

Shedding Light on Neonatal X-rays

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Objectives

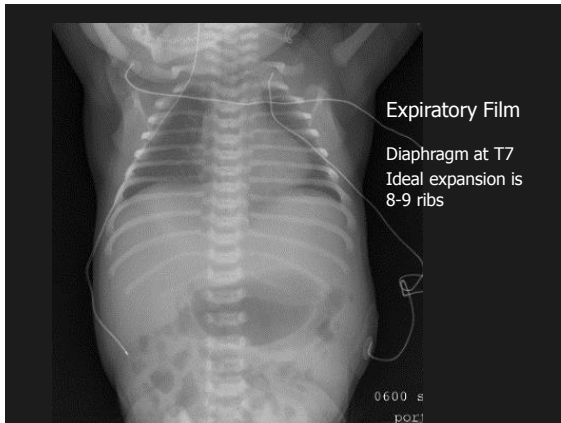
- Utilize a systematic approach to neonatal x-ray interpretation
- Identify correct positioning of the endotracheal tube, umbilical catheters and chest tubes
- Identify common pathologies seen on neonatal x-rays

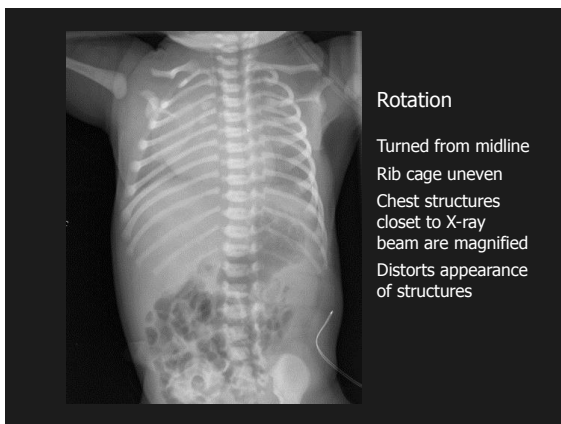
Indications for X-Rays

- Assess lungs and abdomen to follow progression or resolution of a disease process
- Assess heart size and position
- Assess tube and catheter positions

Technical Problems

- Expiratory Film
- Rotated Film
- Underpenetrated Film
- Overpenetrated Film
- Artifact



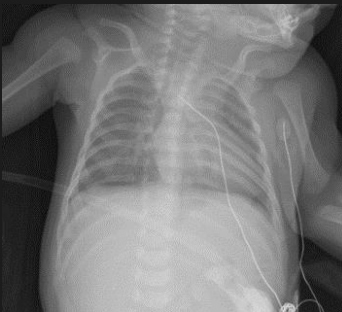




Non-Rotated
Same patient 40
minutes later
Even rib cage

Technical Problems

- Penetration
 - Different tissue densities absorb differing amounts of x-rays
 - X-rays pass through gas → dark shadow
 - Bone and fluid absorbs more x-ray → white image



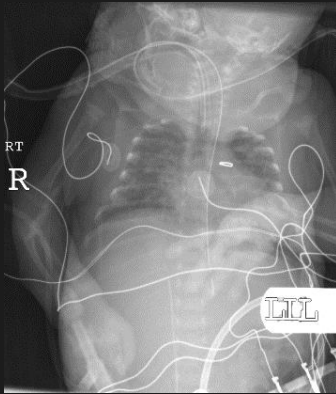
Under
Penetrated

Too little
radiation
Sharp skin
edge
Lungs appear
lighter



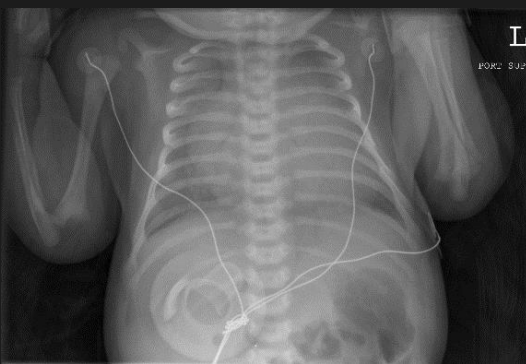
Over
Penetrated

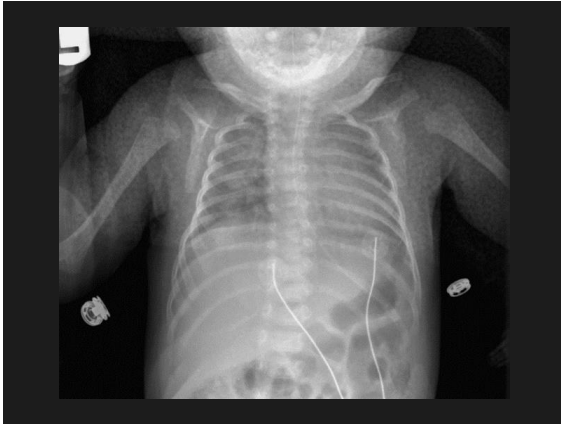
Too much
radiation
Film appears
dark
Arms and skin
"disappear"



