

The prevalence of hyaline membrane disease and the value of shake test and lamellar body concentration in preterm infants

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ABSTRACT

Background The morbidity and mortality of hyaline membrane disease (HMD) are quite high due to delayed diagnosis and intervention. Commonly, HMD occurs in preterm infants with surfactant deficiency because of lung immaturity. Lung maturity test could be performed using biochemical, biophysical, and amniotic fluid turbidity test.

Objective To find out HMD prevalence and the value of shake test and lamellar body concentration in diagnosing HMD in preterm infants.

Methods This was a cross-sectional study carried out at Hasan Sadikin Hospital Bandung on preterm infants born during October-December 2001. The shake test was performed using gastric fluid and amniotic fluid while the lamellar body concentration was performed using amniotic fluid.

Results During the 3-month period, 571 infants were born, of 64 (11.2%) preterm infants, only 41 (64%) fulfilled the inclusion criteria; among those preterm infants, 14 (34%) suffered from respiratory distress and 7 suffered from HMD (prevalence 17%). All HMD cases occurred in infants less than 32 weeks for gestational age. In 7 preterm infants with HMD, the shake test of gastric fluid obtained by lavage showed negative results in 3 and +1 in 4 infants; while the shake test of amniotic fluid revealed negative result in 5 and +1 in 2 infants. Lamellar body concentration of amniotic fluid was $\leq 18,000$ /ml in all HMD infants. Among three infants less than 32 weeks for gestational age who did not suffer from HMD, +1 shake test of gastric fluid was found in 2 infants and +2 in 1 infant; while shake test of amniotic fluid showed negative result in 1 infant and +1 in 2; the lamellar body concentration of amniotic fluid was $\leq 18,000$ /ml in 2 infants and $> 18,000$ /ml in 1 infant.

Conclusions We concluded that HMD occurred in 17% of preterm infants. The shake test of gastric and amniotic fluids revealed negative or +1 results whereas lamellar body concentration had value of less than or equal to 18,000/mL. More extensive studies are warranted to assess the validity (sensitivity, specificity and predictive values) of these measurements [**Paediatr Indones** 2003;43:77-81].

Keywords: shake test, lamellar body, HMD, preterm infant

Perinatal mortality rate reported from several studies is still high and variable.^{1,2} Prematurity contributes for this perinatal mortality rate.^{3,4} Hyaline membrane disease (HMD) or respiratory distress syndrome type one is a complication that may occur in preterm infants. This disease is caused by surfactant deficiency due to lung immaturity. The prevalence of HMD is not similar among centers in the world and depends on the gestational age.⁵⁻⁸ Delayed diagnosis and intervention play an important role in HMD morbidity and mortality rates. To reduce the HMD mortality and morbidity rates and to determine optimal preterm infants follow up, it is necessary to evaluate HMD through lung maturity test.^{9,10} Shake test and lamellar body concentration could be used for early diagnosis of HMD but these procedures have not been studied yet.

The objective of this study was to find out the HMD prevalence in preterm infants and to evaluate the use of shake test and lamellar body concentration for early diagnosis of HMD.

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Methods

This was a descriptive-observational study with cross-sectional design. Subjects were preterm infants born at Hasan Sadikin Hospital Bandung between October and December 2001. The inclusion criteria were gestational age of 28- <37 weeks or of 196 to 258 days calculated from the recorded date of mother's last menstrual period and a signed parental informed consent. Subjects with amniotic fluid contaminated by maternal blood or meconium were excluded. History of pregnancy was taken from medical records. Maternal risk factors that influence lung maturity such as preeclampsia, placenta praevia and premature rupture of the membrane were observed for the occurrence of HMD. Shortly after birth, infant gastric fluid taken by lavage and amniotic fluid of the mothers was taken for the shake test and the assessment of lamellar body concentration. Afterwards, the infants were observed for any signs or symptoms of respiratory distress. Chest x-ray was performed for every infant with respiratory distress to diagnose HMD.

Results

The prevalence of HMD

During the three-month study period, 571 infants were born at Hasan Sadikin Hospital Bandung and 64 (11.2%) of them were preterm. Only 41 preterm infants fulfilled the inclusion criteria. Fourteen infants suffered from respiratory distress and 7 of them were diagnosed as having HMD. The prevalence of HMD was 17%. All HMD babies were less than 32 weeks of gestational age. The characteristics of 41 preterm infants including sex, mode of delivery, maternal characteristics, and asphyxia are seen in **Table 1**.

Shake test of gastric and amniotic fluid

The interpretation of shake test ranged from negative to +4, but of the 41 preterm infants no +4 result was noticed. (**Figure 1 and 2**)

TABLE 1. CHARACTERISTICS OF SUBJECTS

No.	Characteristics	HMD		Total n = 41
		Yes n = 7	No n = 34	
1	Sex			
	Male	5	17	22
	Female	2	17	19
2	Mode of delivery			
	Spontaneous	2	15	17
	Cesarean section	5	18	23
	Vacuum extraction	-	1	1
3	Asphyxia			
	Yes	4	10	14
	No	3	24	27
4	Twin			
	Yes	-	2	2
	No	7	32	39
5	Pre-eclampsia			
	Yes	2	6	8
	No	5	28	33
6	Placenta praevia			
	Yes	4	9	13
	No	3	25	28
7	Premature rupture of membrane			
	Yes	-	3	3
	No	7	31	38

