IMAGING OF THE PEDIATRIC CHEST

BY

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Imaging modalities

- Conventional X-ray & Tomography
- Computed tomography
- Radionuclide imaging
- Magnetic resonance imaging
- Angiography conventional, CT, MRI
- Interventional techniques
Indications

- Patient preparation
- Patient position
- Scanogram

- To assess equivocal plain X-ray findings
- Staging of lung neoplasms
- Metastatic workup of extrathoracic malignancies
- Diagnosis of diffuse lung disease with HRCT
- Assessment of bronchiectasis
- Assessment of suspected post-traumatic vascular injury
No required preparation unless the patient is going to be sedated or injected with contrast material

FASTING FOR 3 - 4 HOURS
- Indications
- Patient preparation
- Patient position
- Scanogram
Contrast injection

1-2 ml/ Kg body weight of water soluble contrast material [urographine, isovist,...] bolus injection

Not indicated when

- Evaluating diffuse lung disease.
- Evaluating bronchiectasis
- Screening for lung deposits
- Some cases of trauma.
7mm sections from lung apex to the C/P angles

- Mediastinal window, lung window, bone window?!

Reconstructed images
Scanning techniques

- Standard Examination
- High resolution [HRCT]
- Spiral, Helical, volumetric CT
Multi-d detector CT
Lobar Anatomy
Lobar Anatomy
Lobar Anatomy
Lobar Anatomy ?!
Focal Lung Lesions

- Nodules
- Masses
- Patches
- Cavities
Pulmonary Nodules

- Tuberculoma
- Hamartoma
- Deposits
- AVM

- **Tuberculoma** usually single, smooth edge, may calcify, less than 3cm
- **Hamartoma** 8% usually single, smooth edge, calcification 15% “Popcorn” less than 3cm
Tuberculoma
Primary complex

- Solitary small lesion 70%
- Usually subpleural
- Large mediastinal nodes may compress the bronchi causing atelectasis
- Affects pleura, lung, and lymph nodes
Extra nodal TB extension into adjacent lung parenchyma
Chest radiograph shows right-sided Para tracheal lymph node enlargement.
Chest radiograph obtained 2 months latter shows consolidation in the right upper lobe, with enlarged right Para tracheal lymph node.
Hamartoma
Metastatic deposits

- Multiple 75% variable size Subpleural 80%
- Sharply defined with smooth edge
- Usually non calcified [deposits of osteosarcoma ]
- Fine micro nodular or miliary deposits
- Cannon ball deposits
Different types of deposits

Canon ball deposits from adenoid cystic carcinoma
Deposits from Ewing’s sarcoma, F 17Y
Pulmonary AVM

- Simple type 80%
- Complex type 20%
- Lower lobes 70%
- Bilateral 8-20%
- Sharply defined lobulated /rounded mass lesion 90%
- 1- few cm in size- No calcification
- Cord like bands from the lesion to hilum
Pulmonary Arteriovenous Malformation
Pulmonary Arteriovenous Malformation
Pulmonary arteriovenous malformations are usually solitary but can be multiple in certain genetic syndromes such as Osler-Weber-Rendu disease.

Patients may present with dyspnea, hemoptysis, cyanosis, or clubbing, or they may be asymptomatic.

These lesions most commonly occur in the lower lobes and are seen on chest radiography as round, homogeneous nodules or masses.

CT shows the anomalous feeding artery and draining vein.

Large lesions are typically treated with intravascular embolization.
Pulmonary Masses

- Pulmonary Neuroblastoma
- Metastatic Deposits
- Hydatid Cysts
- Inflammatory Pseudo tumor

Pediatric
Neuroblastoma - Thoracic

- The most common malignancy in the 1st week of life
- Mean age at presentation 2 years
- The most common pediatric malignancies are leukemia, CNS tumors and neuroblastoma
- May regress spontaneously or mature to ganglioneuroma

Common site is the adrenal gland, but can arise anywhere along the sympathetic chain including the mediastinum.
Neuroblastoma - Thoracic

Imaging findings

- Posterior mediastinal Para spinal mass
- Matrix calcification in up to 85% of cases by CT
- Heterogeneous density and enhancement

- Assess for
  - Intraspinal extension
  - Contralateral extension
  - Local and distant metastases
M 14Y

