICU in Mumbai, India, showed that the duration of mechanical ventilation and duration of stay in PICU increased the risk of developing nosocomial pneumonia (9). In a study in St. Louis, Missouri, it was determined that the mean ventilator-associated pneumonia rate was 11.6/1000 ventilator days (10).

This study aimed to determine the epidemiology of NI in a PICU ward in Tehran.

PATIENTS and METHODS

This cross sectional study was conducted over a period of six months in a pediatric intensive care unit (PICU) in Rasul Akram teaching hospital in Tehran. All patients admitted to PICU were enrolled into the study if they stayed at least for 48 hours. Patients aged less than one month or older than 16 years, those who expired within 24 hours of PICU admission and surgical and traumatic cases were excluded.

Nosocomial infection was defined according to the guidelines prepared by National Nosocomial Infection Surveillance (NNIS) system. It was defined as an infection not present or incubating at the time of PICU admission, with onset of after 48 hours of PICU stay. Medical records, including charts, daily flow sheets, laboratory and radiographic reports were reviewed by the investigators during daily visits of all patients. All data were gathered using a well-designed questionnaire. Finally, data analysis was achieved with EPI6 software. Categorical variables were compared using χ^2 analysis. Continuous variables

were compared using t-test. P value <0.05 was considered significant.

RESULTS

A total of 102 patients were included in the study. Demographic characteristics, mortality, nosocomial infection incidence, and mean PICU stay are summarized in table 1. A total of 15 patients had nosocomial infection according to NNIS guidelines, therefore, the NI rate was calculated 14.7%. The mean PICU stay was 16.1 days for nosocomial infection group versus 8.9 days for non- NI group. The difference was statistically significant ($p < 0.05$).

Table 1. Demographic characteristics of subjects admitted in PICU of Rasul Akram hospital

Variables	
Total person-day hospitalization	1017 days
Confirmed NI* cases	15(14.7%)
Mean PICU stay (person-day)	
NI group (n=15)	8.9
Non-NI group (n=87)	16.1
Mortality rate	
NI group	6(40%)
Non-NI group	10(11.5%)
Total	16(15.7%)
Age group of NI subjects (n=15)	
≤2	10(67%)
>2	5(33%)
Gender of NI group (n=15)	
Boy	9(60%)
Girl	6(40%)
Basis of Diagnosis by NNIS	
Clinical criteria	11 (73.4%)
Laboratory	2 (13.3%)
Both (Clinical-Lab)	2 (13.3%)

NI: Nosocomial infection

A total of 16 patients died in PICU during study period, of whom 6 (40%) had a nosocomial infection. Hence, subjects with NI are 5.13 times more likely to die (OR=5.13, 95%CI: 1.29-20.65, $p < 0.05$). Furthermore, of 15 NI subjects, 10 aged

less than 2 years. Thus, it could be concluded that age under 2 years was a risk factor for nosocomial infections. Indeed, ≤ 2 years subjects are 4.44 times more likely to develop NI (OR=4.44, 95%CI: 1.23-16.77). Unlikely, gender did not influence the possibility of NI.

Positive cultures were identified in 4 cases. Therefore, most of the cases were clinically diagnosed. The causative organisms for nosocomial infection were coagulase-negative staphylococci (CONS), klebsiella and pseudomonas aeruginosa, sequentially. Respectively, these organisms were cultured from tracheal tube secretions, urine, and blood.

Ventilator-associated pneumonia was the most common nosocomial infection (5 cases), followed by urinary tract infections (4 cases) and clinical sepsis (2 cases).

DISCUSSION

We performed a cross sectional study to determine the NI incidence rate, mortality and other epidemiological determinants in a group of children admitted to PICU. Prior investigators have shown a higher incidence rate of NI in PICU when compared with other wards (1-4). The calculated NI rate in our study (14.7%) is lower than reports from Sao Paulo and Barcelona (5,6), but higher than usual rates reported from PICU in the United States (7). Similar to a study in India, we demonstrated that long stay in PICU is the main risk factor for NI (8).

Results revealed that subjects with NI are 5.13 times more likely to die. This is in agreement with studies conducted in European countries (3). Our findings along with other studies showed that gender had no significant effect on NI, however, the age groups classified as a risk factor. We found that age under 2 years or infancy is a risk factor for NI (OR= 4.44). Reymond showed infants younger than one year of age are more susceptible to NI (7-

12% for infants aged <1 year vs 1.5-4% for those aged >10 years) (4).

Furthermore, based on our findings, relying on laboratory results may be misleading, thus, clinical and laboratory findings must be considered. This is in accordance to NNIS guidelines. Therefore, NNIS definitions are comprehensive and recommended for NI surveillance and diagnosis (9-11).

Finally, like many other prior studies, nosocomial pneumonia was the most prevalent infection among our cases (8-12).

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