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Risk of early onset pneumonia in neonates with abnormal gastric aspirate

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Abstract

Background Early onset neonatal pneumonia is the risk factor for neonatal sepsis that increases risk for neonatal deaths. Recognition, prevention, and treatment of this problem is major factors in the managemant of high risk neonates. Analysis of gastric aspirate, collected soon after birth is a useful screening test for predicting pneumonia.

Objective To evaluate the risk of early onset of neonatal pneumonia in neonates with abnormal gastric aspirate.

Methods A case control study was done on infants with early onset neonatal pneumonia born in Sanglah Hospital during the period of July 2004 until November 2005. The control group consisted of high risk infants without early onset pneumonia. Multiple logistic regressions was performed to determine the confounding effects of multiple variables that were considered as risk factors for early-onset neonatal pneumonia.

Results Forty-five infants with early onset neonatal pneumonia were recruited. Multivariate analysis showed that abnormal gastric aspirate and low APGAR score were significant factors associated with early-onset of neonatal pneumonia with OR 4.05 (95%CI 1.26;13,02), P=0.019, and OR 6.95 (95%CI 2.45;19.77), P<0.0001, respectively.

Conclusion Abnormal gastric aspirate and low APGAR score are risk factors for early onset neonatal pneumonia in high risk infants. **[Paediatr Indones 2008;48:110-113]**.

Keywords: *gastric aspirate, early-onset neonatal pneumonia*

Pneumonia is common in neonates, although the number of reported cases varies depends on the diagnosis criteria used and the characteristics of population under study. Most reports cite the prevalence of pneumonia is in the range of 5-50 per 1,000 live births. The incidence rate is higher in neonates born to mothers with amnionitis, in prematurity, and meconium-stained amnion fluid.[1]

Early onset of neonatal pneumonia is the risk factor for neonatal sepsis which may cause death.[2] Mortality rate due to neonatal pneumonia is high, 10-25% of the cause of neonatal death is pneumonia.[1] In Perinatology Unit of Sanglah Hospital in the year 2003 the mortality rate of neonatal pneumonia was around 3.5% from the overall death cases.[3]

Previous studies indicate that examination of gastric aspirate of newborns is helpful to predict pneumonia incidence. Indarso *et al*[2] in her study on neonates with risk of infection in Neonatology Ward in Dr Soetomo Hospital found that risk of pneumonia infection was eight times greater in infants with

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abnormal gastric fluid than in those with a normal gastric fluid.

The aim of this study was to find out the risk of early onset of neonatal pneumonia in infants with risk of infection, with abnormal gastric aspirate in Department of Child Health, Medical School, Udayana University, Sanglah Hospital Denpasar.

Methods

A case control study was conducted in Neonatology Division, Department of Child Health, Sanglah Hospital between July 2004 until November 2005. The inclusion criteria were infants born in Sanglah Hospital who suffered from pneumonia within 48 hours after birth, birth weight of >2,000 g, infants with the history of delivery with premature rupture of membrane >6 hours, cloudy amnion fluid, mothers with febrile and prolonged labor. Exclusion criteria were those with severe congenital anomaly, birth injury, endotracheal intubated, mechanical ventilation, forceps delivery or vacuum extraction, hemorrhagic gastric fluid, mothers who suffered from systemic disease and parents who disagreed to participate. Subject was selected consecutively. The minimal samples size needed in each group was 45 (α=0.05, power 80%).

Early onset neonatal pneumonia was defined as pneumonia occurring within 48 hours after birth. It was diagnosed based on clinical manifestation and confirmed by chest x-ray.[4,5] Gastric fluid was considered abnormal when the leukocyte finding were >5 per visual field or presence of bacteria. The control group consisted of infants randomly chosen from infants with risk of infection who were not suffering from neonatal pneumonia. Infants in the control group were matched with the cases in term of sex. All infants underwent gastric fluid tests, and were managed according to standard procedures and followed-up during the treatment period to find out their final conditions.