Artifact

Extraneous
objects can
obscure areas
of interest

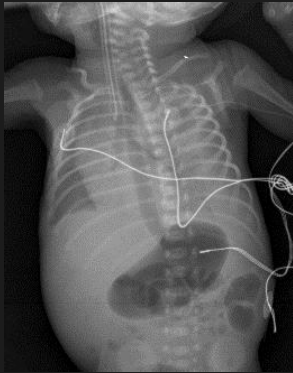




Systematic Evaluation

- Technique
- Heart size and shape
- Lung fields
- Abdominal gas
- Tubes
- Bones





Mediastinum

Contains heart, aorta, vena cava, trachea and esophagus

Trachea to right of esophagus

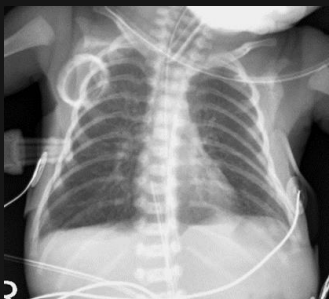
Carina - bifurcation of trachea T3 - T4

Left mainstem bronchus at sharper angle

ETT should be midway between clavicles and carina



Cardiomegaly



Small heart size due to hyperinflated lungs.

Diaphragms flattened, 11 rib expansion



Umbilical Lines

UAC (T8). Loops down umbilical artery to iliac, then turns up the aorta to LEFT of the spine

Low: L3-4 High: T6-9

UVC (crossing PFO). No loop. Umbilical vein → ductus venosus → IVC.

UVC desired position is just above diaphragm.

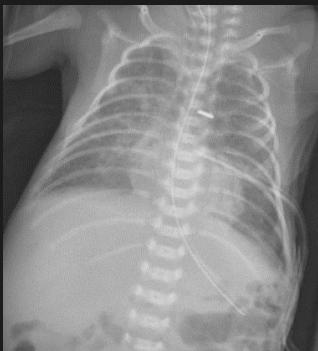
ETT down R mainstem



Lines Lateral View (same patient)

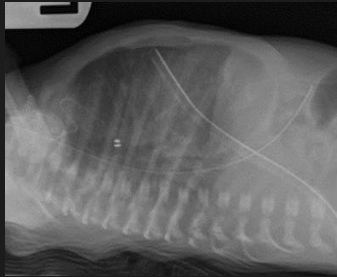
UAC down umbilical artery to aortic bifurcation, then up the aorta along spine.

UVC straight from umbilicus thru liver and ductus venosus into heart

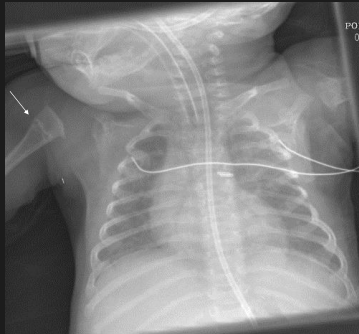


Chest Tube

For evacuating pneumothorax or pleural effusion



Chest Tube
(cross table lateral)
Anterior position
for evacuating air
Posterior position
for evacuating
fluid



Bones
Fractured
right
humerus



Bones
Hemi-vertebra

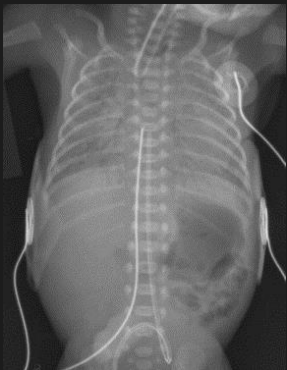
Respiratory Diseases

- Atelectasis
- RDS
- Pneumonia
- Meconium Aspiration Syndrome (MAS)
- Congenital Diaphragmatic Hernia (CDH)
- Air Leaks
 - PIE
 - Pneumothorax
 - Pneumomediastinum
 - Pneumopericardium



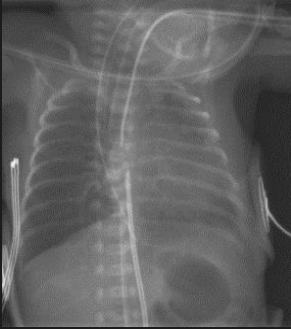
Left Atelectasis
(ETT right mainstem)

Volume loss as air is absorbed from left lung
Heart pulled toward left
Due to: malpositioned ETT, obstruction of bronchus (mucus plug, blood, meconium, foreign body)



RDS

Surfactant deficiency
Homogenous pattern
Low lung volumes
Diffuse reticulogranular "ground glass" pattern (White-out)
Air bronchograms (aerated bronchioles)
UVC: T6 UAC: T6



RDS after surfactant
(same patient)

