Hyaline Membrane Disease in Preterm Newborn

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Abstract
Hyaline membrane disease (HMD) is commonly found in preterm infants. This disease occurs as the result of surfactant deficiency due to prematurity. Surfactant deficiency results in increased alveolar surface tension, with resistance to inflation and alveolar collapse at the end of expiration. As a result, the alveoli are injured due to shear stresses on the alveolar walls. The injury could be seen in chest x-ray, as the most common radiological modality to help differentiate diagnosis. Plain chest x-ray findings of HMD are low lung volumes, diffuse, bilateral and symmetrical granular opacities, bell-shaped thorax, and air bronchograms. This case study showed chest x-ray finding of preterm newborn that diagnosed with respiratory distress syndrome clinically.

Keywords: Hyaline membrane disease, Newborn, Preterm, Respiratory distress syndrome

Background
Respiratory distress syndrome (RDS), once called hyaline membrane disease is a respiratory disease commonly found in preterm infants, but can also occur in term infants.1 While this disease occurs as the result of surfactant deficiency which is a function of gestational age, certain maternal and neonatal factors play a role in the development of the disorder.2 However, predicting which infants will become symptomatic is not always possible before birth. Regardless of the cause, respiratory distress can escalate to respiratory failure and cardiopulmonary arrest if the condition is not recognized and managed quickly. Therefore, it is imperative that any health care practitioner who taking care of newborn infants can recognize the signs and symptoms of respiratory distress, differentiate various causes, and initiate management strategies that can prevent significant complications or reduce mortality.3

Hyaline membrane disease happens as a result of surfactant deficiency due to prematurity. Although surfactant granules are present in lung cells as early as gestational age of 20 weeks, surfactant is not produced in sufficient amounts until 34 weeks. Lack of surfactant results in increased alveolar surface tension, with subsequent resistance to inflation and alveolar collapse at the end of expiration. In this process, the alveoli become injured, presumably as a result of shear stresses on the alveolar walls.4

These injuries could be found in chest X-ray. There are 4 stages radiologically in HMD which are:
1. Stage 1: Slight reticular (slight granular) decrease in transparency of the lung, no certain difference to normal findings.5
2. Stage 2: Soft decrease in transparency with an air bronchogram increase, which overlaps the heart (sign of an alveolar lung reaction). 5
3. Stage 3: Same as stage 2 with gradual stronger decrease in transparency, as well as blurry diaphragm and heart. 5
4. Stage 4: white lung, homogenic lung opacity. 1

In a study of 59 neonates with clinically suspected RDS, Vergine et al. found chest x-ray to have sensitivity of 91% and specificity of 84%.6 The result suggests that chest x-ray is good modality to diagnose HMD. Therefore, in this case study, we presented our experience of diagnosing HMD in preterm neonates.
**Discussion**

The patient was a newborn male, born by caesarean section from a Gravida 3 Para 2 Abortus 0 mother, at 32-34 weeks of gestational age. The amniotic membrane was ruptured at the hospital. It was not complicated with meconium stained nor foul smelled. At birth the patient did not cry spontaneously, only moaned with APGAR score in first, fifth, and tenth minutes of 4, 7, 8 respectively. Since the patient did not breathe immediately and looked cyanosis, neonate resuscitation was carried out. After resuscitation, his breathing was fast (>60 times/minute), shallow, and irregular with retraction of intercostal muscles, so the patient was treated in the perinatology room and was given oxygen from nasal cannula. However, the shortness of breath worsened, thus chest X-ray was obtained and the patient was admitted to the Neonatal Intensive Care Unit (NICU) and given oxygen with continuous positive airway pressure (Figure 1).

The result of the radiological examination of the Antero-posterior chest X-ray revealed a grade 1 of Hyaline membrane disease appearance with reticulonodular spots (ground glass appearance) in both lungs, decreased transparency of both lungs and reduced bronchovascular markings. Cardiomegaly also presented, thus the diagnosis of congenital heart abnormalities should be considered. (Figure 2) The radiograph finding was consistent with HMD stages that stated in the earlier section. 5 Besides chest x-ray, lung ultrasound can also be used in order to diagnose HMD. Four prospective cohort studies and two case control studies found the sensitivity and specificity of lung ultrasound were 97% and 91% respectively. However, there is potential of missing co-morbid air-leak syndromes. Moreover, lung ultrasound has economic and administrative challenges as it would require neonatal clinicians to spend time learning a new skill and the need to stand-by in the hospital 24 hours a day, 7 days a week.6 Therefore, chest X-ray still an important modality to diagnose HMD due to its simplicity and low-cost.

**List of abbreviations**

<table>
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<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>HMD</td>
<td>Hyaline Membrane Disease</td>
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<td>RDS</td>
<td>Respiratory Distress Syndrome</td>
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<td>NICU</td>
<td>Neonatal Intensive Care Unit</td>
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**Declarations**

**Ethics approval and consent to participate**

Informed consent from the patient has been obtained before the study.

**Consent for publication**

Consent for publication regarding patient data has been obtained before the study. All the patient identity has been kept secret.

**Availability of data and materials**

Not Applicable

**Competing interests**

The authors declare that they have no competing interests.

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**References**