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Original Research Article

Incidence of nosocomial infection in the pediatric intensive care unit of a teaching hospital delivering tertiary level care

Varsha Suresh Ahirrao[1]*, Anupama Mauskar[2], Ravi T.[3]

[1]Assistant Professor, Department of Paediatrics, MVJMC and RH, Bangalore, Karnataka, India
[2]Professor and Head, Department of Paediatrics, HBT Medical College and Dr. R N Cooper General Hospital, Mumbai, Maharashtra, India
[3]Consultant Medical Oncologist, Sri Shankara Cancer Hospital and Research Centre, Bangalore, Karnataka, India

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***Correspondence:**
Dr. Varsha Suresh Ahirrao,
E-mail: drvarsha2006@yahoo.co.in

ABSTRACT

Background: Nosocomial infections are generally a chain of events whereby a source or reservoir of microorganisms is transmitted by some method to a susceptible host. The organisms causing infections can come from either the patient's own endogenous flora or from external sources including hospital staff, equipment or even food, water, walls, floor, and some other surfaces.
Methods: Children in age group of one month to twelve years are admitted to our PICU. All the patients admitted in PICU with PICU stay of more than 48 hours were daily monitored for fever or any other symptoms or sign suggestive of any infection. The patients who developed the same 48 hours after admission, which was not present at the time of admission, were included. Centers for Disease Control and Prevention definitions of nosocomial infections, as described later, are used as criteria for diagnosis of infections.
Results: During study period, 466 patients were admitted to PICU with their PICU stay for more than 48 hours. Out of 466 patients, 35 patients had 49 episodes of nosocomial infections. Nosocomial incidence rate = 10.51 per 100 admissions. Nosocomial infection incidence density = 19.37 per 1000 patient days.
Conclusions: In patients with nosocomial infection, the mean PICU stay was 17.31 days and mean hospital stay was 23.95 days.

Keywords: Children, Nosocomial infection, PICU

INTRODUCTION

Critical or Intensive care units are observed as to provide the most advanced medical services to critically ill patients who otherwise may not have survived. The application of advanced technology is not without hazards and among these, hospital acquired or nosocomial infections are common complications of an admission to an intensive care unit. Nosocomial infections are infections that develop in hospitalized patients and are neither present nor incubating at the time of admission to the hospital. The term 'nosocomial' originates from the Greek words 'nosos' (disease) and 'komeion' (to take care of).[1] In the light of this entomology, a more inclusive definition is "infections that occur as a result of health care."

Nosocomial infections are generally a chain of events whereby a source or reservoir of microorganisms is transmitted by some method to a susceptible host. The organisms causing infections can come from either the patient's own endogenous flora or from external sources

including hospital staff, equipment or even food, water, walls, floor, and some other surfaces.

Nosocomial infections have increased the mortality and morbidity of hospitalized patients. In studies conducted by various authors, the incidence of nosocomial infections ranged from 2.8% to 21.6%.[2,3] Mortality associated with nosocomial infection has been difficult to determine, but in United States it is estimated that, of 2,00,000 deaths in patients with nosocomial infections 20,000 were attributable directly to nosocomial infections. Each nosocomial infections add extra days to the affected patients stay in the hospital. Nosocomial infections have led to extra hospital stay and expenditure, which has overburdened the already strained health economy.[4]

Incidence of nosocomial infections is more in ICU patients. Patient admitted to intensive care units are more likely to acquire nosocomial infections both due to their underlying disease with resulting impairment of the humoral and cellular immunity; and the invasive procedures that they undergo which breakdowns their natural defense barriers.

Pediatric intensive care units differ from adult intensive care units in a number of ways including the age of the age of the patients. Fewer children than adults in ICUs have chronic or degenerative organ system disorders and probably majority of the children, if successfully treated, will return to a normal productive life.

Studying the incidence and prevalence of nosocomial infections is the first step in forming hospital policies for infection control. Most of the nosocomial infections could be prevented if hospitals have effective infection control policies.

METHODS

The study was carried out in the intensive care unit of a large teaching hospital for duration of one year.

Prospective surveillance study was design from September 1st to 31st August 2007-2008.

Paediatric intensive care unit of a teaching hospital of tertiary level. The PICU (paediatric intensive care unit) of this hospital has a total number of 10 beds. This PICU is well equipped with ventilators and other equipment required for specialized paediatric care.

Inclusion criteria

Children in age group of one month to twelve years are admitted to our PICU. All the patients admitted in PICU with PICU stay of more than 48 hours were daily monitored for fever or any other symptoms or sign suggestive of any infection. The patients who developed the same 48 hours after admission, which was not present at the time of admission, were included. Centres for Disease Control and Prevention definitions of nosocomial infections, as described later, are used as criteria for diagnosis of infections.

Exclusion criteria

Patients with any clinical feature or laboratory investigation, suggesting concerned infection being prior to the admission to the PICU.

Patients were suspected to have developed nosocomial infections in the PICU, if they developed any one of the following of the clinical features 48 hours after admission to the PICU.

