ORIGINAL ARTICLE

Nosocomial Infections from Intravenous Catheter

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ABSTRACT The subjects of the study consisted of 164 sick newborn infants (97 boys and 67 girls) who had no signs or symptoms of infections. The intravenous fluid drip (at scalp vein or saphenous vein) was put on soon after taking blood culture. Removal of venous catheters was indicated when the patient's condition no longer needed their use or there was sign of local infection. This study showed that the lower the birth weight or the gestational age, the higher the incidence of infection. The most prominent nosocomial infection in this study was phlebitis (16.5%) followed by infiltration (14.6%), and bacteremia (7,9%). The predominant microorganism was *E. coli* (59.7%). The overall incidence of nosocomial infection was 44.5% and the mortality was 24.7%. **[Paediatr Indones 1995; 35:78-83]**

Introduction

Nosocomial infection is a localized or systemic condition acquired after admission to the hospital as an adverse reaction to the presence of an infectious agent(s) or its toxin(s).[1] The highest priority for infection control resources is assigned to surveillance of patients in neonatal intensive care unit (NICU).

NICU patients constitute a large proportion of patients infected with multiple resistant organisms; outbreaks occur more frequently in NICU, and there is a significant increase in morbidity and mortality in infected vs noninfected patients.[2] The incidence of nosocomial infections in NICU is 5 to 25 percent.[3] The incidence of nosocomial infection in the nursery of Cipto Mangunkusumo General Hospital (CMGH) is 7.7%.[4]

Infants who are critically ill and remain in a pathogen-filled environment are often in jeopardy because of their prolonged length of stay in the hospital. Mortality associated with these infections is anywhere from 5 to 20%,

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depending on the geographic area and specific birth weight groups,[5] while in the nursery of CMGH was 13.8%[4].

Nursery epidemics can be caused by gram-negative and gram-positive or viral organisms because they have (1) the ability to colonize or infect human skin or the gastrointestinal tract; (2) the ability to be carried from person to person by hand contact; an (3) characteristics that allow existence on hands of personnel or in fluids or on inanimate objects, including intravenous fluids, respiratory support equipment, solution used for medications, disinfectants and banked breast milk.[6]

This study was performed in 1992; its purpose was to know the incidence of the local and systemic nosocomial infection due to intravenous scalp vein, the type of the microorganisms which cause the infection, as well as the mortality of the infection.

Methods

The subjects of this study were 164 out of 629 sick newborn infants, who were admitted into the nursery of CMGH in the year 1992. The records of the babies were kept on special form admittance. Information was recorded on each baby's identity, birth weight, sex, site of infusion, Apgar scores, diagnosis at admission, and the occurrence of infections during hospitalization.

None of the babies showed evidence of infection on admission. The intravenous fluid drip was put on immediately after taking blood culture. Removal of venous catheters was indicated when the patient's condition no longer necessitated their use. Other indication for catheter removal included any signs of local infections, infiltrations, phlebitis, etc. After removal of the catheter continuous pressure was applied to the catheter insertion site for 5 or more minutes until no bleeding is noted. The catheter was inspected to confirm that the entire catheter had been removed and the tip sent for culture. The site was given povidone-iodine solution, dressed with a small self-adhesive bandage or gauze pad, and inspected daily. The blood culture was done again after removing of venous catheter.

Results and Discussion

During the one-year study period (1992) there were 164 newborn babies consisted of 97 (59.1%) boys and 67 (40.9%) girls, who were put on intravenous catheter. Of the 164 patients 73 (44.5%) suffered from nosocomial infections (NI). Indwelling catheter is one of the procedure which involve breaking the integrity of the skin, or introducing any foreign material within the infant carry a risk of infection such as infiltration, phlebitis, bacteremia, etc. In addition, the newborn infant has poor ability to concentrate the inflammatory response at the site of infection because of its deficiency in cellular and humoral immunity, especially in premature babies (birth weight less than 2500 grams or the gestational age less than 37 weeks) as shown in Tables 1 and 2.

Tables 1 and 2 show that the incidence of NI in low birth weight (LBW, i.e.,

birth weight less than 2500 grams) or gestational age than 37 week infants was higher than that in infants with the body weight of more than 2500 g or full term infants. It means the lower the birth weight or gestational age the higher the incidence of infection. In other words the incidence of infection is inversely proportional to gestational age and/or birth weight.

Table 1. Correlation between birth weight and NI

	Nosocomial infection					
	Yes		No		Total	
	n	%	n	%	n	%
<2500	29	50	29	50.0	50	35.4
>2500	44	41.5	62	58.5	106	64.6

Table 2. Correlation of gestational age and NI

Gestational age (wk	Nosocomial infection					
	(+)		(-)		Total	
	n	%	n	%	n	%
< 37	20	52.6	18	47.4	38	23.2
≥ 37	53	42.1	73	57.9	126	76.8
Total	73	44.5	91	55.5	164	100

The results with respect to higher incidence of NI in LBW newborn infant were similar to those from the neonatal special care unit in CMGH[4] and the findings of Balley and Goldfarb.[7]

LBW infant is one of the predisposing risk factors for infection. LBW infants are far more likely to be jeopardized by the invasion of foreign agents.

These infants have missed out on passive transmission of maternal exposure to antigens and subsequent creation of an antibody defense system.

