Pediatric imaging

Pneumonia

- Imaging methods
- Imaging appeal

Pneumonie

Definition: it is the infection of the lung that causes filling of the pulmonary alveols with contents.

Classification in dependence on radiological appearance

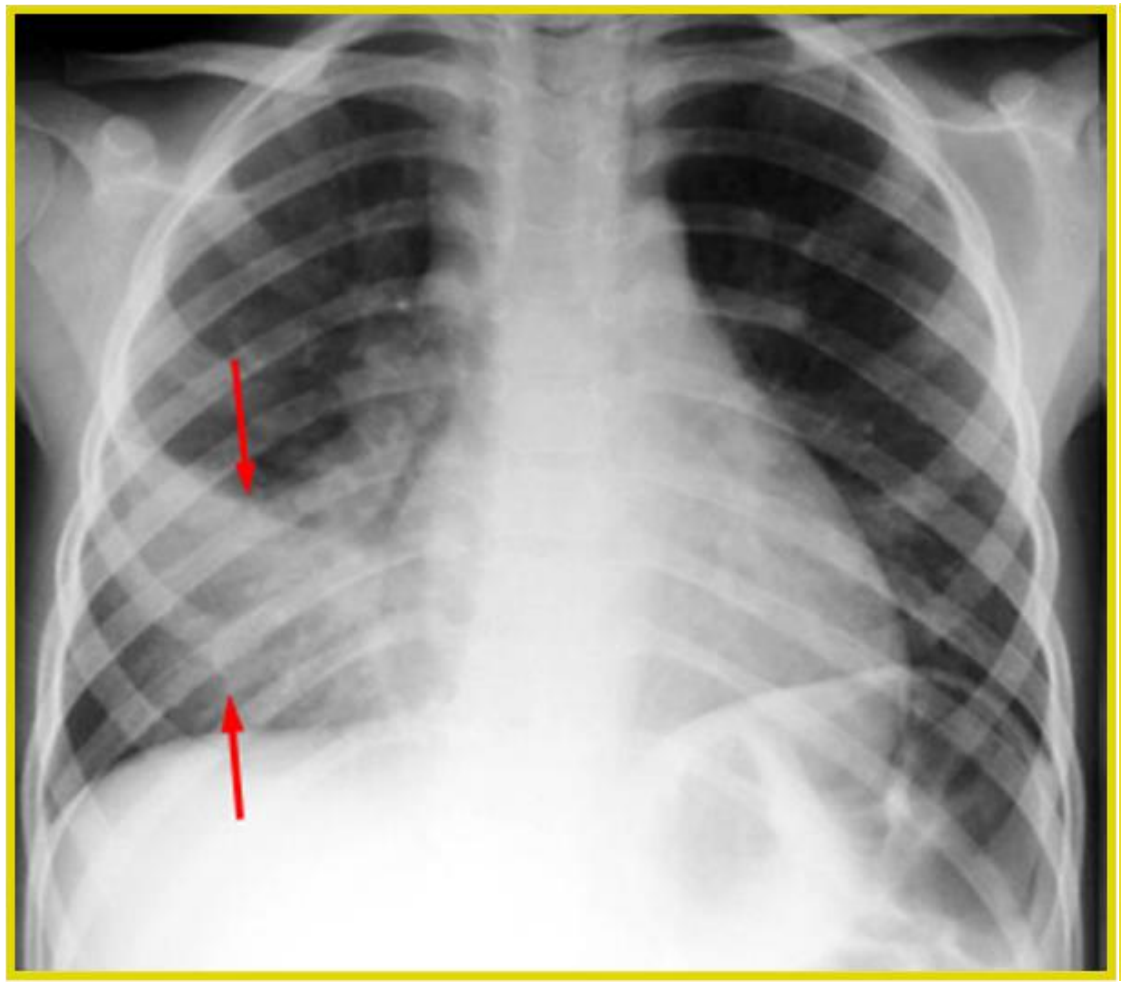
Community pneumonia (segmental or subsegmental)

Atypical pneumonia (so-called interstitial)

