

Nosocomial Septicemia in Neonates

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ABSTRACT This study reports the prevalence of nosocomial septicemia (NS) and the relative risk (RR) of NS in neonates with intravenous (IV) line as well as in low birth weight infant, and the role of C-reactive protein (CRP) in detecting septicemia. We evaluated a prospective cohort of 182 out of 541 neonates admitted to the Special Care Unit of Cipto Mangunkusumo General Hospital, Jakarta, during a 12 month period (October 1996 to September 1997). Information was recorded on each baby's identity including primary diagnosis. On the basis of clinical evidence they were divided into two groups: neonates with IV line (92) and non IV line (90). Neonates in whom clinical was suspected when they were more than 72 hours of admittance were eligible for study. Clinical diagnosis of septicemia was confirmed by CRP and proven by blood culture. There were 182 newborn infants, 106 boys of them were boys. 66 out of 182 (36.3%) were diagnosed as septicemia clinically. Among them (81.8%) were CRP positive and 85.2% were proven by blood culture. The overall prevalence of septicemia was 25.3% of evaluation and was most common in IV line with a prevalence of 36.9%, while in non IV line was 13.3%. The RR of NS in IV line and low birth weight infants were 2.74 and 2.67 respectively. The etiologic agents were mostly gram negative: *E.coli* (49.1%), *Pseudomonas* sp. (16.4%), *Enterobacter* sp. (19.1%). The only gram positive cocci was *Staphylococcus aureus* (12.7%). NS almost always occurs in Special Care Unit. CRP was a valuable adjunct for diagnosing septicemia. The RR was higher in IV line and low birth weight infants. The most common pathogens in this study was gram negative. (*Paediatr Indones* 1999; 3:14-19)

Introduction

The neonates who are very ill/high risk and remain in a pathogen filled environment are often in jeopardy because of their prolonged length of stay in the hospital. The use of invasive devices such as intravenous line (IV line) disrupts the integrity and protective role of dermal barriers, allowing for the development of phlebitis, infiltration and bacteremia¹.

Mortality associated with these infections any where from 5 to 20% depending on the geographic area and specific birthweight². In the nursery of Cipto Mangunkusumo General Hospital the mortality was a little bit higher (24.7%)¹. Septicemia might be difficult

signs and symptoms of septicemia are non specific. Therefore the diagnosis of septicemia has to be proven by blood culture.

The purpose of this study is to report the prevalence of nosocomial septicemia, the relative risk of nosocomial septicemia in IV line and low birth weight infant, the role of C-reactive protein and its causative organisms.

Methods

This is a prospective cohort study was undertaken to determine the relative risk (RR) of nosocomial septicemia in neonate with IV line and in low birth weight infant. Between October 1996 and September 1997, 541 evaluation for septicemia were performed in 182 neonates admitted to Special Care Unit of Cipto Mangunkusumo Hospital, Jakarta. The records of the infants were kept on special form admittance.

Information was recorded on each baby's identity: birth weight, gender and primary diagnosis on admission. The neonates were assigned to two groups: group I with IV line (92) and non IV line (90). Infants were enrolled in this study if there were no signs and symptoms of septicemia on admission and normal value of C-reactive protein (CRP). Neonates who suffered from septicemia in the first 3 days of life were excluded because this study reviews NS occurring after 72 hours of admission in the presence of clinical signs and symptoms suggestive of septicemia³ or clinical deterioration in neonates⁴. The scientific indications for blood culture were determined when CRP test more than 12 mg/L⁵. CRP was done in the same Special Care Unit. CRP test was done as follows: one drop of reagent is added to one drop of serum (obtain by centrifuging a microhematocrit tube for five minutes) mixed and agitated for five minutes. A positive test result is characterized by agglutination. The blood culture was done at the Clinical Pathology (Subdivision of Microbiology) University of Indonesia, Jakarta.

Results

During the study there were 182 newborn infants consist of 106 (58.2%) boys and 76 (41.8%) girls. 66 out of 182 (36.3%) were clinically diagnosed as septicemia. This was confirmed by CRP with the result of 54 out of 66 (81.8%) were positive. among them 85.2% (46 out of 54) was blood culture positive. The overall prevalence of septicemia was 25.3% of evaluation and was most common in group I with a prevalence of 36.9%, while in group II was 13.3%.