Odds ratio was calculated to determine the association of gastric fluid and risks of early onset neonatal pneumonia. Influences of external variables and depending variables were analyzed with regression logistic regression model. Statistical test was considered significant when the p value was < 0.05.

Results

During the study period, the total number of deliveries was 4374. Six hundreds and seventeen infants (14.11%) were at risk of infection, 55 infants (8.9%) among them suffered from pneumonia, 45 infants were recruited as study cases, 10 did not meet the inclusion criteria (8 infants with birth weight less than 2,000 g and 2 had late onset of pneumonia).

The average birth weight of cases and controls were 3096 (SD 614.817) g, and 3124.44 (SD 366.75) g, respectively. The average gestational age for cases and controls were 38.91 (SD 1.395) weeks and 39.29 (SD 1.53) weeks, respectively. The characteristics of the subjects are shown in **Table 1**.

The proportion of infants with abnormal gastric fluid significantly differs between the two groups, i.e., 47% of infants with early onset neonatal pneumonia versus 16% in infants in the control group, OR=4.75 (95%CI 1.754;12.866), P=0.001, **Table 2**. Multivariate analysis shows that abnormal gastric fluid and low APGAR score influenced significantly with OR 4.06 ((95%CI 1.26;13,02), P=0.019 and OR 6.95 (95%CI 2.45;19.77), P<0.0001, respectively (**Table 3**).

Septicemia developed in 4 (9%) of cases and none in the control group, [P=0.041, OR=2.10 (95% CI 1.68;2.67)]. The number of infant death was 2 (4%) among cases and no death among the controls. The cause of death was septicemia.

Discussion

The incidence of neonatal pneumonia is about 5-50 per 1,000 live births.[1] Weber *et al*[5] reported that The incidence of early onset of neonatal pneumonia is about 1.79 per 1,000 live births. In this study it was found that the incidence of early onset of neonatal pneumonia was greater than that found by Weber *et al*[5] which was 12 per 1,000 live births. This difference may be due to diagnosis criteria used and shorter time period of this study.

The newborn gastric fluid contains little amount of pepsin, renin, and free acid.[6] It is influenced by mother's amnion fluid.[7] Normally, amnion fluid is sterile. The presence of peripheral markers, such as C-reactive protein and leukocyte cell predicts intra-

Table 1. Basic characteristics of study subjects

Characteristics	Cases (n=45)	Controls (n=45)
Mothers		
Gestational age (week), mean (SD)	38.91 (1.395)	39.29 (1.53)
Antenatal care =4 times, n (%)	44 (98)	44 (98)
Mode of delivery, n (%)		
Spontaneous	25 (56)	22 (49)
Cesarean section	20 (44)	23 (51)
Prolonged labor, n (%)	6 (13)	3 (7)
Premature rupture membrane, n (%)	23 (51)	30 (67)
Cloudy amnion fluid, n (%)	27 (60)	20 (44)
Fever, n (%)	2 (4)	1 (2)
Antibiotics, n (%)	25 (56)	31 (69)
Infants		
Sex, boys n (%)	28 (62)	28 (62)
Birth weight (g), mean (SD)	3096 (614.817)	3124.44 (366.75)
APGAR score, mean (SD)	4.71 (2.139)	6.60 (1.03)
Antibiotics, n (%)	42 (93)	41 (91)
Sepsis, n (%)	4 (9)	0 (0)
Death, n (%)	2 (4)	0 (0)

Table 2. Distribution of gastric aspirate findings among cases and controls

Gastric aspirate	Cases	Controls
Abnormal	21 (47%)	7 (16%)
Normal	24 (53%)	38 (84%)

X^2=10.161 df=1 P=0.001
OR=4.75, 95%CI 1.754;12.866

Table 3. Multivariate analysis of factors associated with early onset of neonatal pneumonia