- Unexplained fever (>380C)
- Leukocytosis(>=10,000)
- New infiltrate on the chest X-ray
- Persistent tracheal aspirates or secretions
- Turbid urine, suprapubic tenderness, dysuria, burning micturition
- Thrombophlebitis.

Detailed examination of all patients included in the study was done as follows:

- Temperature, pulse, blood pressure
- Respiratory system was examined for breath sounds and any other abnormal sounds
- Abdominal examination was done for localised tenderness or tenderness over peritoneal dialysis catheter site
- Purulent secretions for endotracheal tube
- Features suggestive of thrombophlebitis.

RESULTS

Incidence of nosocomial infections

During study period, 466 patients were admitted to PICU with their PICU stay for more than 48 hours. Out of 466 patients, 35 patients had 49 episodes of nosocomial infections.

- Nosocomial incidence rate = 10.51 per 100 admissions
- Nosocomial infection incidence density = 19.37 per 1000 patient days.

Clinical profile

Table 1: distribution of patients with nosocomial infections as per AGE.

Age	Number	Percentage
1 month to 3 month	4	11.42
4 month to 5 year	22	60
6 year to 12 year	10	28.57

Average age of patients with nosocomial infections was 4.05 years.

Table 2: Distribution of patients as per sex.

Sex	Number	Percentage
Male	18	51.42
Female	17	48.57

Table 3: Duration of stay in IPCU before onset of nosocomial infection occurs.

Duration	Number	Percentage
<96 hours	12	34.28
>=96 hours	23	65.71

Maximum number of patients (65.71%) developed nosocomial infections after 96 hours of PICU stay.

Table 4: Underlying diseases.

System involved	No.	Percentage
CNS	14	40
CVS	3	8.57
Respiratory	5	14.28
Renal	3	8.57
Others	10	28.57

Thirty-five patients with nosocomial infections can be categorized into following groups:

Out of 35 patients who developed nosocomial infections, 40% patients had central nervous system diseases including tetanus (five patients), Guillain-Barre syndrome (GBS) (two patients), and tubercular meningitis with hydrocephalous (three patients). 14% patients had respiratory diseases including bronchopneumonia (three patients), bronchiolitis (one patient), chronic lung disease i.e. bronchiolitis obliterative organizing pneumonia (one patient). 3% had congenital heart diseases. Other 10% of patients included three patients with severe malaria, two patients with dengue haemorrhagic fever, one patient with methylmelonic aciduria, one patient with drowning, one patient with kwashiorkor and one with abdominal tuberculosis.

Prior antibiotic use

Out of 35 patients who developed nosocomial infections, 24 (68.58%) patients had received antibiotic prior to the admission to the PICU. Median PICU stay in patients with nosocomial infections was 11 days. Mean PICU stay is 17.31 days. 77.14% patients had their PICU stay more than 7 days. Median hospital stay in patients with nosocomial infections was 16.5 days.

Mean hospital stay was 23.94 days. 94.28% patients had their total hospital stay more than 7 days, and 74.28% patients had their stay more than 14 days.

DISCUSSION

Nosocomial infections are becoming an increasing problem, both for the hospitalized patients as well as the hospital. Nosocomial infections are five times more common in ICU patients. The present study was undertaken to determine the current incidence of nosocomial infection, to study the clinical profile of children with nosocomial infections, different sites of nosocomial infections, microbial pattern and device related nosocomial infection rate in patients admitted in PICU over a period of one year. Out of 466 patients in the PICU, 35 patients developed 49 episodes of nosocomial infections. The incidence of Nosocomial infections was 10.51 per 100 admissions.

Table 5: Incidence of nosocomial infections in paediatric hospitals[5]

Roy et al	6.5%
Cooper et al	2.8%
Gardner et al	4.6%

The incidence of nosocomial infections is higher in an Intensive care setting than in the general ward.

Table 6: Incidence of nosocomial infections in different paediatric intensive care units.

Authors	Incidence
Avila Figuera C et al[6]	9.8
Correia M et al[2]	7.6
Donowitz et al[3]	13.7
Milliken et al[7]	6.1
NNIS[8]	6.2
Legras A et al[9]	21.6

In the studies conducted by various authors, the incidence of nosocomial infections ranged from 2.8% to 21.6%.[2,3] In this studies, the incidence rate found is within the above range. Nosocomial infection incidence density was 19.37 per 1000 patient-days, which is similar to incidence density found in various studies of different authors. It is 14.1 per 1000 patient-days in the study conducted by Richards et al and 46.1 per 1000 patient days in study conducted by Marcelac et al at Brazil.[10,11]

