Neonatal/Pediatric Cardiopulmonary Care

Assessment

Anatomic and Physiologic Differences

- Cardiopulmonary System
- Metabolic System
- Other

Cardiopulmonary Differences

- Tongue proportionally larger
- Large amt. lymphoid tissue in pharynx
  ↓
  ↓
Neonatal Assessment

Cardiopulmonary Differences

- **Epiglottis**
  - Proportionally larger
  - Less flexible
  - Omega-shaped (Ω)
  - Lies more horizontal

Cardiopulmonary Differences

- **Larynx**
  - Lies higher in relation to cervical spine
  - = narrowest segment of infant airway (cricoid ring)

Cardiopulmonary Differences

- Diameter of *trachea* at carina =

- Length of *trachea* =
Cardiopulmonary Differences

All differences (so far) combined

•
•

Cardiopulmonary Differences

• Less rigid

↑ in neg. pressure effort (to ↓ ventilation) just ↓ chest size since thorax is less rigid

Result →

Cardiopulmonary Differences

• Ribs more horizontal

Infant can't increase A-P diameter

Result →
Neonatal Assessment

Cardiopulmonary Differences

Ribs & sternum

- Any attempted increase in ventilation is accomplished by increasing -

- Increasing respiratory rate increases -

Cardiopulmonary Differences

- Heart
  - Larger in proportion to thorax size (imposes on lungs)

- Abdominal content
  - Larger in proportion to thorax size (push up on diaphragm)

- Alveoli
  - Infant -
  - Adult -

Cardiopulmonary Differences

Ribs, sternal, heart, abdominal & alveolar differences

↓
Cardiopulmonary Differences

- **Obligate nose-breathers**
  - Breathe through nose under most conditions
  - Any ↓ in nasopharynx diameter increases airway resistance and WOB

Metabolic Differences

- **Caloric requirement**:  
  - Neonates =  
  - Adults =  

- Neonate has *higher oxygen need in proportion to body size* (VO2)  
  - Infant =  
  - Adult =

Metabolic Differences

- **Do not respond to medication therapy in any predictable manner**  
  - Similar infants may have dramatically different reactions to same meds  
  - No definitive dosages or frequencies of administration established  
  - Each time a drug is given, dosage must be adjusted for each patient
Other Differences

• **Large amount of skin surface area** \( \propto \) **weight**
  - Adult male:
  - Term neonate:
  - 28 wk. Premie:

Other Differences

• **80% of body weight** = **water**
  - Found in extracellular spaces

• **Transition from uterine life to survival outside is critical time**

• **Responsibility of HCG to determine how well infant is adapting**

• **Vital to know**
  - Obstetric history
  - Pregnancy history
  - L & D history
Gestational Age Assessment

- Until 1960's gestational age was based mostly on birth weight
  - <2500 g.
  - >4000 g.
- Assumed all fetuses grow at same rate
- Important to determine age to anticipate potential problems to treat or avoid

Dubowitz Scale

- Assesses gestational age with physical (11) & neurological (10) exam
- Scored 0-5 for each sign
- Physical signs more accurate
- When both evaluated = more accurate than either used alone
- Accurate to within 2 weeks
- Is a slow method, so .... .... ..

Ballard Scale

- 6 neuro signs & 6 physical signs (scored 0-5)
- Comparable to Dubowitz in accuracy
- Requires less time
- Assess:
  - Sole creases
  - Skin maturity
  - Lanugo
  - Ear recoil
  - Breast tissue
  - Genitalia
  - Posture
  - Wrist angle
  - Arm recoil
  - Hip angle
  - Scarf sign
  - Heel to ear
Classification of Neonate

• Gestational age + weight
  - SGA (small for gestational age)
  - AGA (appropriate for gestational age)
  - LGA (large for gestational age)

Physical Assessment

• Purposes
  - Discover physical defects
  - Successful transition?
  - Effect of L & D, anesthetics, analgesics
  - Assess gestational age
  - Signs of infection or metabolic disorder
  - Baseline for further comparison