Variables	B	SE	*p*	OR	CI95%
Gastric aspirate abnormal	1.400	0.595	0.019	4.056	1.264; 13.019
APGAR score	1.939	0.533	0.000	6.954	2.447; 19.764
Antibiotics of mothers	-1.183	1.427	0.407	0.306	0.019; 5.022
Prolonged labor	-0.162	0.884	0.855	0.851	0.150; 5.901
Premature rupture membrane	-1.129	0.885	0.202	0.323	0.057; 4.814
Cloudy amnion fluid	-0.376	0.850	0.659	0.687	0.130; 3.635

Dependent variable: early onset neonatal pneumonia

amnion infection, increases the risk of pneumonia in infants.[8] Leibovich *et al*[9] who investigated 140 gastric fluid of high risk neonates, found that abnormal gastric fluid had 75% sensitivity and 68% specificity for the occurrence of septicemia, while Thomson *et al*[10] found 89% sensitivity and 49% specificity. Indarso *et al*[2] on their study found 39 infants (2.36%) with pneumonia out of 1649 infants with risk of infection, where as 29 infants (74.35%) had abnormal gastric fluid (RR=8.04, P=0.00001). The outcome in this study was similar to that in the study of Indarso *et al*[2] where we found 21(47%) infants with early onset of neonatal pneumonia had abnormal gastric fluid, while 7(16%) in the control group did (OR=3.82; P=0.024).

Generally, there are many predisposing factors of early onset neonatal pneumonia.[1,3,11] Study on newborns with early onset neonatal pneumonia in America found that 78% infants had associated risk factors. In contrast, in India only 40% infants with neonatal pneumonia had risk factors and more than 50% with unknown predisposition factor.[4] The known risk factors of early onset neonatal pneumonia are premature rupture of membrane >12 hours, cloudy amnion fluid, body temperature of mother >38 C, urinary tract infection in mothers, poor antenatal care, poor dietary intake of mothers.[1,4] In this study, low APGAR scores significantly associated with early onset of neonatal pneumonia. Infants with pneumonia have lower APGAR scores due to

antenatal lung infection as well as amnion aspiration during intranatal.[4]

The most common complication of neonatal pneumonia is septicemia. Indarso *et al*[2] found neonatal septicemia in 7(17.9%) out of 39 infants who suffering from neonatal pneumonia. A lower value was found in this study, the incidence rate of neonatal sepsis were 4 infants (9%) out of 45 cases. This was perhaps due to early antibiotic administration given to infants with high risk infection.

Neonatal pneumonia in preterm infants has poorer prognosis compared to the term ones.[12] Mortality rate of infants with neonatal pneumonia is around 5-10%, and it can reach up to 30% in extremely low birth weight infants.[1] In India, death in infants with early onset neonatal pneumonia is greater compared to late onset neonatal pneumonia, the mortality rate is 74% and 29%, respectively. The risk factors of death are hypoxia and low birth weight.[4] Weber *et al*[5] find that among 35 infants who suffered from early onset of neonatal pneumonia, 10 infants (29%) died and all are preterm infants. This study found a smaller number mortality rate compared to the study of Weber *et al*[5] where death only occurred in 2 infants (4%) with neonatal pneumonia. This difference may be due to different subject characteristics where most of subjects in this study were full-term and had birth weight of >2,000 g. Besides, infants with risk of infection in this study were given antibiotics, that may play a role in reducing mortality rate.

Although the incidence rate of abnormal gastric fluid in infants with early onset neonatal pneumonia was significantly higher compared to the controls, there were few limitations in this study, such as: matching was only done on sex variable, the reading of x rays was not done by a single radiologist, the gastric fluid was analyzed by some analysts, the number of subjects was small, and bias in enrolling the controls influenced the outcome of this study.

As a conclusion abnormal gastric aspirate and low APGAR scores are risk factors for early onset of neonatal pneumonia in high risk infants.

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