Deposits of Osteosarcoma
Multiple well defined opacities in the left lung. CT showed the cystic nature of the lesions.
Pulmonary hydatid cyst

Air in the wall – Halo sign
Pulmonary inflammatory pseudo tumors

- The most common 1ry lung mass in children
- 2nd decade M ≥ F
- Solid sharply circumscribed lung mass
- Located anywhere in the chest, commonly in the lower lobes
- Average size 5cm, but may fill the hemi thorax
- 25% have matrix calcification
Pulmonary inflammatory pseudo tumors

- 5% are multiple, no malignant potential
- Atelectasis and effusion may be seen, but no lymph nodes
- Definitive diagnosis by biopsy
- 5% behave aggressively with invasion of the surroundings
- Excellent prognosis with complete excision

Heterogeneously enhancing mass in the right lower lobe with peripheral enhancement. The resected specimen showed hyperemic rim with central fibrotic scar.
Inflammatory pseudotumor
Pulmonary sequestration

- **Nonfunctioning lung** parenchyma that do not communicate with the tracheobronchial tree and have an anomalous systemic arterial supply.

- Although clinical presentation is often accompanied by recurrent infection, most commonly the diagnosis is made **incidentally**.

- **Intralobar sequestrations** is contained within **visceral pleura**, while extralobar sequestrations has a separate pleural covering.

- The most common location is the **left lower lobe**.
- Sequestration appears as a persistent opacity or **mass**.
- Lesions contain air only when super **infection** is present.
Sequestrated lung segment
Left lower lobe opacity with systemic arterial blood supply from the aorta

Sequestrated lung segment
**Bronchopulmonary sequestration** in 3-year-old boy. Coronal reconstruction of contrast-enhanced CT scan shows opacity within left lower lobe with prominent vessels. Feeder vessel from aorta is seen.
Pulmonary Cavitary lesions

- Lung abscess
- Ruptured Hydatid cyst
- Cavitating neoplasm

Adults  Pediatric
Abscess, 2 Cases
Apical lung abscess
Lung abscess versus hydatid cyst
Chronic lung abscess  Emphysematous bulla
Intracavitary lesions

- Fungal ball
- Rupture Hydatid
Mycetoma
Hydatid cyst

Water lily sign

Meniscus sign

Water lily sign
Ruptured hydatid cyst
Patches [air bronchogram]

- Pneumonia
- Infraction?!
Different types of lung consolidation by X-Rays
Middle lobe consolidation
Middle lobe consolidation
Para pneumonic complications

- Pleural effusion
- Empyema
- Peumatoceles
- Peumothorax
- Abscess formation
- Bronchiectasis
- Cavitary necrosis
Para pneumonic effusion/ Empyema

- Fluid in the pleural space secondary to adjacent infection
- X ray & CT → pleural fluid in conjunction with pneumonia
- Effusion versus empyema use US or enhanced CT

**CT advantages:**

- Can differentiate transudate from exudates
- Can assess lung parenchyma for cavitary necrosis, lung abscess
- Can assess the pericardium
- Can show the position of derange tube
Para-pneumonic effusion and Empyema
Empyema - 2 cases
Pneumatocele:
Localized air collection, usually with Staph. Pneumonia, but may occur with other types of pneumonias. Extension of inflammatory exudate into the lesion causes formation of air-fluid level.

More common than true lung abscess.
Pneumonia with central breakdown

- Persistent pneumonia inspite of treatment
- Areas of necrosis within the consolidated lung
- Cavities filled with fluid then air when communicates with aerated lung
- Usually staphylococcal infection

Consolidation breakdown into abscess
Pneumonia with follow up breakdown
Consolidation breakdown into abscess
Brochiectasis
Cystic fibrosis

Autosomal genetic defect → abnormal chloride transport across epithelial membranes →↓ water content of airway mucus → mucus plugging → obstructive changes + bronchial wall inflammation → bronchiectasis [typically pan lobar]

Imaging findings

- Central bronchiectasis is seen in almost all cases
- Bronchial wall thickening
- Peribronchial interstitial opacities
- Mucus plugging → branching or nodular opacities
- Mosaic pattern [ areas of hyper translucency] [decreased perfusion]
Dilated bronchi with thickened walls filled with mucous plugs [gloved fingers] [signet ring]
Cavitary necrosis
Complicating pneumonia in children