Physical Assessment

• Done when infant is stabilized (keep warm)

• 2 parts to exam
  - Quiet observation
  - Hands-on
Neonatal Assessment

Quiet Observation

• **Observe color**
  - Light-skinned -- skin color
  - Dark-skinned -- mucous membranes
  - Should be pink
  - Blue or pale -- hypoxemia
  - Blue feet, hands OK for 1st few hours
  - Yellow hue to skin or eyes = jaundice
  - Dark green = meconium (asphyxia may have been present in utero)

Quiet Observation

• **Look for presence of lanugo**
• **Skin maturity**
• **Activity**
  - Symmetry of movement
  - Good muscle tone
  - Normal movement of all extremities
• **Overall appearance of patient**
  - Malformations
  - Head size-to-body size
  - Cysts, tumors

Quiet Observation

• **Respirations**
  - Normal =
  - Periodic breathing is normal (<5-10 sec. without cyanosis or bradycardia)
    • True Apnea =
  - Tachypnea =
    • Could be respiratory distress, needs to be investigated
  - Symmetrical chest movement
  - Should be good abdominal movement
    • Sign of intact diaphragm
Neonatal Assessment

Quiet Observation

- **Watch for the 3 classic signs of respiratory distress**

  1. Attempt to get more volume to lungs

  2. High pitched noise made by glottis closing before end of expiration = PEEP to keep alveoli from collapsing

Quiet Observation

3.

- Inward movement of thoracic soft tissue
- May be mild, moderate or severe
- Supraclavicular, suprasternal, intercostal, substernal
- As respiratory distress increases — lung compliance ↓ — negative pressure in thorax ↑ to overcome ↓ CXR — soft tissues “sucked” in

- Evaluate degree of respiratory distress with Silverman-Anderson Index

Silverman Scoring

![Silverman Scoring Diagram](image_url)
Neonatal Assessment

Hands-On Exam

- Warm hands, warm stethoscope
- Start at head and work down

- **Head**
  - Inspected for cuts, bruises, edema
  - Fontanelles (soft spots; anterior & posterior)
    * Should be firm but soft, not bulging (↑ ICP) or depressed (dehydrated)

Hands-On Exam

- **Mouth** (clefts)
- **Ears** (age)
- **Neck** (cysts, tumors)
- **Breast tissue** (age)

Hands-On Exam

- **Heart**
  - Auscultated
  - HR
    * Normal ➔
    * <100 ➔
    * >80 ➔
    * >160 ➔
Hands-On Exam

**Heart**
- Apical pulse
  - Point on chest where heart sounds heard loudest
  - = point of maximal intensity (PMI)
  - Normal is at left 5th intercostal space, mid-clavicular line
  - If moves later

**Heart**
- Normally 2 distinct heart sounds
  - 1st sound louder
- Murmurs
  - Turbulent flow in heart
  - Valvular defects, septal defects, PDA, aortic stenosis
  - Not all murmurs are bad

Hands-On Exam

**Lungs**
- Well-aerated, no adventitious sounds

**Pulses**
- Brachial pulses compared to femoral
  - Should be of equal intensity & symmetrical in rhythm
  - Both weak = hypotension, ↓ QT, peripheral vasoconstriction
  - Femoral weak, brachial normal = coarctation of aorta, PDA
Neonatal Assessment

**Hands-On Exam**

- **Blood pressure**
  - Normally varies with gestational age, weight, cuff size, state of alertness
  - Taken with Doppler or electronic (cuff around thigh), UAC
  - Diastolic may be difficult to assess
  - Normal =

- **Abdomen**
  - Palpated for cysts, tumors
  - Liver palpated & measured in cm
  - Normally abdomen protrudes
  - If scaphoid (sunken) = diaphragmatic hernia
  - Check umbilical stump for 3 vessels
  - Bowel sounds documented