On analyzing the age-group distribution of our study group, we found that larger proportion i.e. 60% of nosocomial infections were found in the age group from four month to five year, as was seen in NNIS study done from 1992 to 1997 by Richards MJ et al, where 57% of nosocomial infections were found in age group of more than two months to five year.[10] Campins M et al had found the maximum incidence of nosocomial infections in the younger age group.[12] In our study, neonates were not included and the number of patients admitted to the PICU in age group of 1 month to 3 month was less compared to patients in the age group of three month to

five year. This could explain nosocomial infections in age group of one month to three month formed only 11.42% of total nosocomial infections. There was no significant difference in the number of male and female having nosocomial infections with male to female ratio being 1.05:1. The study by Dinkei R H et al showed females to be affected more than males.[13]

The duration of stay in the ICU is an important risk factor for acquisition of Nosocomial Infections. Out of 35 patients, 23 i.e. 65.71% of patients had developed nosocomial infection after 96 hours of PICU stay. This could be explained by the fact that longer the duration of hospital stay, greater is the contact of the patient with health-care personnel, often in crisis situation; greater exposure to environmental micro-organisms, and more frequent are the invasive procedures- all contributing to increased risk of nosocomial infections. This observation was in accordance with the study done by Milliken J et al in which 90% of children with nosocomial infections developed the infection after 7 days of stay.[7]

Median PICU stay in patient with nosocomial infection was 11 days with mean of 17.31 days and median hospital stay was 16.5 days with mean of 23.95 days. Correia et al showed that the mean duration of stay was longer in patients with nosocomial infections (9.8 versus 1.8 days).[2] In study done by Urrea M et al, the duration of hospitalization for patients with and without infection was 22.5 and 9 days respectively (P<0.001).[14] Prior antibiotic use is significant risk factor for development of nosocomial infections. In this study, out of 35 patients with nosocomial infections, 68.58% of patients had received antibiotic prior to the admission to the PICU.

In this study, primary BSIs (bloodstream infections) and pneumonias were the two most frequent nosocomial infections each contributing to 34.69% of total nosocomial infections followed by UTIs (urinary tract infections), which were 24.48% of total infections. Others were 6.12% of total infections. Out of three patients i.e. 6.12% patients with other infections, one patient had nosocomial peritonitis following peritoneal dialysis. Other, case of GBS, had developed one skin and soft tissue infection in form of decubitus ulcer. One patient, a case of tetanus, had a contact with a neighboring patient who had proven infectious hepatitis (Hep A) with hepatic encephalopathy, and developed hepatitis A after 25 days of contact.

CONCLUSION

The incidence of nosocomial infection in our study was 10.51 per 100 admissions and the incidence density was 19.34 per 1000 patient-days. Maximum number of patients was in the age group of 4 months to 5 years. No significant difference was observed in the number of males and females having nosocomial infections.

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REFERENCES

1. Feigin RD, Cherry RD. Textbook of pediatrics infectious diseases. Vol II, 1st Ed. WB Saunders Company. Philadelphia; 1981:1655-1693.
2. Correia M, Simao C, Lito CM. Nosocomial infections in a pediatric ICU. Acta Medica Portuguesa. 1997;10(6-7);463-8.
3. Donowitz LG. High risk of nosocomial infection in the pediatric critical care patient. Critical Care Med. 1986;14:26-8.
4. Mukherjee S, Nani AS. Nosocomial infection-an epidemiological perspective guidelines for antibiotic therapy. Bombay Hospital J. 1997;24-25.
5. Schaffner W. Prevention and control of hospital acquired infections. Text book of medicine, Eds Wyngaarden Smith, Bennet; 19th Edition. WB Saunders; 1992:1589-1594.
6. Figuerosa A. Prevalence of nosocomial infections in children:survey of 25 Hospitals in Mexico. Salud Publica de Mexico 41st suppl; 1999:518-25.
7. Milliker J, Tait G, Ford A, Jones EL. Nosocomial infection in a pediatric ICU. Critical Care Med. 1988;16:233-7.
8. CDC: National Nosocomial Infection study report (quarterly); first and second quarter, 1973. 1974:20-27.
9. Legras A, Robert R. Nosocomial infection: prospective survey of incidence in 5 French ICUs. Intensive Care Med. 1999;24(10):1040-6.
10. Richards MJ, Edwards JR, Culver DH, Gayness RP. Nosocomial infections in pediatric intensive care unit in the United States. National Nosocomial Infection Surveillance System. Pediatr. 1999;103(4);e39.
11. Marcelo L. A bramczyk I,II, Werther B. Carvalho Eduardo S carvalho II; Eduardo A.S, medeivos I, II: Nosocomial Infection in a pediatric intensive care clinic in a developing country. Braz J Infect DIS. 2003;7(6):1407-17.
12. Nosocomial Infections in Pediatric patient: a prospective study in Spanish hospitals. 1993;21(2):58-63.
13. Dinkel RH. A survey of nosocomial infections and their influence on hospital mortality rates. J Hospital Infect Eng. 1994;28(4):297-304.
14. Urrea M, Pons M, Latorrec SM, Palomeq. A prospective incidence study of nosocomial infections in a pediatric intensive care unit. Pediatr Infect Dis J. 2003;22(6):490-4.

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