

Frequency of Nosocomial Infections in Pediatric Intensive Care Unit at King Abdulaziz Medical City, Riyadh, Saudi Arabia

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Abstract

Background: Nosocomial infections in PICU vary from 6–26%. Causative pathogens isolated depend upon patient disease, exposure to invasive and non-invasive procedures, and body-system affected.

Objectives: To determine frequency of nosocomial infections, organisms involved, sites affected and clinical outcome in pediatric patients.

Methods: It is a retrospective cross-sectional study on pediatric patients who acquired infections after 48 hours of admission in PICU at King Abdulaziz Medical City during 2012. Data was collected from medical, laboratory records.

Results: 22 (3%) patients acquired nosocomial infections in 684 admissions during year 2012, out of which 12 were female and 10 were male patients. The common incidence was found in first year of age (10 patients). There were a total of 57 events in these patients; respiratory infections were the commonest (24) followed by urinary infections (19). Most common organism involved was *Klebsiella* (16) followed by *Candida* (13).

Most common pathogens isolated from respiratory infections were *Klebsiella pneumoniae* (6) and *Pseudomonas aeruginosa* (5), while *Klebsiella* (6) and *Candida* (5) were found in urinary tract infections. The common organisms causing septicemia included *Candida* (4) and *Klebsiella pneumoniae* (4).

In initial 10 days of admission at PICU, 10 patients acquired the infection (median 14 days). Acquisition of nosocomial infections prolonged hospitalization (median 49.5 days).

Conclusion: Nosocomial infections were caused by *Klebsiella* and *Candida*. These pathogens mainly caused respiratory, urinary and hematogenous infections, respectively. They have prolonged hospitalization. There is an extensive need for further studies to identify risk factors and review empiric management.

Keywords: Nosocomial infection; Pediatric patients; Pediatric intensive care unit, Stay of hospitalization; Mortality rate

Introduction

Infections are one of the main causes of morbidity and mortality globally [1]. Some patients acquire infections during hospitalization. The infections contracted from hospital by a patient, admitted for a reason other than that specific infection, or acquired during a visit to hospital are called nosocomial infections or hospital-acquired infections [2]. These include also infections acquired from hospital but appearing after discharge and the occupational infections among staff of the health facility [2]. These infections lead to localize or systemic effects. To label a nosocomial infection, patient should not be in an incubation period for that infection before the admission to the health facility [3].

Incidence of nosocomial infections in pediatric intensive care unit is different among different countries and hospitals which vary between 6.1% and 26%. While in Middle East, the incidence of nosocomial infections in PICU is 14.7% [4-6]. Among these differences, it varies between ages. Pediatric patients are more susceptible for infection than adult particularly in the first two years of life [4,7]. These infections commonly include hematological infections, lower respiratory tract and urinary tract infections respectively [7,8]. The nosocomial pathogens affecting pediatric patients vary depending upon the site of infection. Blood stream infections related to central lines are polymicrobial (48%) [7]. The common organisms isolated from blood stream infection are *Klebsiella pneumoniae*, Coagulase-negative *Staphylococci*, and *Pseudomonas aeruginosa* respectively. Common nosocomial pathogens identified from lower respiratory tract infections are *Pseudomonas aeruginosa* followed by *Staphylococcus aureus* [8,9]. The common nosocomial pathogens from urinary tract infections are

E. coli followed by *Candida albicans* [8]. Device-related infections were mostly described [8,10]. Those infected patients have five times risk of mortality [6].

Incidence and prevalence of many infectious diseases in developed countries have reduced due to better public health measures and effective medications. Moreover the extensive use of primary care preventive measures and new diagnostic investigation might have changed the pattern and mortality of infectious diseases [11,12]. Pediatric nosocomial infections can be reduced by 50% by adopting appropriate preventive measures [10]. The risk of nosocomial infection increases with prolonged hospitalization and it becomes common after first week and increases to reach 52% after a month of admission [4]. The risk of nosocomial infections depend on various factors, for example: host factors, duration of stay in PICU, number of interventions, invasive procedure, aseptic techniques employed, and inappropriate use of antimicrobial agents [10]. Nosocomial infections in pediatric patients are different from adult infections [8]. The frequencies of these hospital acquired infections among pediatric patients are variable in different

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countries and there is limited data available for KSA [7,9]. Our study aimed to determine frequency of nosocomial infections at a tertiary care hospital in Riyadh.