- **Genitalia** – age

- **Feet** – age

- **Temperature**
  - Rectally or axillary or ear
  - 36.2°C - 37.3°C (97.2°F - 99.1°F)
Neurological Exam

• **Much of neuro exam can be done during physical exam**
  - Movement
  - Crying
  - Response to touch
  - Body tone

Neurological Exam

• **Reflex exams**
  - Rooting reflex
    • Gently stroke corner of mouth
    • Infant should turn head towards side stroked
  - Suck reflex
    • Place pacifier or clean finger into mouth
    • Infant should begin to suck

Neurological Exam

• **Reflex exams**
  - Grasp reflex
    • Place index finger into infant's palm
    • Grasp finger & place your thumb over fingers
    • Gently pull infant to sitting position
    • Assess degree of head control
    • Healthy infant can keep head upright
Neurological Exam

- Reflex exams
  - Moro reflex
    - Slowly lower infant
    - Just before he touches bed, quickly remove your finger allowing him to fall to bed
  - Arms should extend up & out, hips & knees should flex

- Dubowitz or Ballard Scale scoring
  - Whitaker, Comprehensive Perinatal & Pediatric Respiratory Care,
    - pg. 116–117, 120

Chest Radiography

- Cannot be used for diagnosis of NB lung disease
  - Dx made from physical exam, lab data, clinical signs
  - Erroneous interpretation common
    - Artifact
    - Improper technique
    - Patient movement
- Used to:
  - Can also be used to differentiate between diseases with -
Neonatal Assessment

Anatomic Considerations (on CXR)
- Can cause confusion if not understood
- Position of carina
  - Higher than adult
  - NB -
  - adult -

Anatomic Considerations (on CXR)
- Thymus gland
  - Extends in mediastinum from lower edge of thyroid gland to near 4th rib
  - Less dense than heart, more dense than lung tissue
  - Often confused with heart border
  - Can appear as an upper lobe atelectasis or pneumonia
  - Often delta (Δ)-shaped - called

CXR Interpretation

1. Patient ID and date
   - Check ID, date, time
   - Use most recent CXR

2. Orientation
   - Patient's right on your left
   - Heart to the left
   - Not upside down
Neonatal Assessment

CXR Interpretation

3. **CXR Quality**
   - Exposure?
   - Normal = can see spaces between vertebrae

4. **Patient position**
   - Straight
   - Clavicles + spine form “T”
   - Peripheral ribs should turn down

CXR Interpretation

5. **Insp or exp?**
   - Insp - diaphragm at or ↓ 9th rib
   - Hyperinflation will be near or ↓ 10th rib
   - Exp - diaphragm at 6-7th rib
   - Look for deformed or fractured ribs

CXR Interpretation

6. **Diaphragm**
   - Domed on both sides
   - Right 1 rib higher than left
   - Flat with hyperinflation and air trapping
CXR Interpretation

7. **Abdomen**
   - Excessive air bubble may mean gastric distention
   - Liver on right
     - Gray-to-white
     - Should not extend more than 1-1.5 cm below rib cage
   - URC or UDC
     - URC tip - T7-8 or L3-4
     - UDC tip in IVC just above diaphragm

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CXR Interpretation

8. **Cardiac silhouette & thymus gland**
   - Should be <60% of thoracic width

9. **Hilum**
   - Examine vasculature
   - Excess – CHF, cardiac malformation
   - Decreased – R→L shunt (↓ pulmonary blood flow)

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CXR Interpretation

10. **Trachea**
    - Should see from larynx to carina
    - Often slightly deviates to right
    - Increased deviation with atelectasis, pneumothorax
CXR Interpretation

11. **ETT**
   - Tip 1/2 way between clavicles & carina
   - Too far – risk of RMsB intubation
   - Not far enough – risk of extubation

12. **Main stem bronchi**
   - Right – seems like extension of trachea
   - Left – angles at almost 90°

13. **Lungs**
   - Should see vasculature extend to pleural surface