Table 1. Proportion of nosocomial septicemia in group I and II

	Septicemia		Total
	Yes	No	
Group I	34	58	92
Group II	12	78	90

RR = 2.74 (95% Confidence intervals: 1.54; 5.00)

Table 2. Association between birth weight and nosocomial septicemia

Birth weight (gram)	Group I		Group II		Total		N
	Septicemia		Septicemia		Septicemia*)		
	Yes	No	Yes	No	Yes	No	
	+	-	+	-	+	-	
<2500	30	36	10	54	40	90	130
≥2500	4	22	2	24	6	46	52

*) RR = 2.67 (CI 95%: 1.20; 5.91)

Table 3. Primary diagnosis on admission and nosocomial septicemia in group I

Primary diagnosis	Septicemia				Total	
	+		-		N	%
	N	%	N	%		
Very low birth weight	14	40.0	21	60.0	35	38.2
Cardiovascular	5	23.3	16	76.7	21	22.8
Congenital anomaly	5	41.7	7	58.3	12	13.0
Miscellaneous	10	41.7	14	58.3	24	26.0
Total	34	36.9	58	63.1	91	100

Table 4. Primary diagnosis on admission and nosocomial septicemia in group II

Primary diagnosis	Septicemia				Total	
	+		-		N	%
	N	%	N	%		
Very low birth weight	6	19.3	25	80.7	31	34.3
Cardiovascular	1	5.3	19	94.7	20	22.2
Congenital anomaly	1	6.3	15	93.7	16	17.8
Miscellaneous	4	13.0	19	87.0	23	25.6
Total	12	13.3	78	86.7	90	100

Table 5. Distribution of pathogens associated with nosocomial septicemia*

Pathogens	N	%
<i>Escherichia</i>	27	49.1
<i>Pseudomonas</i> sp.	9	16.4
<i>Enterobacter</i> sp.	7	12.7
<i>Staphylococcus aureus</i>	7	12.7
<i>Klebsiella</i> sp.	5	9.1
Total	55	100

* Each infant might have one or more pathogens

Discussion

In this study 36.3% were diagnosed as septicemia clinically. To confirm the diagnosis, the CRP investigation was done and the result was 81.8% CRP positive. CRP was the only approach to the diagnosis of septicemia beside blood culture. Seemingly CRP test was a valuable adjunct for diagnosing septicemia because 85.2% out of 81.8% was blood culture positive. It can not be 100% positive because CRP positive might be also due to tissue injury other than infection. Recently Ng et al.⁵ have emphasized that between 24 and 48 hours of onset, CRP was the best single marker, with an overall sensitivity and specificity of 84% and 96% respectively.

The relative risk of nosocomial septicemia in low birth weight infant was 2.3 (Table

2). It means that the low birth weight infants are far more likely to be jeopardized by the invasion of foreign agents. Because of being born too soon, these neonates have missed out on passive transmission of maternal exposure to antigens and subsequent creation of antibody defense system as well as the cellular immune system is not well developed in the preterm infants exhibiting decreased phagocytic cellular defences.⁷

The high prevalence and relative risk of NS in neonates with IV line might be due to the technique of insertion was not sterile and maintenance of the insertion site throughout the life of the catheter; type of solution being administered through the IV line; number of "break-ins" into the catheter system and intravenous tubing; the presence of infection elsewhere in the body.⁸ Moreover the underlying conditions were quite severe (because the diseases on Table 3 which were put on IV line due to suffered from either respiratory problem, acidosis or dehydration. The IV line might be put on the admittance or during hospitalization) which can alter the immune function of the neonate and prone to invasive bacterial infection. Septicemia was occurred in neonates with IV line as well as non IV line (Table 4). This might be due to the neonate remain in pathogen filled environment (like Special Care Unit) often in jeopardy of their prolonged length of stay in the hospital. Many neonates remain in the hospital for more than 2 weeks after discharge because of difficulty in contacting parents, the distance to be traveled and the costs incurred by the parents in fetching their infant as well as they left their infant behind in the hospital because of congenital malformation or unwanted child. Apart from that the immaturity of neonatal host defenses in a major risk predisposing to bacteremia.⁹ The innate immunity of the term human neonates provides adequate protection against exposure to most pathogens. Since the intrauterine environment is sterile and the fetus has had limited exposure to immunological stimuli, the neonate's immune system has functional impairments which may render it defenseless against a major assault.¹⁰ The spectrum of predominant pathogens responsible for nosocomial septicemia has not change since 1995.¹ *Escherichia coli* still account for the majority of cases (49.1%). Other gram negative organisms were *Pseudomonas* sp. (16.4%), *Kelbsiella* sp. (9.1%) and *Enterobacter* sp. (12.7%). The only gram positive cocci was *Staphylococcus aureus* (12.7%). In conclusions, it can be said that the prevalence of nosocomial septicemia in this study is quite high, and nosocomial septicemia is almost always occurred in Special Care Unit. CRP was a valuable adjunct for diagnosing septicemia because most of CRP positive was proven by blood culture. The relative risk of nosocomial septicemia was higher in infants with IV line and low birth weight infants. The most common pathogens in this study was gram negative.

References

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