Neonatal/Pediatric Cardiopulmonary Care

Assessment

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Anatomic and Physiologic Differences

- Cardiopulmonary System
- Metabolic System
- Other

3

Cardiopulmonary Differences

- *Tongue* proportionally larger
- Large amt. *lymphoid tissue* in pharynx

⇓
⇓

4

Cardiopulmonary Differences

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

⇓

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Cardiopulmonary Differences

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

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Cardiopulmonary Differences

- Diameter of *trachea* at carina =

- Length of *trachea* =

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Cardiopulmonary Differences

All differences (so far) combined

⇓

-
-

8

Cardiopulmonary Differences

Ribs & sternum

- **Less rigid**

↓

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

Result →

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Cardiopulmonary Differences

Ribs & sternum

- **Ribs more horizontal**

↓

Infant can't increase A-P diameter

Result →

10

Cardiopulmonary Differences

Ribs & sternum

- Any attempted increase in ventilation is accomplished by increasing –
- Increasing respiratory rate increases –

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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 –

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Cardiopulmonary Differences

Ribs, sternal, heart, abdominal & alveolar differences

⇓

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Cardiopulmonary Differences

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

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Metabolic Differences

- ***Caloric requirement***:
  - Neonates =
  - Adults =
- Neonate has ***higher oxygen need*** in proportion to body size (VO_2)
  - Infant –
  - Adult –

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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

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Other Differences

- ***Large amount of skin surface area ∝ weight***
  - Adult male:
  - Term neonate:
  - 28 wk. Premie:

⇓

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Other Differences

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

⇓

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- **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

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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

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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 ....

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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

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Classification of Neonate

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

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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

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Physical Assessment

- Done when infant is stabilized (keep warm)
- 2 parts to exam
  - Quiet observation
  - Hands-on

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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)

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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

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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

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Quiet Observation

- **Watch for the 3 classic signs of respiratory distress**
  1.
     - Attempt to get more as volume to lungs
  2.
     - High pitched noise made by glottis closing before end of expiration = PEEP to keep alveoli from collapsing

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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 ↓ C_L → soft tissues "sucked" in

- **Evaluate degree of respiratory distress with Silverman-Anderson Index**

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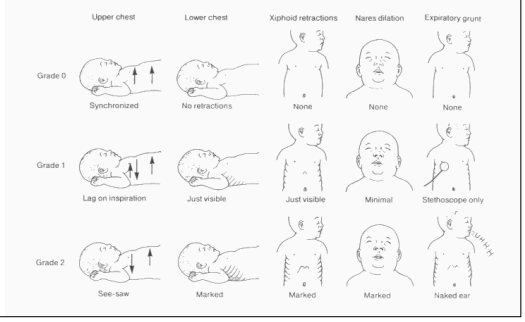
Silverman Scoring



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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)

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Hands-On Exam

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

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Hands-On Exam

- ***Heart***
  - Auscultated
  - HR
    - Normal –
    - <100 =
    - <80 –
    - >160 =

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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
    - If moves later
      -
      -

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Hands-On Exam

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

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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, ↓ Q_T, peripheral vasoconstriction
  - Femoral weak, brachial normal = coarctation of aorta, PDA

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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 =

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Hands-On Exam

- ***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

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Hands-On Exam

- ***Genitalia*** – age
- ***Feet*** – age
- ***Temperature***
  - Rectally or axillary or ear
  - 36.2°C – 37.3°C (97.2°F – 99.1°F)

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Neurological Exam

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

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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

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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

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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

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Neurological Exam

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

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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 –

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Anatomic Considerations (on CXR)

- **Can cause confusion if not understood**
- ***Position of carina***
  - Higher than adult
    - NB –
    - adult –

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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

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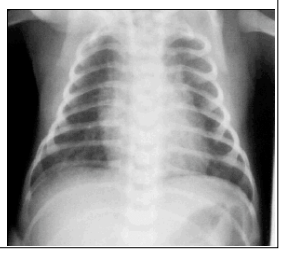
CXR Interpretation

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



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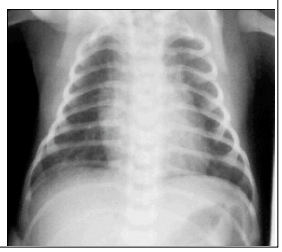
CXR Interpretation

3. CXR Quality

- Exposure?
- Normal = can see spaces between vertebrae

4. Patient position

- Straight
- Clavicles + spine form "T"
- Peripheral ribs should turn down



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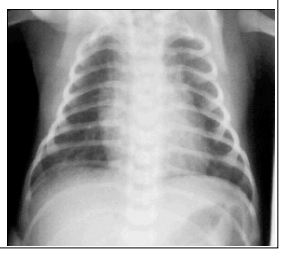
CXR Interpretation

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



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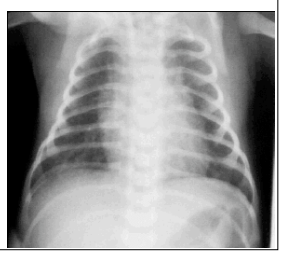
CXR Interpretation

6. Diaphragm

- Domed on both sides
- Right 1 rib higher than left
- Flat with hyperinflation and air trapping



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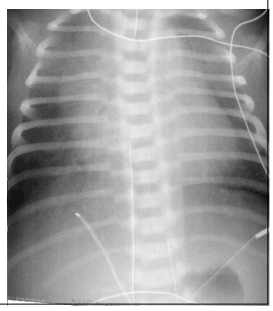
CXR Interpretation

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
- UAC or UVC
  - UAC tip - T7-8 or L3-4
  - UVC tip in IVC just above diaphragm



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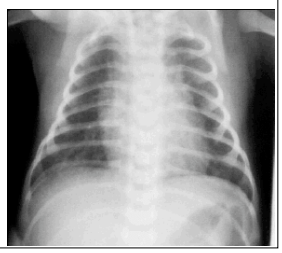
CXR Interpretation

8. Cardiac silhouette & thymus gland

- Should be <60% of thoracic width

9. Hilum

- Examine vasculature
- Excess - CHF, cardiac malformation
- Decreased - R→L shunt (↓ pulm blood flow)



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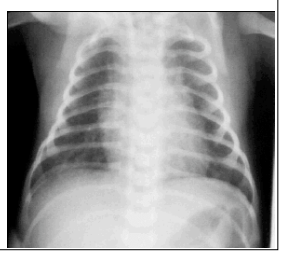
CXR Interpretation

10. Trachea

- Should see from larynx to carina
- Often slightly deviates to right
- Increased deviation with atelectasis, pneumothorax



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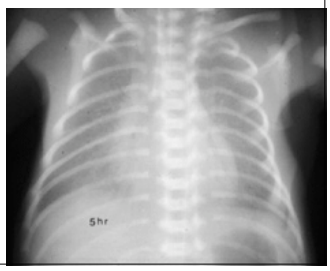
CXR Interpretation

11. *ETT*

- Tip 1/2 way between clavicles & carina
- Too far – risk of RMSB intubation
- Not far enough – risk of extubation



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CXR Interpretation

12. *Main stem bronchi*

- Right – seems like extension of trachea
- Left – angles at almost 90°

13. *Lungs*

- Should see vasculature extend to pleural surface