- A complication of severe pneumonia
- Usually associated with staphylococcal pneumonia
- CT is the examination of choice
- Severely ill patient
- Usually treated medically
- Surgical excision in cases of progressive sepsis and shock

Thrombotic occlusion of alveolar capillaries
  - Ischemia
  - Necrosis
  - Liquefaction
  - Fluid filled cavities
  - Expectorated fluid
  - Air filled cavities
Cavitary necrosis of a right upper lobe Strept. pneumonia with follow up of a 4Y girl

Same day

13D

39D
Cavitary necrosis of the right upper lobe with follow up

[Donnelly & Klosterman AJR, 171, 1998]
Cavitary necrosis
Amazingly, despite the necrosis and Cavitary lesions involving large portions of the lung, long term follow up radiographs [40 days] showed clear lungs without volume loss, scarring or residual cavities.

[Donnelly & Klosterman, AJR, 171, 1998]
Unilateral lung pathology

- Congenital hypoplastic lung
- Congenital lobar emphysema
- Cystic adenomatoid malformation
- Macloid syndrome

Hypo plastic lung
Right upper lobe hyperinflation with mediastinal shift to the left side
Congenital lobar emphysema

- Progressive over inflation of a lung lobe due to obstruction
- May be diagnosed in utero, but commonly in infancy
- M:F = 2:1  Respiratory distress
- X rays and CT: Enlarged hyper lucent lobe with attenuated vessels
- Compression of the remainder lung with mediastinal shift

Lobar emphysema
Two cases of congenital emphysema involving the left and right upper lobe as seen by MDCT with coronal and surface rendered reconstruction.
Macloid syndrome
Macleod’s Syndrome
Cystic adenomatoid malformation

Congenital lung mass of adenomatoid proliferation
Hamartomatomas proliferation of the terminal bronchioles

- Unknown cause  1:100,000  M=F
- Present during infancy, but can be seen at any age
- Respiratory distress, recurrent chest infection
- Multicystic mass with air ± fluid in the cysts
- Cysts may communicate with the bronchial tree
- Can affect any lobe or whole lung
- Enlargement of the affected lung → mediastinal shift
Accounts for 25% of all congenital lung malformations

These lesions are now diagnosed on prenatal US or MRI, and newborns can be asymptomatic at birth.

Imaging shows a mass with a variable number of solid and cystic components.

Communicates with the bronchial tree at birth and therefore typically contains air soon after birth.

Because of the risks of recurrent infection and malignant potential, resection remains the current treatment.
Multicystic lesion in the left lung in a neonate
Associated with mediastinal shift
Cystic adenomatoid malformation
<table>
<thead>
<tr>
<th>Cystic adenomatoid malformation</th>
<th>Diaphragmatic hernia</th>
</tr>
</thead>
<tbody>
<tr>
<td>➤ Air- fluid levels more likely do not change with position</td>
<td>➤ Air fluid levels less likely can change with position</td>
</tr>
<tr>
<td>➤ Lesion stops at the diaphragm</td>
<td>➤ Lesion continues into the abdomen</td>
</tr>
<tr>
<td>➤ Barium studies -ve</td>
<td>➤ Barium studies +ve</td>
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ْسبحانك اللهم و بحمدك! نشهد ان لا اله الا انت! نستغفرك و نتوب اليك
Cavitary necrosis
Bronchopneumonia with lower lobe collapse

Middle lobe pneumonia

Bronchopneumonia

M 2Y
Miliary TB
Thymic cyst

Hemangioma of the neck and chest wall
Bronchogenic cyst

- Foregut duplication cyst
- Abnormal ventral budding of the TB tree
- Well defined, ovoid or rounded, smooth outline mass in the paratracheal or subcarinal region, \( T2 \) homogenous bright signal
- Solitary
- Unilocular
- Mediastinal: more common (pericarinal)
- Pulmonary: medial thirds of the lungs (lower lobes)
- Non-enhancing or minimal in the thin wall

emphysema
Interstitial fibrosis
Classic lobar pneumonia
Cystic adenomatoid malformation
Axial CECT in patient with complex congenital heart disease shows left systemic artery (arrows) to right lower lobe from descending aorta.