Round Pneumonia

Cavitating Pneumonia

Segmental and lobar pneumonia



Radiographic features

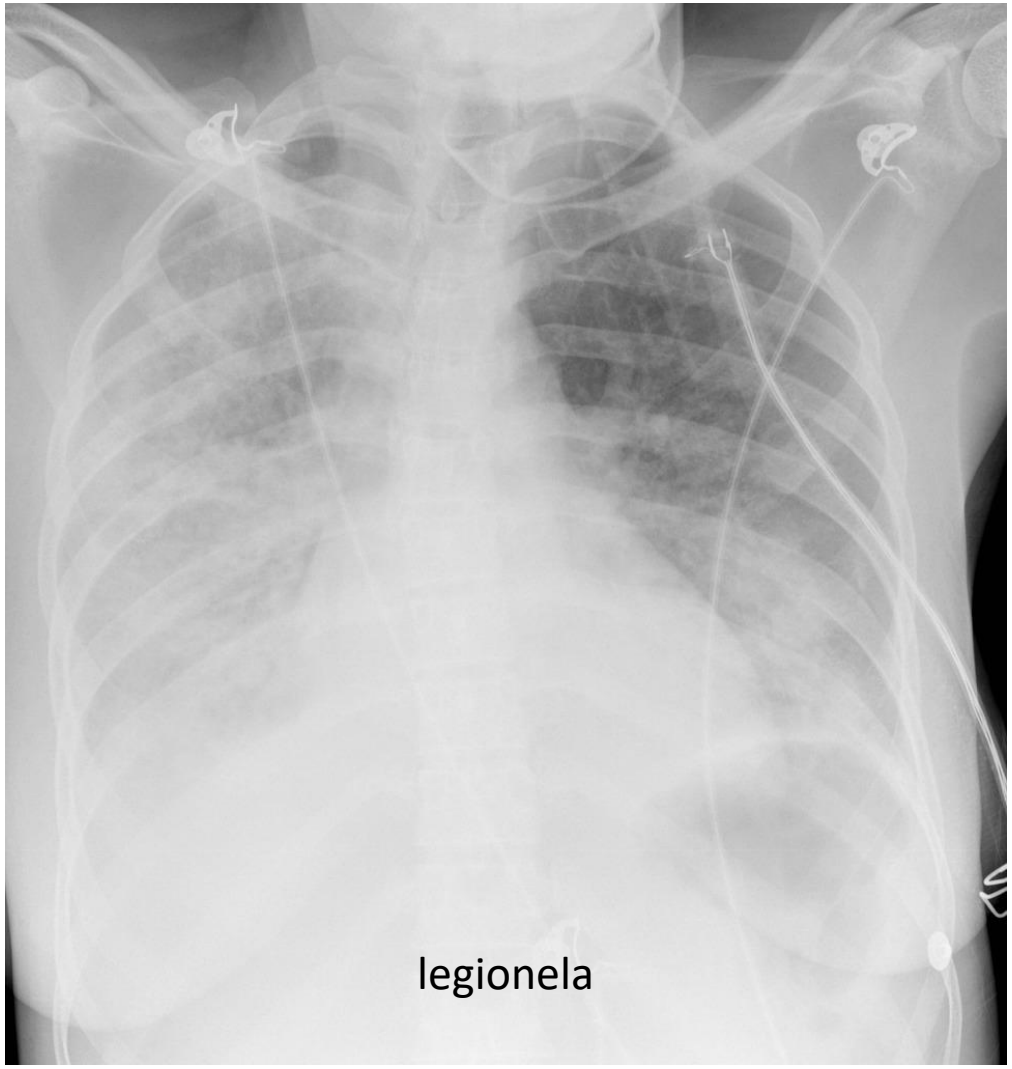
Plain radiograph

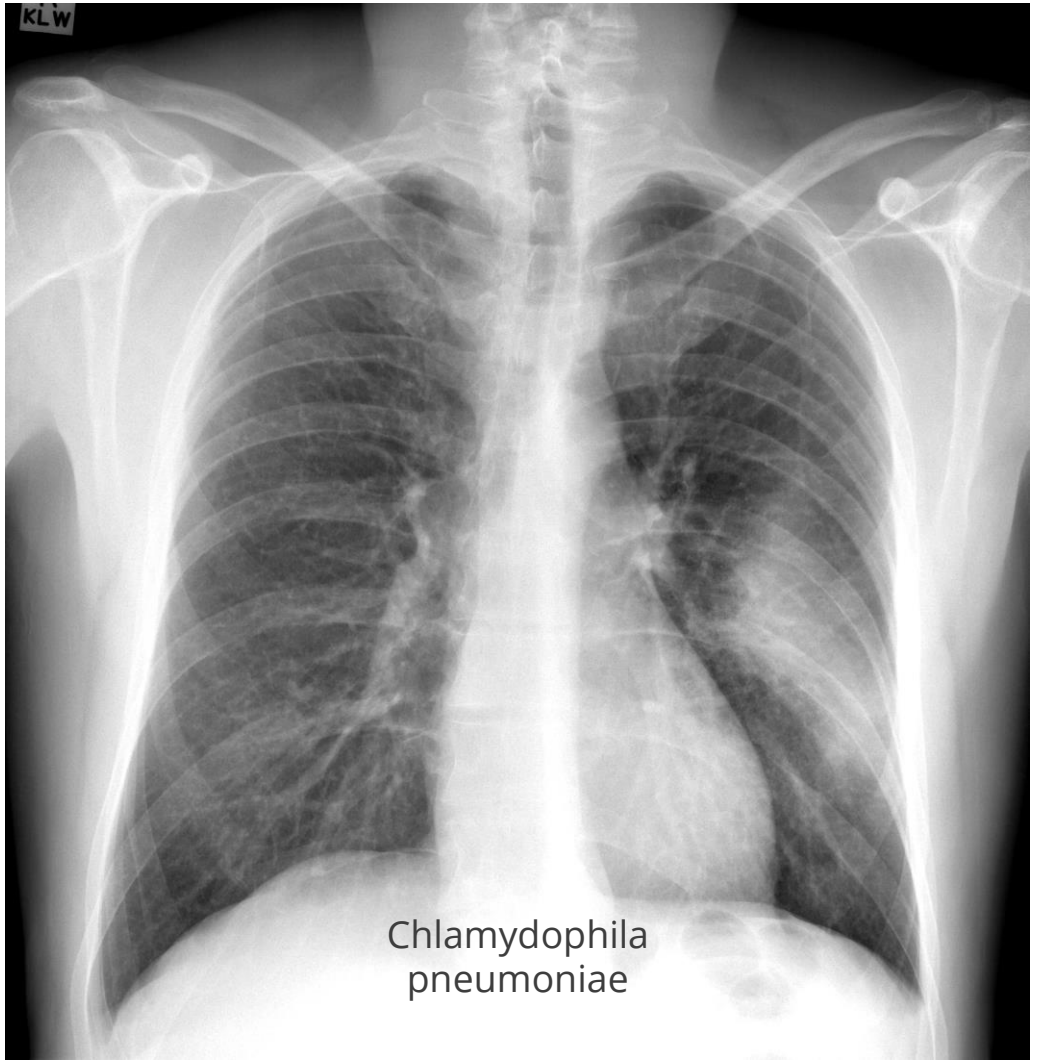
- Most patients will have a chest radiograph, which most commonly demonstrates an air space consolidation appearance. It may affect from a subsegmental portion to an entire lobe.

CT

- CT chest is usually reserved for cases that are refractory to treatment or for the assessment of potential complications such as lung abscess or empyema