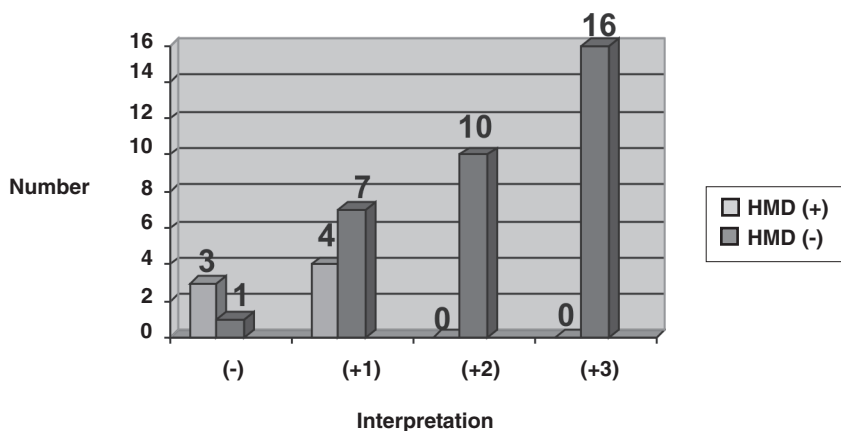


Figure 1. Shake test of gastric fluid

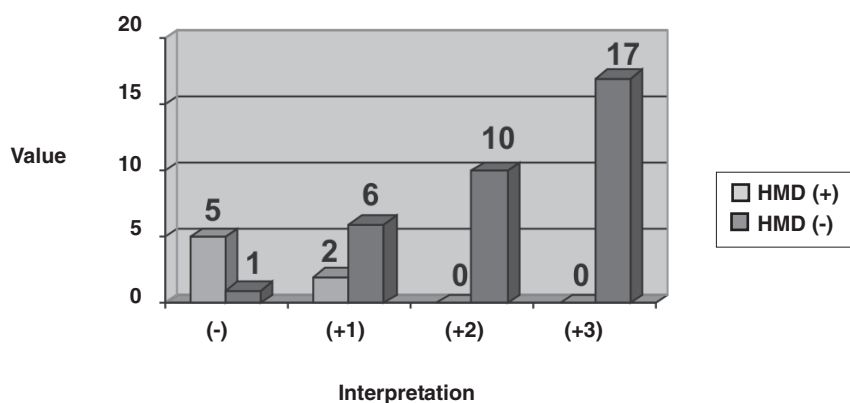


Figure 2. Shake test of amniotic fluid

Lamellar body concentration

The lamellar body concentration of 41 preterm infants is presented in Figure 3.

Discussion

The prevalence of hyaline membrane disease in preterm infants during this study period was 17% (7 out of 41). All infants with HMD had gestational age of less than 32 weeks. This result is in accordance with previous studies which revealed that the prevalence of HMD depends on gestational age.^{7,8,11} Preterm infants tend to experience HMD more often than the mature ones.

Infants who were born from mothers with preeclampsia had less HMD. Several studies revealed con-

trovery in determining factors that affect lung maturity. Kulovich and Gluck (1979) showed that preeclampsia did not affect the acceleration of lung maturity; whereas Ferroni (1984) reported that preeclampsia though not depended on the severity and length of the disease could accelerate lung maturity significantly.⁹ Preterm infants born from mothers with placenta praevia had less HMD. All infants with premature rupture of the membranes in this study did not experience HMD. Male infants in this study suffered from HMD 2.2 times more than females. This rate was higher than the study conducted by Phelaw, Landau and Oliwski (1990) that revealed male infants suffered from HMD 1.7 times more than females.¹² According to the mode of delivery, this study showed that infants born by cesarean section suffered from HMD more frequently than those by spontane-

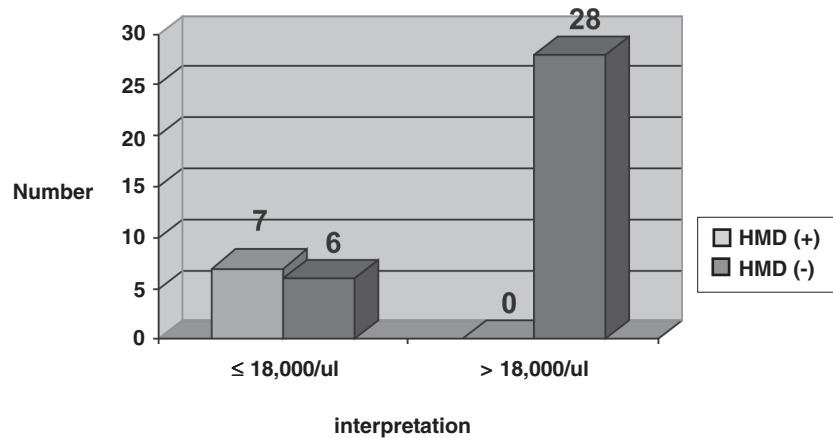


Figure 3. Lamellar body concentration

ous deliveries. Infants with perinatal asphyxia experienced HMD less than those without asphyxia.

All infants with HMD had negative or +1 gastric and amniotic fluid shake test and their gestational age was less than 32 weeks. This results supported previous studies which revealed that infants with a negative shake test had 60% probability of developing HMD and those with a +1 had a probability of 20%.¹³ Preterm infants with HMD had lamellar body concentration of less than or equal to 18,000/mL. This finding was lower than that of the studies conducted by Dubin (1989), Bowie (1991) and Dalence (1995) which showed lamellar body concentration of HMD infants of less than 30,000 /mL. This difference might be due to different methods and tools.¹⁴⁻¹⁶

We concluded that HMD occurred in 17% of preterm infants. The shake test of gastric and amniotic fluids revealed negative or +1 results whereas lamellar body concentration had value of less than or equal to 18,000/mL. More extensive studies are warranted to assess the validity (sensitivity, specificity and predictive values) of these measurements.

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