CTA in same patient as on left posterior view, shows systemic arterial supply (arrows) to right lower lobe opacity arising from descending aorta.
(Left) Axial CECT shows left lower lobe opacity with systemic arterial supply (arrow) from descending aorta. (Right) Coronal CTA shows systemic arterial supply (arrows) arising from descending aorta.

(Left) Anteroposterior radiograph shows left lower lobe opacity (arrows) in the left retrocardiac area which was persistent over multiple radiographs obtained for symptoms of pneumonia. (Right) Axial TIWI MR in same patient as to left shows left lower lobe opacity with systemic arterial supply (arrows).

(Left) Coronal MRA in same patient as above shows systemic arterial supply (arrows) to opacity in left lower lobe. (Right) Cross pathology in same patient as on left shows resected left lower lobe with abnormal pulmonary tissue with pleural covering.
Axial CECT shows homogeneous, well-circumscribed, rounded fluid attenuation lesion in right paratracheal region (arrow) with no perceptible rim or internal enhancement.

Coronal T1 C+ MR shows oblong, well-circumscribed, low signal lesion (open arrow) with barely perceptible enhancing thin rim (arrow) in the right paravertebral region.
Typical

(Left) Axial T2WI MR shows homogeneous, well-circumscribed ovoid mass (arrow) with signal greater than CSF (curved arrow). (Right) Anteroposterior radiograph shows large, smooth, homogeneous, left retrocardiac parenchymal mass (arrows).

Variant

(Left) Axial CECT shows infected bronchogenic cyst (white arrow) adjacent to the left lower lobe bronchus (black arrow) with a thick rim (open white arrow), and reactive pleural effusion (curved arrow). (Right) Sagittal STIR MR shows a well-circumscribed homogeneously high signal mass which appear to have two separate lobules (arrows).
**Typical**

(Left) Axial T1WI MR shows normal thymus (arrows) in an infant. Note quadrilateral shape, smooth borders, and homogeneous signal, and nondisplacement of airway and vessels. (Right) Axial CECT in a teenager shows normal thymus (arrows) with triangular shape, homogeneous attenuation, smooth borders, and lack of compression of adjacent structures.

**Typical**

(Left) Anteroposterior radiograph in infant shows normal appearance with thymus (arrows) draped over cardiac silhouette. (Right) Anteroposterior radiograph in an infant shows normal thymus with triangular extension to left (arrows). Note smooth borders.
(Left) Anteroposterior radiograph shows large mediastinal mass (arrows).
(Right) Axial CECT in same patient shows mass with compression of SVC (open arrow) and posterior displacement and compression of the airway (arrow).

(Left) Anteroposterior radiograph shows large mediastinal mass (arrow).
(Right) Axial CECT radiograph shows mediastinal mass (arrows) with paratracheal extension.
Axial CECT shows a large mass containing fat (black arrow), calcium (white arrow), and soft tissue (white open arrow) attenuation material with preservation of fat planes (black open arrow).

Anteroposterior radiograph shows a convex contour abnormality of the cardiomediasinal silhouette in the region of the left atrial appendage (arrows).
(Left) Anteroposterior radiograph in patient with seminoma shows complete opacification of right hemithorax with deviation of mediastinum to left. Rounded lesion adjacent to left heart border (arrow) was solitary metastasis. (Right) Axial CECT in same patient shows heterogeneous mass with solid (white arrow) and necrotic (black arrow) regions. Note pleural thickening (white open arrows) and effusion (black open arrow).

(Left) Axial CECT in same patient shows a well-circumscribed metastatic nodule in the left lower lobe (arrow) with complete opacification of the right hemithorax. (Right) Axial CECT shows a well-circumscribed mass containing fat, fluid, and soft tissue attenuation material, adherent to the pulmonary artery.
Normal thymus

- Large on chest X ray up to 5 years of age
- Decreases in size by the end of 1st decade
- Should not have a prominent mass in the 2nd decade
- 80% of prominent thymuses occur in boys
- Normal thymus does not displace or compress mediastinal structures
- Prominent thymus for age \(\rightarrow\) CT or US (architecture)
Germ cell tumors

Teratoma, seminoma, non seminomatous tumors

**Mature teratoma**

- Benign lesion
- 25% of anterior mediastinal tumors in children
- Contains soft tissue, *fat, calcium* and fluid
- Usually extends to one side of midline
- Pleural or pericardial effusion may be seen
- Usually asymptomatic, dyspnea, chest pain
- Excellent prognosis with complete excision
lobar emphysema