Atypical pneumonia





Radiographic features

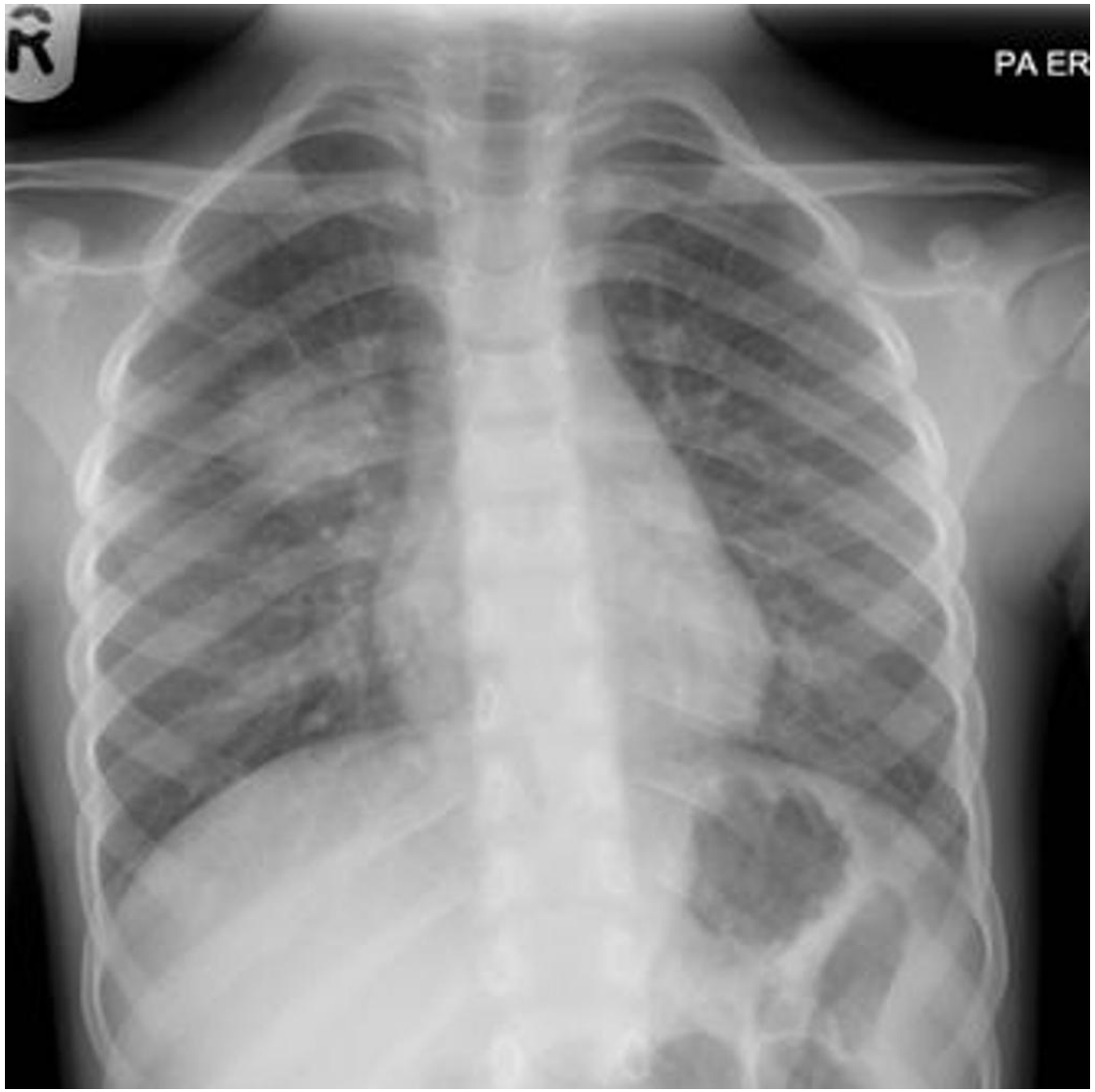
Plain radiograph

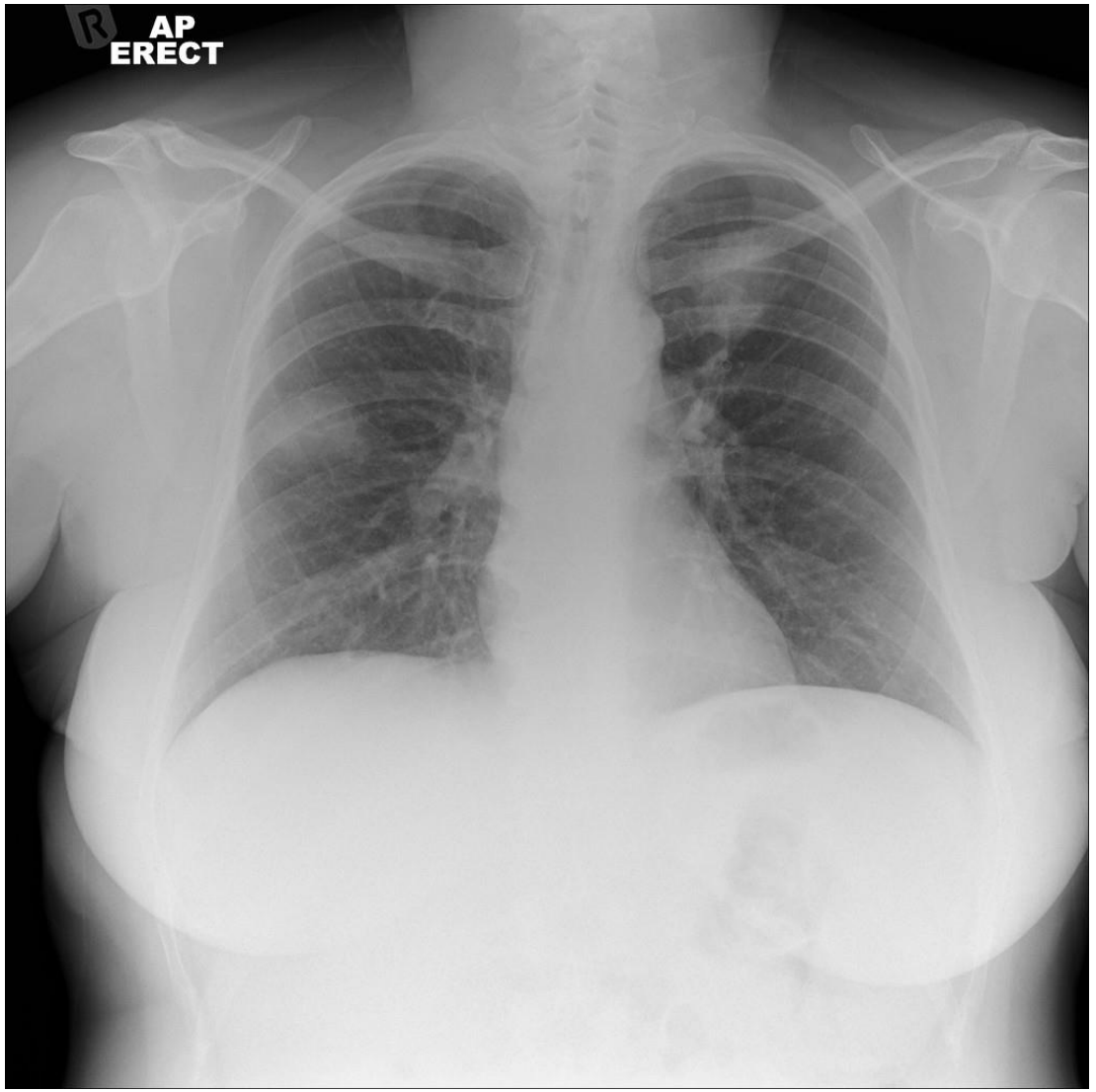
- Because the inflammation is often limited to the pulmonary interstitium and the interlobular septa, atypical pneumonia has the radiographic features of patchy reticular or reticulonodular opacities. Subsegmental and sometimes segmental atelectasis from small airway obstruction may occur. The radiographic features are often more extensive than what is suggested clinically.

CT

- Atypical pneumonia has a pattern of focal ground-glass opacity in a lobular distribution. Involvement is often diffuse and bilateral.
- There may evidence of pleural effusion.
- Bronchial wall thickening is another common CT finding .
- Diffuse ground glass nodules in a centrilobular pattern are often present, although they progress to a soft tissue density as the infection and inflammation progress.
- In *Mycoplasma pneumoniae* infection, airspace consolidation is common. High-Resolution Computed Tomography is sensitive for nodules, which are seen in ~90% of patients .
- In *Legionella pneumophila* infection, residual scarring may persist after resolution of the infection.