Methods

Study was a retrospective cross-sectional study on pediatric patients from neonate to 14 years who acquired nosocomial infections in PICU at King Abdulaziz Medical City, in Riyadh during 2012. Patients were included via non-probability convenience sampling technique. Patients who had an infection before admission or who got infection within 48 hours of admission were excluded.

As protocol of King Abdulaziz Medical City, any patient who is suspected to have an infection should be cultured properly. Investigations include culture with appropriate specimen depending on site of infection. Data was collected from lab Database for positive culture of specimens (blood, urine and sputum) for admitted patients. Then, medical records of patients were reviewed to obtain information; including demographic data (age and sex), purpose of admission, date of admission, date of discharge, date of acquisition of infection, site of infection, culture result and isolated organism. If the information were not mentioned in lab or medical record or electronic database it was marked as unmentioned.

Data was coded prior to entry in SPSS. These data were collected, reviewed, coded, entered, filtered, cleaned and then analyzed by first author and co-authors by using version 19 of IBM SPSS software. It was a descriptive analysis by using frequencies to summarize categorical variables that collected during period of one month. Also, continuous variables were expressed as mean or median and standard deviation. A p-value of <0.05 was considered as significant. Consent was not needed as it was retrospective study but proper permission was sought from King Abdullah International Medical Research Center. Patient's information was not collected to maintain confidentiality and coding of patients was used.

Results

Among 684 patients admitted to pediatric ICU during 2012, there were 22 patients who had nosocomial infections that show incidence of 3 % (9 patients were excluded). During admission of these patients, 13 patients had two or more infections to be a total of 57 episodes of infections. Frequency of respiratory, urinary tract and blood infections were 24, 19 and 14, respectively (Table 1). Different age groups and genders were affected by nosocomial infections. Ten patients had nosocomial infections during first year of age. There were 12 female and 10 male (Table 2).

Frequency of nosocomial infection (n=684)		
Category	Frequency	
Nosocomial cases	22	3%
Not infected	662	-
Nosocomial infections during each admission (n=22)		
One infection	9	-
Two infection	6	-
Three or more	7	-
Distribution by system (n=57)		
Respiratory	24	-
Urinary	19	-
Blood	14	-

Table 1: Frequency of nosocomial infection.

Age of patients (n=22)	
Age group	Frequency
1 – <6 months	5
6 – <12 months	5
12 – <3 years	4
3 – <6 years	2
6 – <12 years	4
12–14 years	2
Distribution of patients by gender	
Male	10
Female	12

Table 2: Characteristics of patients.

Length of hospitalization prior to first infection (n=22)	
Days	Frequency
≤ 10	10
<10 – ≤ 30	4
<30 – ≤ 60	5
>60	3
Total length of hospitalization (n=22)	
less than 10	2
10 to 30	5
30 to 60	6
more than 60	9
Outcome (n=22)	
death	17
discharge	5

Table 3: Effect of nosocomial infection.

Organisms	Frequency (n=65)	Pneumonia (n=30)	UTI (n=20)	sepsis (n=15)
<i>Klebsiella species</i>	16	6	6	4
<i>Candida species</i>	13	4	5	4
<i>E. coli</i>	7	2	3	2
<i>Staphylococcus species</i>	7	4	1	2
<i>Pseudomonas aeruginosa</i>	7	5	2	-
<i>Enterococcus species</i>	4	-	2	2
<i>Acinetobacter baumannii</i>	3	3	-	-
<i>Streptococcus species</i>	3	1	1	1
<i>Stenotrophomonas maltophilia</i>	3	3	-	-
<i>Serratia marcescens</i>	1	1	-	-
<i>Aspergillus flavus</i>	1	1	-	-

Table 4: Frequency of organisms in nosocomial infection.