TB Miliary
pneumo-mediastinum

Hydropnumothorax, supine and erect
Cystic adenomatoid malformation

Normal thymus 7 month old
lobar emphysema

Interstitial lung fibrosis
Pulmonary edema
TB
Bronchoneumonia CT
Figure 1. Contrast-enhanced spiral CT section at the level of the aortic root shows bilateral air-space consolidation in the lower lobes. There is associated lymphadenopathy (arrows) abutting the descending pulmonary arteries. The CT interpretation and clinical diagnosis were bilateral lower-lobe bronchopneumonia (community acquired), which resolved with antibiotic therapy.
Figure 1. Transverse CT scan at the level of the middle lobe bronchus in a 35-year-old man with Q fever pneumonia and associated headache, fever, and malaise shows consolidation of the middle lobe and air bronchograms (arrows).
**Figure 2a.** *C. burnetii* infection in a 46-year-old man with malaise and a high temperature of 8 days duration. (a) Transverse CT scan shows multiple patchy areas of consolidation (arrowheads) in the right and left upper lobes. Air bronchograms (arrows) are seen in one of the areas of consolidation. (b) Transverse CT scan obtained at a level 2 cm inferior to a and at lung window settings depicts multiple nodular or wedge-shaped opacities (arrows) in a peripheral distribution. Some of these opacities have a vessel connection (large arrowheads) and a halo of ground-glass opacification (small arrowheads). Of the large vessels in the right lung, the dorsal one (large arrowhead) has an arterial origin, whereas the two ventral vessels have a venous origin, which was identified on sequential images (not shown).
Figure 3. Transverse CT scan at the level of the basal bronchi in a 19-year-old man with Q fever pneumonia, a history of a nonproductive cough, and a fever of 50 days duration shows multiple nodules (arrows) in a peribronchovascular distribution at the posterior basal segments of both lower lobes. On the more cephalad scans (not shown), consolidation of multiple segments in both upper lobes was depicted.
Figure 3a. Images show correlation of axial CT and histologic findings in a lung with pulmonary metastasis from colonic carcinoma. (a) Low-dose CT image (50 mA, 120 kV, 5-mm collimation, pitch of 2) in a lung shows diffuse infiltration (histologic finding was bronchopneumonia) and a 3-mm, well-defined nodule (arrow). (b) Photomicrograph shows the nodule, which represents a metastasis from colonic carcinoma. (Hematoxylin-eosin stain; original magnification, x2.5.)
Figure 1: Transverse thin-section CT scan demonstrates *C. pneumoniae bronchopneumonia* with airway dilatation in 66-year-old man. Centrilobular nodules (arrows) and lobular areas of consolidation with bilateral airway dilatation (arrowheads) are seen. Note the associated areas of linear opacity.
Figure 5: Transverse thin-section CT scan demonstrates *M. pneumonias* bronchopneumonia in 23-year-old man. Branching centrilobular nodules (tree-in-bud appearance, arrowheads) are seen on a background of faint GGO. Bronchial wall thickening (arrow) is also noted.
TB
Septic emboli
Septic emboli
**Figure 23a.** Esophageal foreign-body granuloma in a 3-year-old boy with cough, stridor, and dysphagia who was admitted in respiratory distress. He had had a choking episode while eating paella with clams 1 month earlier. (a) Posteroanterior chest radiograph shows a foreign body (a clamshell) at the thoracic inlet (arrow). (b, c) Axial CT scan (b) and three-dimensional reconstruction image (c) show the hyperattenuating foreign body (arrow) with a hypoattenuating pseudomass that causes tracheal stenosis.
**Figure 10a.** Retropharyngeal abscess with mediastinal extension in a 3-year-old boy with pharyngeal perforation caused by a pen. (a) Lateral radiograph of the neck shows widening of the prevertebral space with air in the retropharynx (arrow). (b) Anteroposterior plain radiograph of the cervicothoracic region shows bilateral widening of the upper mediastinum. Note the air in the soft tissue on the left side of the neck (arrow).
Multiple neurofibromas in a 9-year-old girl with neurofibromatosis. Contrast-enhanced axial CT scans at the thoracic inlet (a) and supraaortic level (b) show a well-defined mediastinal mass with bilateral, isoattenuating, nonenhancing masses displacing the supraaortic vessels anteriorly and extending along the borders of the lower ribs (arrows).
Figure 22a. Traumatic pharyngeal pseudodiverticulum in a 3-month-old boy who underwent repair of bilateral inguinal hernias at a rural hospital. Endotracheal intubation was reported to have been difficult, and shortly after surgery the patient developed respiratory difficulty. (a) Chest radiograph shows a large cervicothoracic air collection (arrowheads). (b) Esophagogram shows a large, contrast material–filled cavity (arrow) that compresses the esophagus and displaces it anteriorly.
Unknown primary
Cervicothoracic lipoblastoma: A fatty mass ($M$) with thick internal septa behind the left sternomastoid muscle displacing the trachea.
Mycetoma
End
Normal pediatric chest