Round Pneumonia

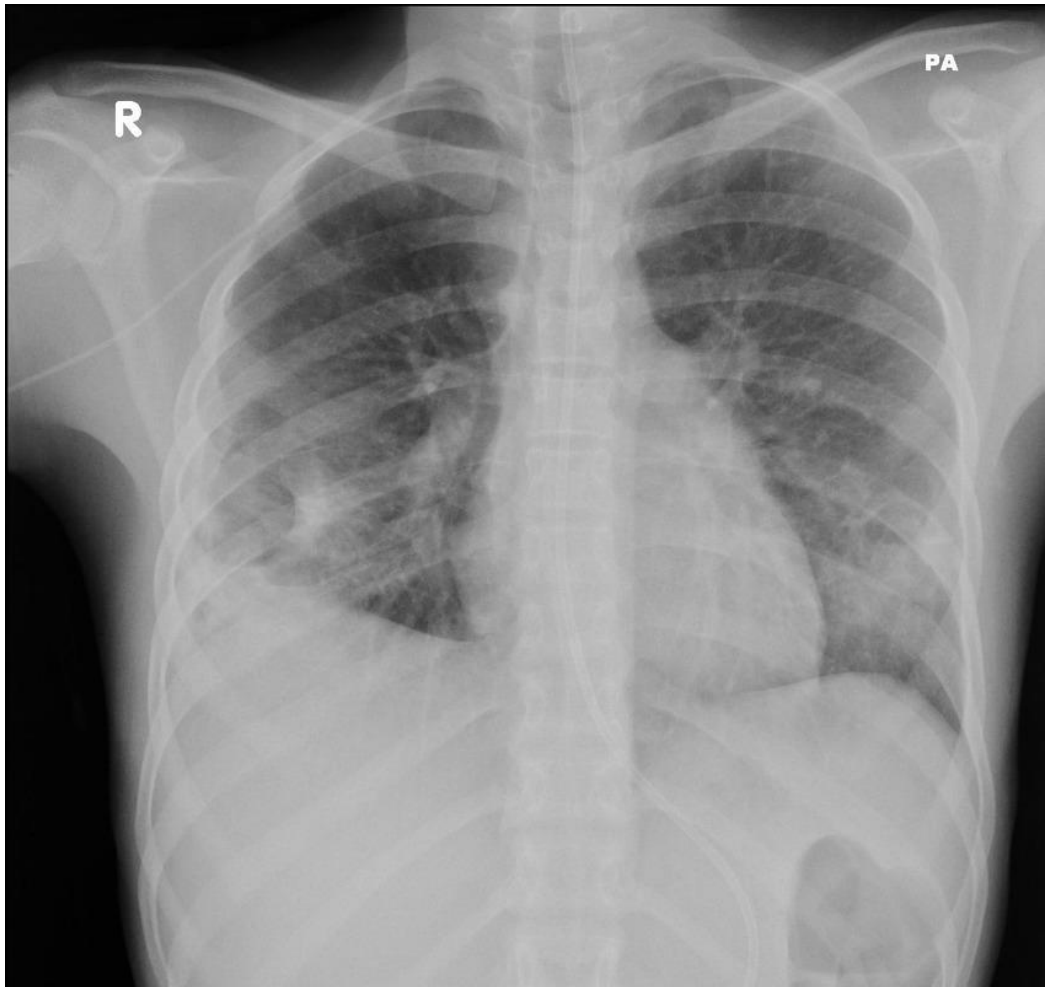


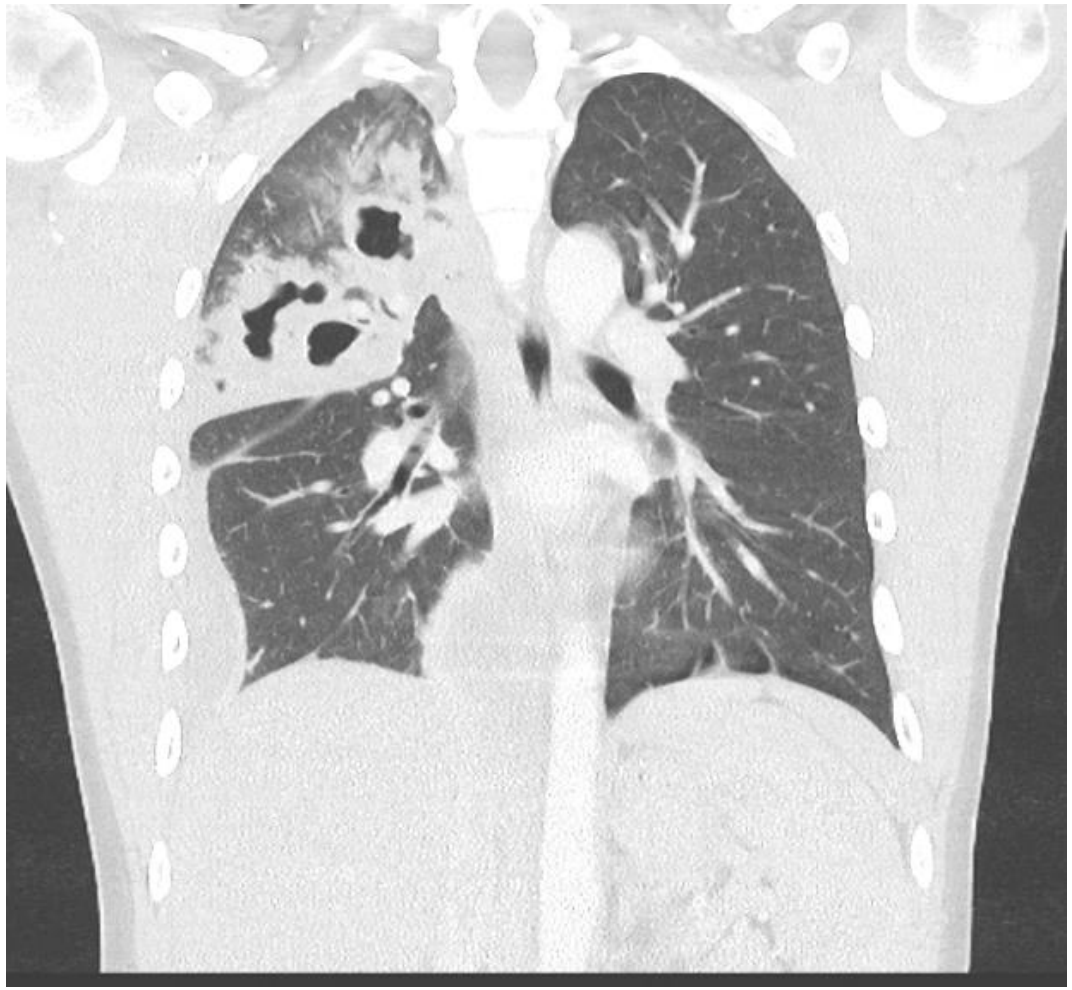


Radiographic features

- Round pneumonias are round-ish and while they are well-circumscribed parenchymal opacities, they tend to have irregular margins. They most commonly occur in superior segments of lower lobes and in the majority of cases (98%), they are solitary.
- Air bronchograms are often present though are only seen in 17% of cases when they occur in adults.
- Why children develop round pneumonia and adults do not relates to the development of inter-alveolar communications and collateral airways. These are called pores of Kohn and canals of Lambert, and when they develop, they allow air-drift between the parenchymal subsegments. In adults, these allow lateral dissemination of infection throughout a lobe, leading to lobar pneumonia. In children, where these have not developed, the limited spread of infection results in round pneumonia.

Cavitating Pneumonia





Radiographic features

- **Plain radiograph**
- May show a subtle area of radiolucency superimposed on a region of consolidation.
- **Cavitating pneumonia** is a complication that can occur with severe necrotizing pneumonia. It is a rare complication in both children and adults.
- In children, cavitation is associated with severe illness, although cases usually resolve without surgical intervention, and long-term follow-up radiography shows clear lungs without pulmonary sequelae.

