“Newborns with Acute Respiratory Distress: Diagnosis and Management”

Ma Teresa C. Ambat, MD
Assistant Professor
Division of Neonatology, Department of Pediatrics
Paul L. Foster School of Medicine
Texas Tech University Health Sciences Center
El Paso, TX
Objectives

• Utilizing an algorithm of evaluation of the newborn in respiratory distress, practitioners will be able to:

1. Perform initial assessment and identify life-threatening conditions that require prompt support
2. Systematically identify common causes of respiratory distress in the newborn period
3. Distinguish between pulmonary disease and cyanotic congenital heart disease
4. Provide general supportive measures for neonates with acute respiratory distress
Case #1

- You are asked to see a baby at the Newborn Nursery who was born at 37 weeks of gestation by elective cesarean section.

- Pregnancy was complicated by maternal diabetes.

- The newborn is now 2 hours old and the nurse is concerned that the baby might have respiratory problem.

- **How would you assess this baby’s respiratory status?**
This is the condition of the baby on your arrival at the newborn nursery.
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• What signs of respiratory distress are manifested by this newborn?
  – Tachypnea, grunting, retractions – IC, SC
Signs of Respiratory Distress in Newborn

- **Tachypnea**: RR >60/min, ↑RR to maintain ventilation in the face of ↓TV
- **Cyanosis**: Due to ↑ diaphragmatic contractions needed to draw gas into the chest
- **Retractions**: Partial closure of glottis during expiration (attempt to maintain lung volume and allow for adequate gas exchange)
- **Grunting**: Gasping, choking, apnea, and stridor (alarming signs)
- **Nasal Flaring**: Nasal flaring decreases airway resistance
- **Additional signs**: Clinical detection of cyanosis depends on total amount of desaturated HB in blood

**Respiratory Distress in Newborn**
Causes of Respiratory Distress in the Newborn

Parenchymal lung diseases – pneumonia, surfactant deficiency, TTN, meconium aspiration – most common causes of respiratory distress in a neonate.
Evaluation and Investigation

- Initial Assessment
- History
- Examination
- Investigation
• Identify life-threatening conditions that require prompt support (evaluate the ABC’s)
  – inadequate or obstructed airway (gasing, choking, stridor),
  – apnea or poor respiratory efforts,
  – cyanosis, and
  – circulatory collapse (bradycardia, hypotension, poor perfusion)

• Immediate oxygen support ➔ bag-and-mask ventilation ➔ intubation ➔ mechanical ventilation (following neonatal resuscitation guidelines)
- **Maternal/Obstetric History**: prenatal fetal assessments (ultrasound, amniocentesis, triple screen), GBS status, maternal diabetes, infections, toxic exposures, medications

- **Labor and Delivery**: fetal monitoring (HR, beat to beat variability, decelerations), prolonged rupture of membranes, maternal fever, vaginal delivery vs. Caesarian section, gestational age, use of forceps/vacuum, complications (trauma, meconium, asphyxia)

- **Neonatal period**: APGAR scores, need for resuscitation
Maternal and obstetric conditions associated with respiratory distress in neonates

A. Maternal Conditions
- Drug abuse
  - Drug withdrawal
- Diabetes Mellitus
  - Hyaline membrane disease, hypoglycemia, polycythemia, cardiomyopathy
- Infections
  - Pneumonia, sepsis

B. Obstetrical Conditions
- Use of anesthesia
  - Central depression
- Hydrops fetalis
  - Pleural effusions
- Premature delivery
  - Hyaline membrane disease
- Chorio-amnionitis, fever
  - Pneumonia, sepsis
- Prolonged rupture of amniotic membrane
- Meconium stained amniotic fluid
- Meconium aspiration syndrome
- Antepartum hemorrhage
  - Anemia, hypovolemia

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- **Family History**: lung disorders, congenital heart disease, early childhood death, consanguinity

- **Details of the presenting respiratory symptoms**: onset (acute vs. insidious), timing (including age at onset), severity (improving, deteriorating), associated symptoms (cough, relation to feeds, emesis etc.)
Common mistakes and assumptions #2
• Focused respiratory exam, including exams of the other systems that are part of the differential diagnosis

• Vital signs: Tachypnea (RR >60/minute), tachycardia (HR >160/minute), decreased oxygen saturation, temperature instability

• Assess anthropometric measurements

• Inspection (the most important aspect of the physical exam): Increased work of breathing, cyanosis, pallor, scaphoid abdomen, meconium staining, asymmetric chest wall movement (suggestive of tension pneumothorax)
Physical Examination

• Palpation: Tracheal deviation, displaced apical beat, thrill may be palpable in the precordium

• Percussion: Usually not very informative in the newborn

• Auscultation: Listen for air entry (symmetry and adequacy of air exchange), bronchial/vesicular air sounds, adventitious sounds (crackles, wheeze), as well as possible bowel sounds, listen to the heart sounds for the presence of any pathological murmurs