Improved but unequal
aeration

ETT right mainstem

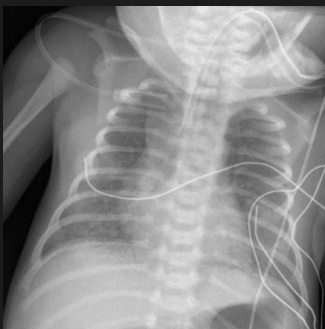
UVC: T8 (improved)



Pneumonia

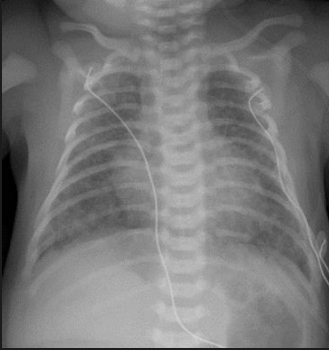
Coarse, streaky,
interstitial
markings

Appearance can
vary widely



RLL Pneumonia

RLL patchy,
granular opacities
ETT good position
midway between
clavicles and carina
OG tube artifact

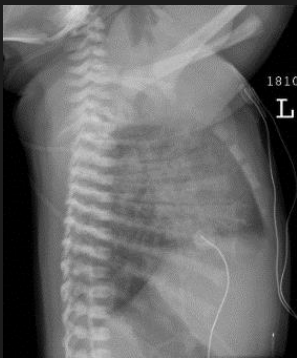


MAS
(meconium aspiration)

Irregular, diffuse
pattern of patchy or
nodular infiltrates,
"chunky"

Lungs hyperinflated

Air trapping can
lead to air leaks



MAS
(same patient)

Lungs hyperinflated
with bowing of
diaphragms



Left CDH

Lucent bowel gas in
pleural space

Herniation of
abdominal organs
into chest cavity

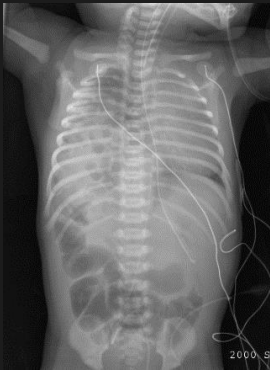
May contain stomach,
bowel, liver, or spleen

85-90% occur on left

Mediastinal shift to
right due to mass
effect of the bowel

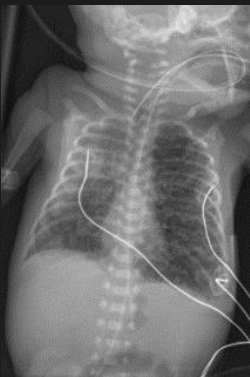
ETT just above carina

Soft tissue edema



Right CDH

Liver and bowel in right pleural space
Mediastinal shift with OG tube & heart pushed left
ETT: T1 (high)



Pulmonary Interstitial Emphysema (PIE)

Alveolar rupture with air accumulation within lung tissue
Pinpoint dark bubbles throughout lung fields
Unilateral or bilateral
Hyperinflation common
Can progress to pneumothorax



Tension Pneumothorax

Accumulation of air in pleural cavity due to alveolar rupture
Collapsed lung outlined by air
Mediastinal shift toward opposite side



Anterior Pneumothorax

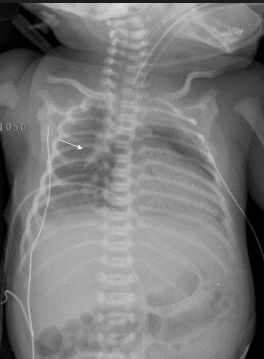
Free air is anterior with lucency along cardiac border or diaphragm

Usually no mediastinal shift

Lateral film helpful to see anterior air

Can progress to tension pneumo

Overpenetrated film



Pneumomediastinum

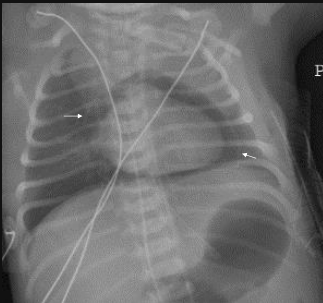
Lucency over upper chest

Free air accumulates within mediastinum

Air lifts thymus off heart outlining the undersurface of the thymus, creating the "sail sign"

Can progress to a pneumothorax or pneumopericardium

Pneumopericardium



Free air accumulates within pericardial sac

p. Radiolucent halo completely surrounds the heart
Classic dome-shaped upper margin

Pericardial rim may be visible (arrows)

Decreased heart size with cardiac tamponade

Pneumopericardium



Serial CXRs from 12:45 to 16:20
 Progressive resolution of
 pneumopericardium
 Mild cardiac tamponade
 Heart size increases with resolution

Case Study

- 30 week gestation infant was just born at a nearby hospital ED
- Was intubated with difficulty by the ED physician secondary to respiratory distress
- You are part of the transport team and arrive 1 hour later.





Lateral
(same patient)

Case Study

- Term infant with respiratory distress after a difficult vaginal birth
- Was placed on nasal CPAP initially and transport was requested
- You are part of the transport team and arrive to find he was just intubated for a sudden bradycardic/desaturation event