Mucoviscidosis or Cystic Fibrosis

- Clinical forms
- Imaging methods
- Imaging appeal

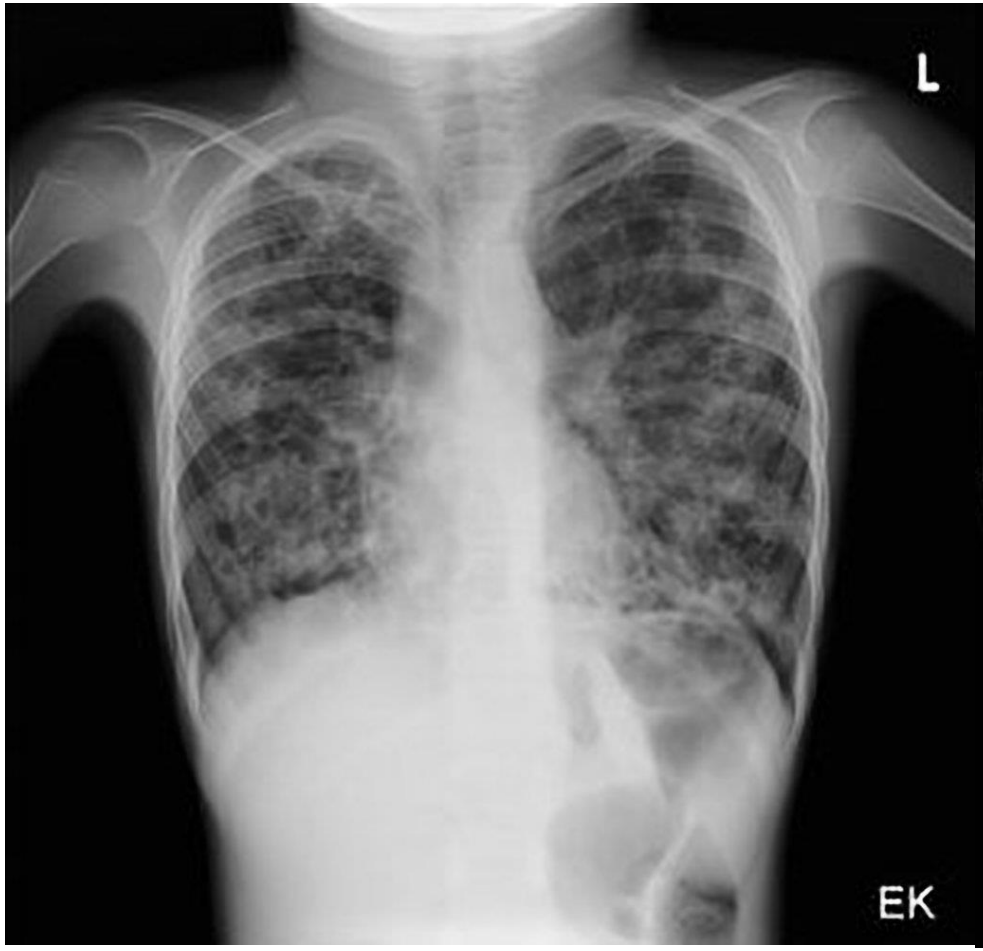
Definition

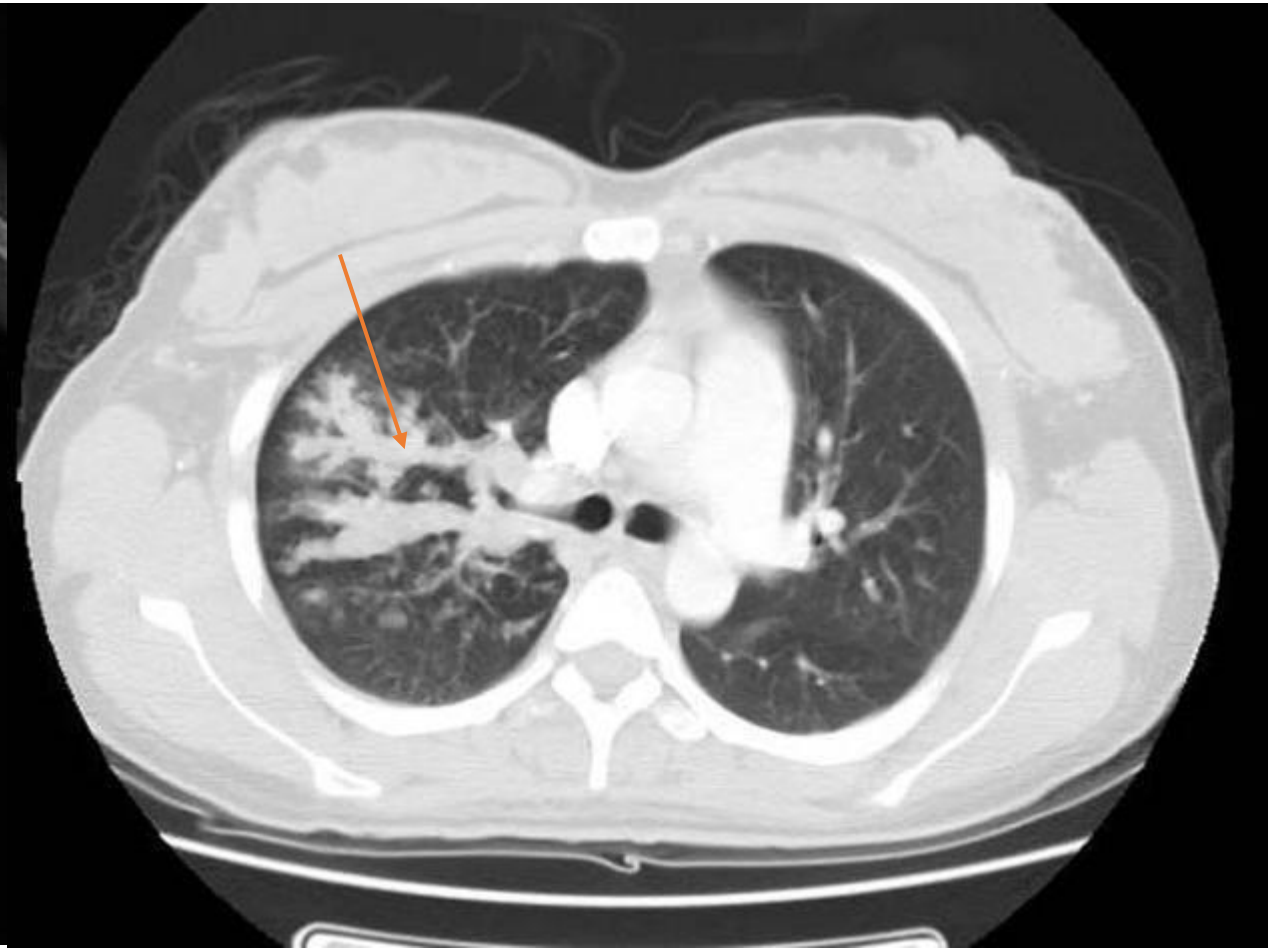
Cystic fibrosis (CF) is a rare genetic disorder that affects mostly the lungs, but also the pancreas, liver, kidneys, and intestine.

Long-term issues include difficulty breathing and coughing up mucus as a result of frequent lung infections.

Other signs and symptoms may include sinus infections, poor growth, fatty stool, clubbing of the fingers and toes, and infertility in most males. Different people may have different degrees of symptoms.

Pulmonary form





Pulmonary form

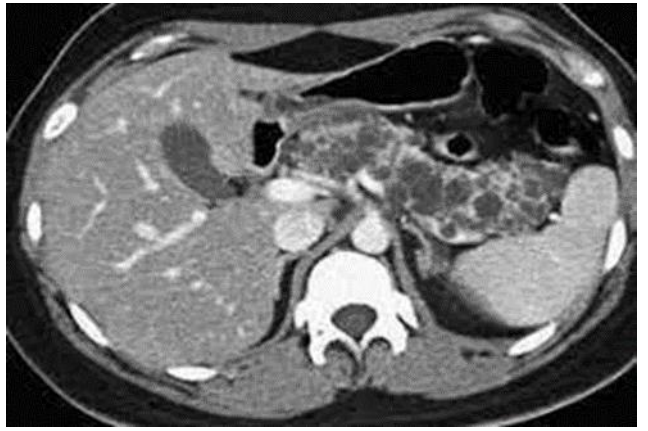
- Lung disease results from clogging of the airways due to mucus build-up, decreased mucociliary clearance, and resulting inflammation. In later stages, changes in the architecture of the lung, such as pathology in the major airways (bronchiectasis), further exacerbate difficulties in breathing. Other signs include high blood pressure in the lung (pulmonary hypertension), heart failure, hypoxia, and respiratory failure.
- In addition to typical bacterial infections, people with CF more commonly develop other types of lung diseases.
- Mucus in the paranasal sinuses is equally thick and may also cause blockage of the sinus passages, leading to infection. This may cause facial pain, fever, nasal drainage, and headaches. Also may develop overgrowth of the nasal tissue (nasal polyps) due to inflammation from chronic sinus infections.
- Cardiorespiratory complications are the most common causes of death (about 80%)