• Special Tests: Transillumination of the chest wall is used to quickly detect a pneumothorax
<table>
<thead>
<tr>
<th>Test</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood gas</td>
<td>Assesses the degree of hypoxemia (ABG), or acid/base status</td>
</tr>
<tr>
<td>Blood glucose</td>
<td>Hypoglycemia can cause of aggravate tachypnea</td>
</tr>
<tr>
<td>Chest radiography</td>
<td>Identify pulmonary causes of respiratory distress, useful in evaluation of CHD</td>
</tr>
<tr>
<td>CBC + diff</td>
<td>Leucoytosis/bandemia – stress or infection; neutropenia – infection, low hgb – anemia, high hgb – polycythemia, low platelet – infection</td>
</tr>
<tr>
<td>Blood culture</td>
<td>May indicated bacteremia</td>
</tr>
<tr>
<td>LP</td>
<td>If meningitis suspected</td>
</tr>
<tr>
<td>Pulse oximetry</td>
<td>Used to detect hypoxia and need for oxygen supplementation</td>
</tr>
<tr>
<td>Hyperoxia test</td>
<td>Baseline right radial (preductal) ABG with the child breathing R.A. then repeat the measurement while the infant is receiving 100% O2</td>
</tr>
<tr>
<td>Echocardiography</td>
<td>If abnormal cardiac examination, failed hyperoxia test (cardiac disease suspected) or has unclear diagnosis</td>
</tr>
</tbody>
</table>
### Differentiation of Cyanotic Heart Diseases From Pulmonary Diseases Among Infants in Respiratory Distress

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Cyanotic Heart Disease</th>
<th>Pulmonary Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>History</td>
<td>Previous sibling with CHD</td>
<td>Maternal fever</td>
</tr>
<tr>
<td></td>
<td>Prenatal diagnosis of CHD</td>
<td>MSAF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Preterm delivery</td>
</tr>
<tr>
<td>P.E.</td>
<td>Cyanosis</td>
<td>Cyanosis</td>
</tr>
<tr>
<td></td>
<td>Gallop rhythm</td>
<td>Severe retraction</td>
</tr>
<tr>
<td></td>
<td>Single S2</td>
<td>Split S2</td>
</tr>
<tr>
<td></td>
<td>Large liver</td>
<td>Fever</td>
</tr>
<tr>
<td></td>
<td>Mild respiratory distress</td>
<td></td>
</tr>
<tr>
<td>CXR</td>
<td>Increased heart size</td>
<td>Normal heart size</td>
</tr>
<tr>
<td></td>
<td>Decreased pulmonary vascularity (except in TGA and TAPVR)</td>
<td>Abnormal pulmonary parenchyma</td>
</tr>
<tr>
<td>ABG</td>
<td>Normal or ↓PCO2, ↓PO2</td>
<td>↑PCO2, ↓PO2</td>
</tr>
<tr>
<td>Hyperoxia test</td>
<td>PaO2 &lt; 150mmHg</td>
<td>PaO2 &gt; 150mmHg (except in severe PPHN)</td>
</tr>
<tr>
<td>Echocardiography</td>
<td>Abnormal heart or vessels</td>
<td>Normal heart and vessels</td>
</tr>
</tbody>
</table>
General Management

**ABCs**

- Monitor ABCs. With respiratory compromise, establish airway, provide respiratory support (O2, mechanical ventilation). Establish vascular access – IVF.

**Supportive Care**

- Monitor Vital signs. Thermoregulation. Maintain normoglycemia. NPO. Correct metabolic acidosis. Antibiotics if sepsis is suspected. PGE 1 if cardiac disease suspected.

**Definitive/Specific therapy**

- According to diagnosis.
Case #1

- Born at 37 weeks, by cesarean section
- Maternal diabetes
- Referred at 2 hours – tachypnea, grunting, retractions

**Initial Assessment**
- ABCs
- Focused exam
- HR 170s, RR 70s
- Equal but poor air exchange
- Sat (R hand) – 83%
- Resuscitation +
- Oxygen support
- NICU Admission

**History**
- ROM – < 18 hrs
- GBS status – negative
- No other contributing prenatal and perinatal history

**Examination**
- No other pertinent exam findings

**Investigation**
- ABG/CBG
- CXR
- Glucose
- CBC
- Blood cultures
Diagnosis - Case #1

- Respiratory distress progressing
- CBG: pH 7.27 CO2 58, O2 50, BE -5
- Glucose: 52
- WBC 12K S45 B2
- CXR: ground glass appearance, air-filled bronchi “air bronchogram”

- Diagnosis: Respiratory distress syndrome (hyaline membrane disease)
Case #2

- 6 hour old, 3.8 kg term newborn male with “blue color”
- HR 140bpm, RR 42, BP 65/38
- Generalized cyanosis, pulse ox 70% (R hand and leg)
- No nasal flaring, retractions, clear to auscultation
- Active precordium, equal pulses, no murmur
- Liver not enlarged
- CXR: normal abdominal situs, clear lung fields, normal heart size, thymus present
- EKG: RVH (normal for age), normal sinus rhythm
Case #2

• What should be done next?
  – Baby was given 100% oxygen to breathe via nasal cannula at 1.5L/min → no change in respiratory status, pulse oximetry 82%
  – ABG: pH 7.32, PCO2 48, PO2 42, HCO3 22
  – Supplemental oxygen continued, no intubation

• What additional test is indicated?
  – Echocardiogram – transposition of the great arteries (TGA) with a small PDA and PFO, no VSD
  – Pediatric cardiologist suggested beginning prostaglandin E₁ (PGE₁) infusion
1. Respiratory distress of the newborn is a common presentation for a wide variety of diseases.
   - Characterized by one or more of the following - nasal flaring, chest retractions, tachypnea, and grunting
   - Additional signs of advanced respiratory distress - cyanosis, gasping, choking, apnea and stridor

2. Initial assessment of newborns in respiratory distress should begin by evaluating the ABC’s followed by history and physical exam.

3. Necessary initial laboratory tests include: CXR, CBC, blood glucose, arterial blood gas and blood cultures.
4. Differentiating cardiac and respiratory causes of cyanosis is a common clinical problem. A hyperoxia test may assist in differentiating between the two.

5. General supportive measures are necessary for nearly all neonates with acute respiratory distress regardless of the underlying pulmonary, cardiac, or other pathologic condition.

6. Specific therapy is indicated by the etiology or respiratory distress.
References


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