Other risk factors known to be associated wit NI is stress like asphyxia, respiratory distress syndrome (RDS), congeni- tal anomaly etc. as shows on Tables 3 and 4. Stress in any form inhibits the newborn's ability to fight infection for several reasons. It increase the metabolic rate, thus requiring more oxygen and energy to support or sustain the body's functions. If the newborn is severely compromised and the oxygen levels continue to be low, regional tissue damage can result ischemic or necrotic areas in the lungs, heart, brain or gastrointestinal system provide a respective environment for colonization and overgrowth of normal bacteria flora. This overgrowth of bacterial is of the common sources of local or systemic infections[6]

Table 3. Distribution of cases by Apgar score at minute 1 and NI

Apgar Score (1')	Nosocomial infection					
	(+)		(-)		Total	
	n	%	n	%	n	%
0-3	9	36.0	16	64.0	25	15.2
4-10	64	46.0	75	54.0	139	84.8
Total	73	44.5	91	55.5	164	100.0

The NI of asphyxiated newborn infants in this study was much higher (44.5%) than the study on 1981 (8.5%).[8] The infection on asphyxiated newborn infants on 1981 was considered as NI because those babies were born and nursed in the same hospital. There were also different percentage of NI in RDS, congenital anomaly and birth trauma. These differences might be due to different kind of study. The study on 1981 was retrospective; the cases were observed by young doctors and there might have been over or misdiagnosis. The present study was prospective in nature, and all cases were handled by the same doctor.

Table 4. Distribution of diagnosis on admittance and NI

Diagnosis	Nosocomial infection					
	(+)		(-)		Total	
	n	%	n	%	n	%
RDS	31	50.0	31	50.0	62	37.8
Cardiovas-cular dis.	3	33.3	6	66.7	9	5.5
Congenital anomaly	7	70.0	3	30.0	10	6.1
Birty trauma	2	66.7	1	33.3	3	1.6
Miscella-neous	30	37.5	50	62.5	80	48.8
Total	73	44.5	91	55.5	164	100.0

There were two peripheral intravenous line used in this study: scalp vein and saphenous vein. Scalp vein was used because it is the easiest and the best vein to use for giving IVFD, although there has been a considerable debate about this. When difficulty is experienced in findings scalp vein, cut-down technique at saphenous vein was done (Table 5). This table shows that NI at the site of saphenous vein was more frequent than at the scalp vein site. This might be due to the contamination of the microorganism from the gastrointestinal tract or from the urinary tract is easier to the site of intravenous access at the extremity.

Table 5. Distribution of cases by peripheral line and NI

Intravenous access	Nosocomial infection				Total	
	(+)		(-)			
	n	%	n	%	n	%
Scalp vein	25	34.2	34	48.6	59	36.0
Saphenous	48	65.8	57	60.6	185	64.0
Total	73	44.5	91	55.5	164	100.0

Table 6. Duration of indwelling catheter in groups with and without nosocomial infection

	Nosocomial infection	
Duration of indwel-lingcatheter (days)	(+)	(-)
Means (SD)	1.99 (0.98)	1.78 (0.63)
Shortest time	1	0
Longest time	9	3

The onset of symptoms appeared after three days of admission. The catheter was removed of because the patient's condition no longer necessitated their use or there were symptoms of infection at the site of access.

Table 6 deepicts the mean duration and range of indwelling catheter. It seems that the duration of indwelling catheter was longer in infants with NI than that in infants without NI, although the difference was not very large.

Table 7 shows that phlebitis was the most prominent feature of local NI. After removal of the catheter, blood culture

and the culture of the tip of the catheter were done. The results were depicted in Table 8.

Colonization of the GI tract with *E.coli* occurs postnatally through environmental exposure such as intravenous access. Apparently gram-negative bacteria are almost always exist and play the main role of NI in the special care unit of CMGH, Jakarta.[2,4,10,11]

Table 7. The diagnosis of nosocomial infection due to intravenous access

Diagnosis	n	%
Phlebitis	27	16.5
Infiltration	24	14.6
Bacteremia	13	7.9
Miscellaneous	9	5.5
Total	164	100.0

Table 8. Distribution of bacteria

E. coli	59.7
Enterobacter sp.	28.2
Staphylococcus sp.	4.4
Proteus vulgaris	3.3
Pseudomonas sp.	2.2
Bacillus sp.	2.2

The evolution of these bacteria to become endemic is not completely understood and cannot always be traced to particular changes.

Table 9 shows the overall mortality of patients with or without NI. The high mortality in our series could not be explained solely on the basis of Ni; it might be due to nosocomial infection, nosocomial infection in combination with the underlying disease, or the primary disease only. The exact cause of death could not be proved by autopsy because it was very hard to get permission from their parents.

Table 9. Prognosis of cases with intravenous access

Prognosis	Nosocomial infection				Total	
	n	%	n	%	n	%
	(+)		(-)			
Alive	55	75.3	65	71.4	120	73.2
Dead	18	24.7	26	28.6	44	26.8
Total	73	44.5	91	55.5	164	100.0

Conclusions

1. The incidence of nosocomial infection is inversely proportional to gestational age and birth weight.
2. Most of the nosocomial infections cases were caused by gram-negative bacteria
3. The scalp vein has been found to be the most satisfactory site.
4. The incidence of nosocomial infections in this study was 44.5% and its mortality was 24.7%.

Acknowledgments

The author is very grateful to dr. Rustadi, Head of the Clinical Pathology, Faculty of medicine, University of Indonesia-Detachment for his generous help in performing the microbiology examination. Without his help this study would not be impossible. The author is also indebted to Dr. Alinda R. Wibowo for her participation in this study.

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