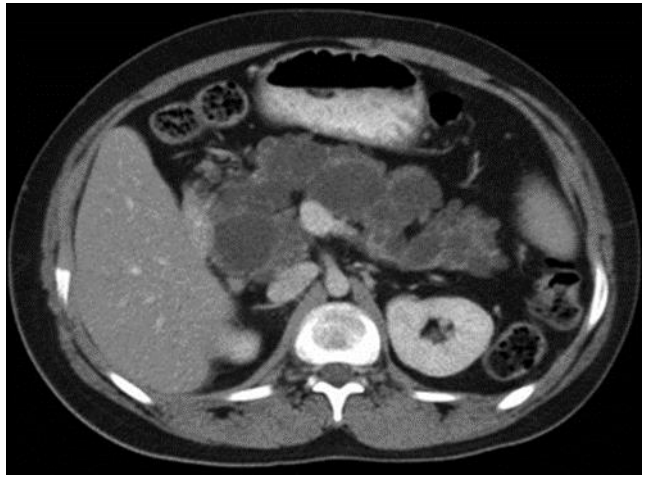
Gastrointestinal form

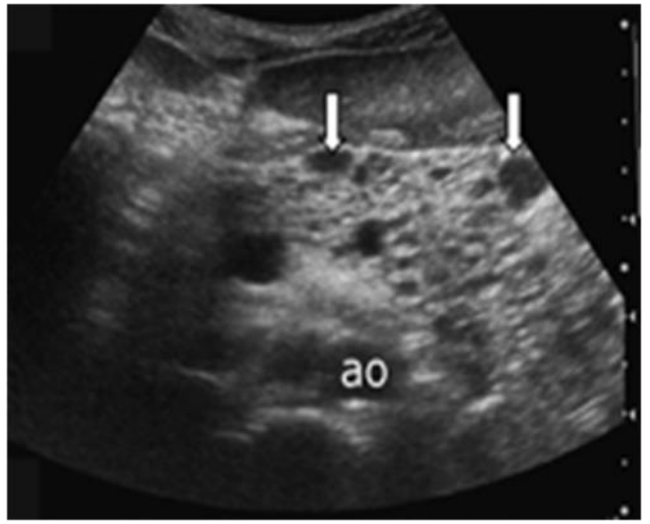
- Thickened secretions from the pancreas. These secretions block the exocrine movement of the digestive enzymes into the duodenum and result in irreversible damage to the pancreas, often with pancreatitis. The pancreatic ducts are totally plugged in more advanced cases, usually seen in older children or adolescents. This causes atrophy of the exocrine glands and progressive fibrosis.
- Individuals with CF also have difficulties absorbing the fat-soluble vitamins A, D, E, and K.
- people with CF experience intestinal blockage.
- Exocrine pancreatic insufficiency occurs in the majority (85% to 90%) of patients with CF
- Thickened secretions also may cause liver problems in patients with CF. Bile may block the bile ducts, leading to liver damage. Impaired digestion or absorption of lipids can result in steatorrhea. Over time, this can lead hepatic cirrhosis. The liver fails to rid the blood of toxins and does not make important proteins, such as those responsible for blood clotting. Liver disease is the third-most common cause of death associated with CF.
- In addition rectal prolapse is more common, occurring in as many as 10% of children with CF, and it is caused by increased fecal volume, malnutrition, and increased intra–abdominal pressure due to coughing.

Endoctin form

- The pancreas contains the islets of Langerhans, which are responsible for making insulin. Damage to the pancreas can lead to loss of the islet cells, leading to cystic fibrosis-related diabetes. It shares characteristics of type 1 and type 2 diabetes, and is one of the principal nonpulmonary complications of CF.
- Vitamin D is involved in calcium and phosphate regulation. Poor uptake of vitamin D from the diet because of malabsorption can lead to the bone disease osteoporosis.







Foreign bodies

- Methods of examination
- Imaging appeal
- Optimal projections

Radiological aspect

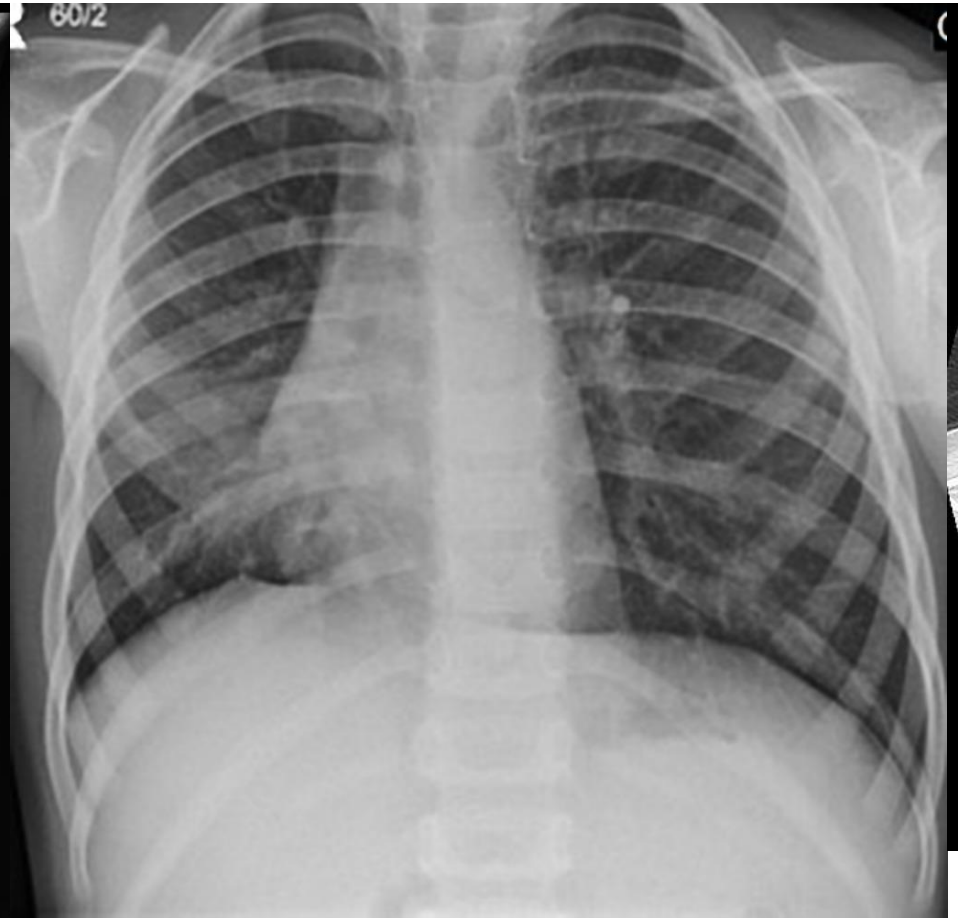
The hallmark of an aspirated foreign body is a lung volume that does not change during the respiratory cycle. Medical imaging departments will have a dedicated suspected foreign body inhalation series.