**Trachea** in midline or slight buckle to right at thoracic inlet.

**Thymus** - large dense mass in the superior mediastinum. Usually wavy contour. Bilobed but not always symmetrical.

**Heart** - dense seen usually with apex to left. Occupies about 50% of chest width at widest point. Aortic knob may be seen through thymus on left.

**Pulmonary vessels** - hila seen best on lateral. Vessels extend to mid lung, tapering gradually.

**Lungs** - uniformly aerated. Appear black on most films.

**Bony structures** - ribs usually 10-12 well seen. Upper thoracic vertebral bodies, scapulae, and clavicles seen well.

**Diaphragms** - right and left equal. Usually seen at level of 9-10 ribs.
Normal pediatric chest

The thymus

- It is a thin, bilobed organ located in the superior mediastinum.
- Large up to 5 yrs, decrease up to 10 yrs. Not prominent in second decade.
- It lies anterior to the heart and great vessels, causing no mass effect.
- The relative size of the thymus increases with expiration and decreases with inspiration.
- It may extend inferiorly to the level of the diaphragm.
- The thymus is a soft organ, overlying ribs may indent it, causing a "wave" sign.
- The right lobe of the thymus can insinuate into the minor fissure, causing a "sail" sign.
- Homogenous, no calcification or low attenuation.
Normal pediatric chest

1 inferior border of the thymus 2 trachea
Normal pediatric chest

The trachea

- Subglottic trachea
  AP: Lateral convexities (shoulders)
  Lateral: not narrower than upper and lower airways.
- Intrathoracic trachea
  AP: well visualized, pushed to the right and indented on the left by the arch. If straight or left: arch anomaly
  Lateral: consistent in diameter for entire length.
Normal neonatal chest

- **Normal Neonatal Chest, Inspiratory**
- The use of the "ABC" approach ensures that all areas of the film are systematically examined.
- **A - Abdomen** - check for: bowel gas pattern suggesting ileus or obstruction, free intraperitoneal air, abnormal calcifications, abdominal situs, and diaphragm position.
- **B - Bone** - check for: fractures, lytic or blastic lesions, and metabolic bone diseases.
- **C - Chest** - check for: midline trachea and mediastinum, abnormal mediastinal and cardiac contours, position of the aortic arch, pleural effusions, pulmonary vascularity, pneumomediastinum, pneumothorax, pneumopericardium, infiltrates, and atelectasis.
• Normal Neonatal Chest, Expiratory
• In older infants and children, a good inspiratory chest film is one in which the relationship of the 6th anterior rib ends intersect the domes of the diaphragm.
• This may be difficult to evaluate in the neonate where proper positioning is difficult. The volume of the thorax is decreased in an expiratory film.
• the following are seen
  - increased pulmonary opacity,
  - Prominent pulmonary vasculature
  - An increase in the size of the heart and mediastinal contents.
Normal pediatric chest

- Normal Neonatal Chest, Lordotic
- The anterior arc of a rib should be directed downward, below the normally horizontal posterior rib
- If the x-ray tube is angled cephalad or if the infant is not lying flat, a lordotic film is obtained.
- This results in the anterior arc of the rib projecting above the posterior rib
- In severe lordotic distortion the ribs can appear dysplastic, the lung volumes decreased, the cardiac silhouette may have an elevated apex and appear enlarged,
- A normal appearing lateral view will confirm the lordotic nature of the frontal film.
• Normal Neonatal Chest, Rotated
• In a properly aligned frontal chest radiograph the distance from the spine to the anterior end of the ribs should be equal, bilaterally, at each level. A rotated film can simulate abnormal mediastinal shift.
Distressed Infants