Among infected patients, 10 of them affected by the first infection during first ten days after admission while four patients got it during the rest of first month. (Median 14 days) hospitalization Length was prolonged. Thus, six patients stayed more than month up to two months and nine patients stayed more than two months (Median 49.5 days) (Table 3). The most common organisms in PICU (out of 65 organisms) were *Klebsiella species* (16 episodes), followed by *Candida species* (13 episodes) (Table 4). The most common organisms in respiratory infections were *Klebsiella pneumoniae* (six episodes) and *Pseudomonas aeruginosa* (five episodes), respectively (Table 4). While in urinary tract infections (UTI), the most common organisms are *Klebsiella species* (six episodes) and *Candida* (five episodes), respectively (Table 4). The most common organism in blood stream infections are *Candida* (four episodes) and *Klebsiella pneumoniae* (four episodes) (Table 4). Among these patients, 17 patients (out of 22 patients) have died during that admission (Table 3).

Discussion

Nosocomial infection in PICU varies between hospitals and countries in according to incidence, common systems involved and organisms. We found less incidence of nosocomial infection compared to other researches that varies between 6.1% to 26% [4,5]. According to systems involved in nosocomial infection our study results showed the most common systems affected were respiratory, UTI and blood. In most of other studies outside of KSA, blood stream infections are the commonest followed by respiratory infection then UTI. [8,13-15]. Another study reported the most common system was respiratory followed by UTI then blood [6]. Organisms that affect PICU in general, were variable among hospitals. Our study showed *Klebsiella* species the commonest, followed by *Candida* then *Pseudomonas aeruginosa*. In another researches, Coagulase-negative *Staphylococcus* species is the most common. It was followed by *Klebsiella*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*. [4,6,14].

Among variability in common organisms in each system, our result showed *Klebsiella pneumoniae* the most common organism in respiratory infection, followed by *Pseudomonas*. While in other researches, there was variability regarding the common organisms (*Staphylococcus aureus* and *Pseudomonas*) in respiratory infection. [8,13,15]. *Klebsiella pneumoniae* and *Candida* were the most common organism in blood stream infections. Among other researches, there was wide variability for common organism causing blood infection. A study from Brazil, reported *E. fecalis* and *E. coli* the commonest cause of blood infection followed by *Staphylococcus epidermis*. [13]. Another study from Brazil reported *Candida* species were the commonest cause of blood stream infections followed by Coagulase negative *Staphylococcus* [15]. In US and Estonia, Coagulase-negative *Staphylococcus* was the most common organism in blood infection [8,16]. *Klebsiella pneumoniae* is most common organism in UTI followed by *Candida* then *E. coli*. Studies reported the Yeast and *E. coli* were the commonest organism in UTI [8,13,15]. Thus, our study and others showed difference in common organisms and sites affected. Length of stay and mortality rate were found to be higher in our study that reaches 77% while it not exceeds 40% other studies. Mortality rate is insignificant because it was observed in one year and associated comorbidities in these children. [6,14-15,17]. Also, hospitalization length prior to get first infection was found to be equal to other study [15]. The nosocomial infections risk decreases after first year of age. The most risk for nosocomial infection is in first two weeks after admission then it slightly decreases.

Conclusion

Our study showed lower frequency of nosocomial infection and higher mortality compared to other studies. Respiratory infections is the most common system infected followed by blood and UTI. *Klebsiella* species were the commonest organism isolated from respiratory infection and UTI while *Klebsiella* species and *Candida* were the most common organisms that affect the blood stream. Further studies are recommended in Saudi Arabia that include large sample size and in different hospitals about nosocomial infections in PICU and specific consideration for prevention and management of nosocomial infection.

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Conflict of Interest

No conflict of interest to be declared and all authors have approved final manuscript.

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