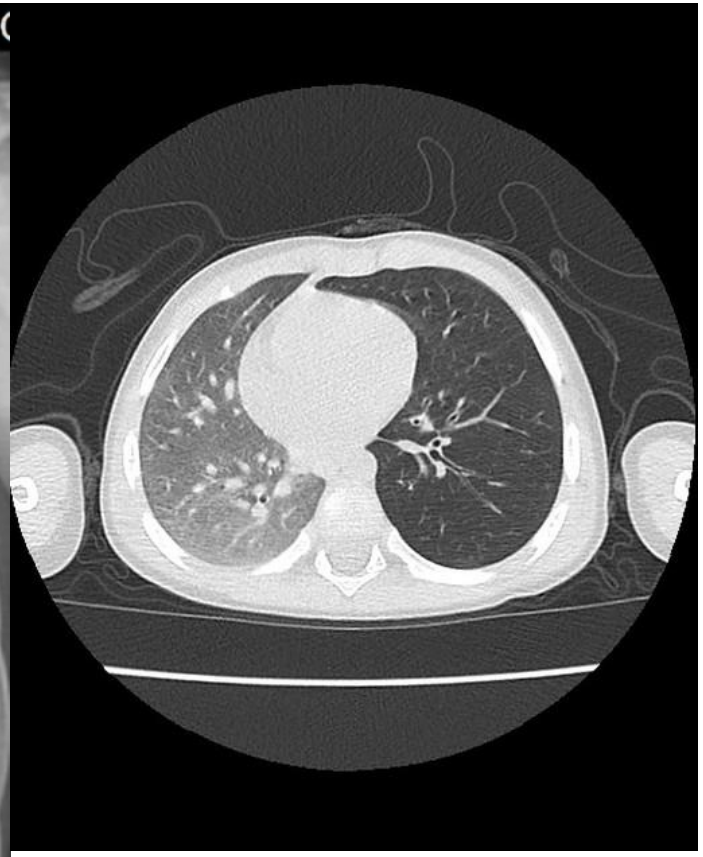
Plain radiograph

- the patient should be radiographed on expiration: this will exaggerate the differences between the lungs due to the check valve mechanism, where air enters the bronchus around the foreign body but cannot exit, the affected lung will usually appear overinflated and hyperlucent, with concomitant rib flaring and a depressed ipsilateral hemidiaphragm
- interrupted bronchus sign
- the chest x-ray will be normal in ~35% of patients
- the majority of foreign bodies are radiolucent
- unilateral emphysema or atelectasis are the most common findings; only uncommonly will a radiopaque foreign body be demonstrated

CT

- Can be useful in the assessment of a missed or retained foreign body after initial bronchoscopy.