- **Congenital lobar emphysema**
  - Condition of progressive over-distention of a lobe producing atelectasis of adjacent lobes and a mediastinal shift.
  - X-ray - quite lucent mimicking pneumothorax.  
    - may be water dense or fluid filled early.
  - Usually a surgical emergency.
  - Differential diagnoses includes adenomatoid malformation, bronchogenic cyst, hygroma.
Distressed Infants

• Chylothorax
  – Cause of large pleural effusion in newborn, thought to be associated with birth trauma.
  – X-ray - effusion is unilateral but may be right or left large
  – Differential includes erythroblastosis, congestive heart failure, renal disease.
  – Treat with thoracentesis.
Distressed Infants

• Neonatal pneumonia
  – Occurs because of interuterine infection (i.e. cytomegalic inclusion virus) or shortly after birth.
  – Virus can be principle cause although other organism such as strep, staph or E Coli.
  – X-ray - patchy infiltrate in perihilar area. May lead to diffuse involvement of entire lungs. Occasionally pleural effusion may occur.
  – Complications - generalized sepsis or lung abscess may occur.
  – Therapy - antibiotic along with oxygen and fluid support as needed.
Distressed Infants

- **Meconium aspiration**
  - Infants are meconium stained at birth.
  - Usually a chemical pneumonia due to swallowing amniotic fluid mixed with meconium.
  - X-ray - patchy aeration of both lungs. Over-distention.
  - Complication leads to air-block syndrome with pneumothorax or pulmonary hemorrhage.
  - Differential - transient tachypnea, neonatal infection, lymphangiectasia.
  - Usually responds to supportive therapy.
Distressed Infants

- **hyaline membrane disease**
  - Condition that affects premature infants related to a deficiency of surface active agent surfactant.
  - Infants are symptomatic immediately or soon after birth.
  - X-ray - diffuse reticulogranular
    - ground glass appearance to lungs. (microatelectasis)
    - Air bronchogram seen at lung bases.
    - Pulmonary interstitial emphysema(therapy).
  - Complications - pneumothorax, bronchopulmonary dysplasia, persistent patent ductus with CHF.
Distressed Infants

**Tuberculosis**

- May occur in newborns because of interuterine infection or may be acquired in infancy.
- X-ray - adenopathy
  - peripheral patchy infiltrate.
  - Foci of infection may calcify.
- Complication - dissemination either by bronchial route or hematogenous route to involve other organ systems (renal, cardiac, etc.). Miliary pattern.
Distressed Infants

- **Esophageal atresia with or without tracheal fistula**
  - Common developmental disorder involving separation of the primitive foregut into trachea and esophagus.
  - May present with gagging or aspiration during feeding. Failure to allow passage of nasal gastric tube.
  - X-ray - dilated upper esophagus on PA and lateral films. Abdomen may be gasless if no fistula.
  - Complication - pneumonia, failure to thrive. Frequently seen with other involving spine, heart, kidneys, GI tract.
Distressed Infants

- **Diaphragmatic hernia**
  - Usually due to embryonic defect in posterolateral portion of diaphragm. Left hemidiaphragm involved more than right.
  - Infants usually asymptomatic at birth but develop progressive respiratory symptoms especially after feeding.
  - X-ray - multiple lucencies in one side of chest with displacement of heart and mediastinum to opposite side. Abdomen is frequently scaphoid due to lack of bowel.
  - Complications - respiratory embarrassment due to mass effect. Lungs may be hypoplastic developmentally.
  - Surgery to repair defect.
Distressed Infants

- **Masses**
  - Masses in chest due to tumor are usually benign, however neuroblastoma does occur frequently as a posterior mass. Teratomas or cystic hygromas present in anterior mediastinum.
  - While displacement of the trachea and esophagus is not uncommon, these masses produce mild symptoms initially.
  - X-ray - smooth or sharply defined mass displacing the trachea and extending into lungs. May contain calcium if teratoma. Hygromas may also be seen extending into neck in majority of cases.
  - Complications - related to mass effect.
  - Differential - pleural effusion, fluid filled lung cysts.
  - Therapy - surgery.