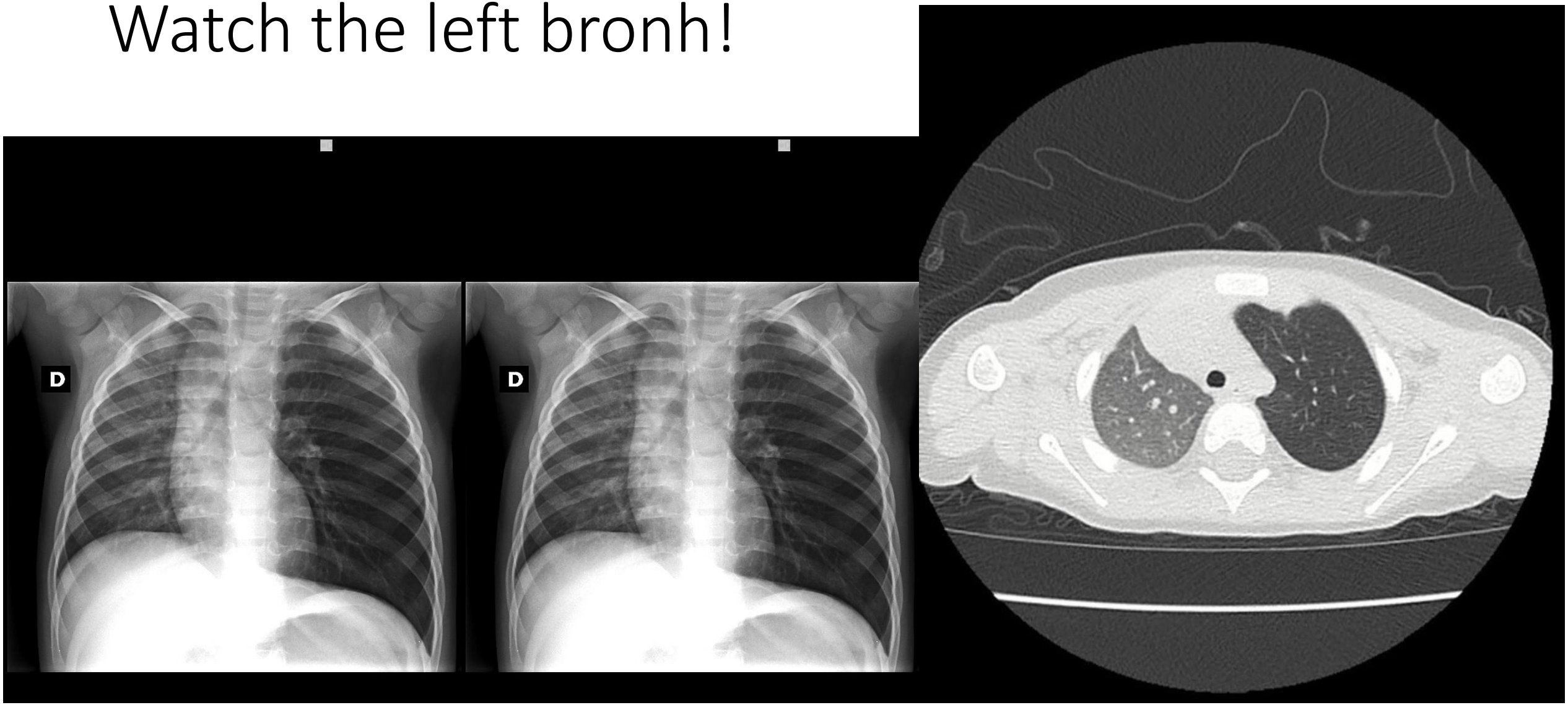




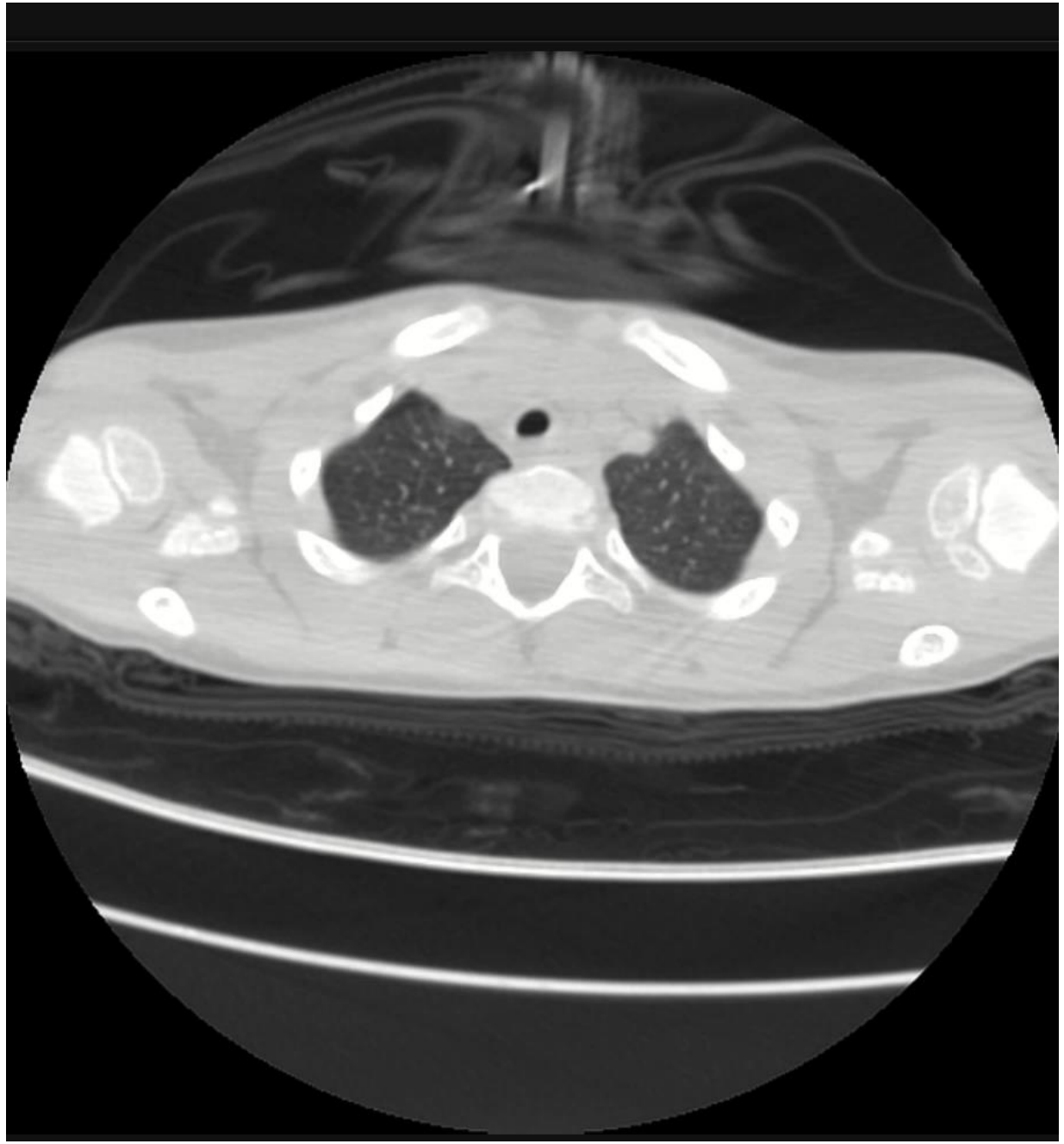
Right hyperinflated lung

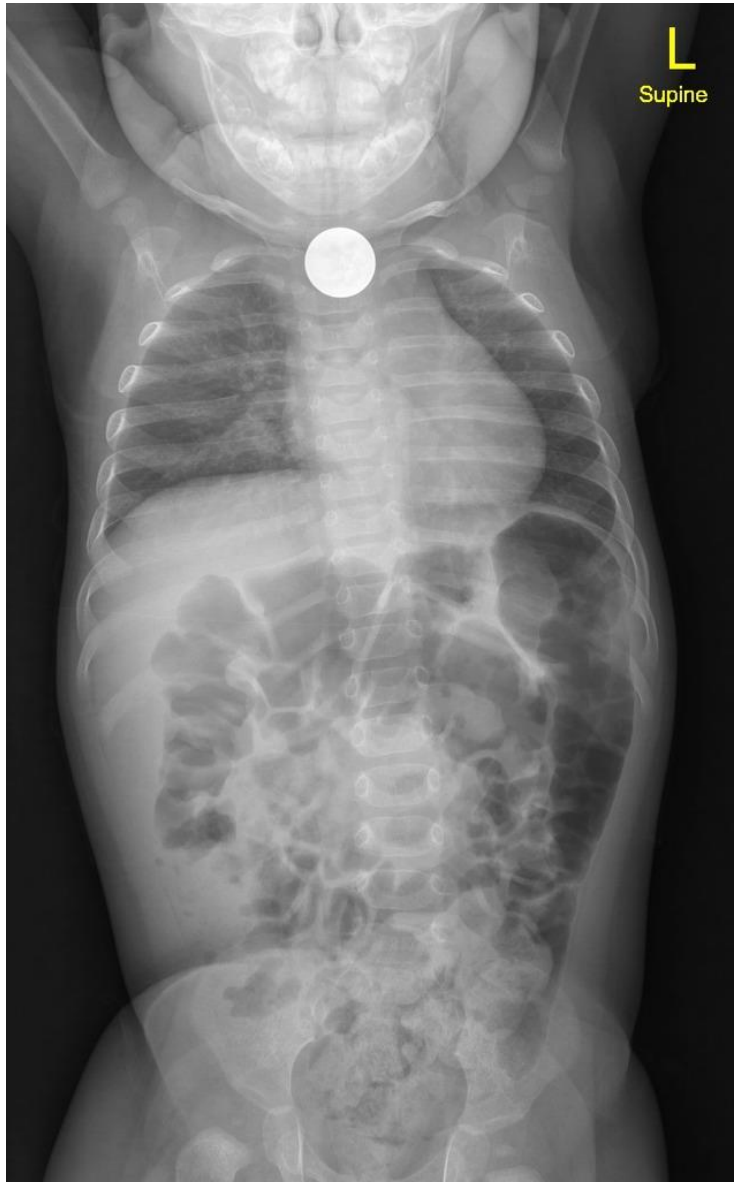
Medium lobe on the right collapsed

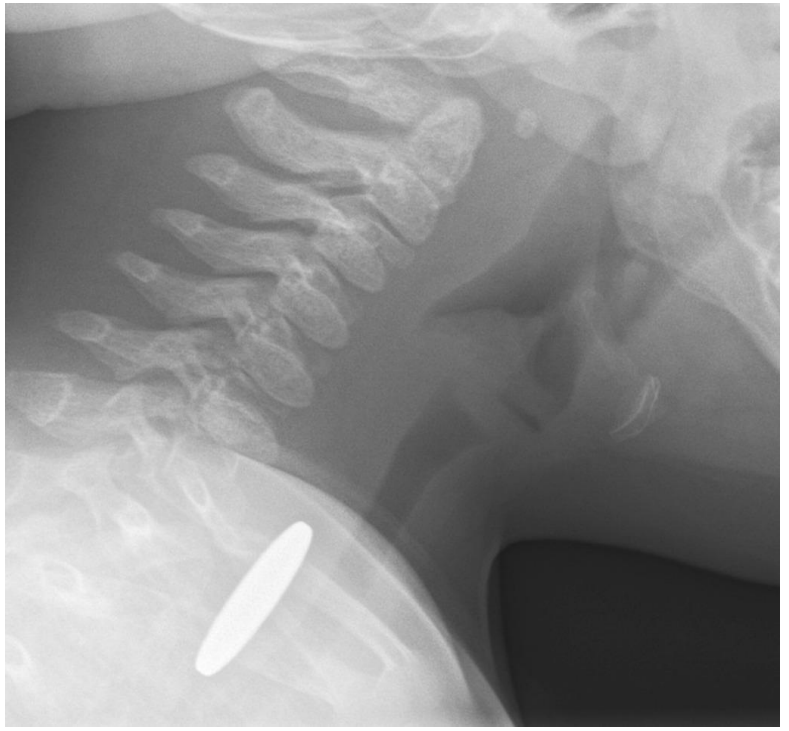
Watch the left bronh!



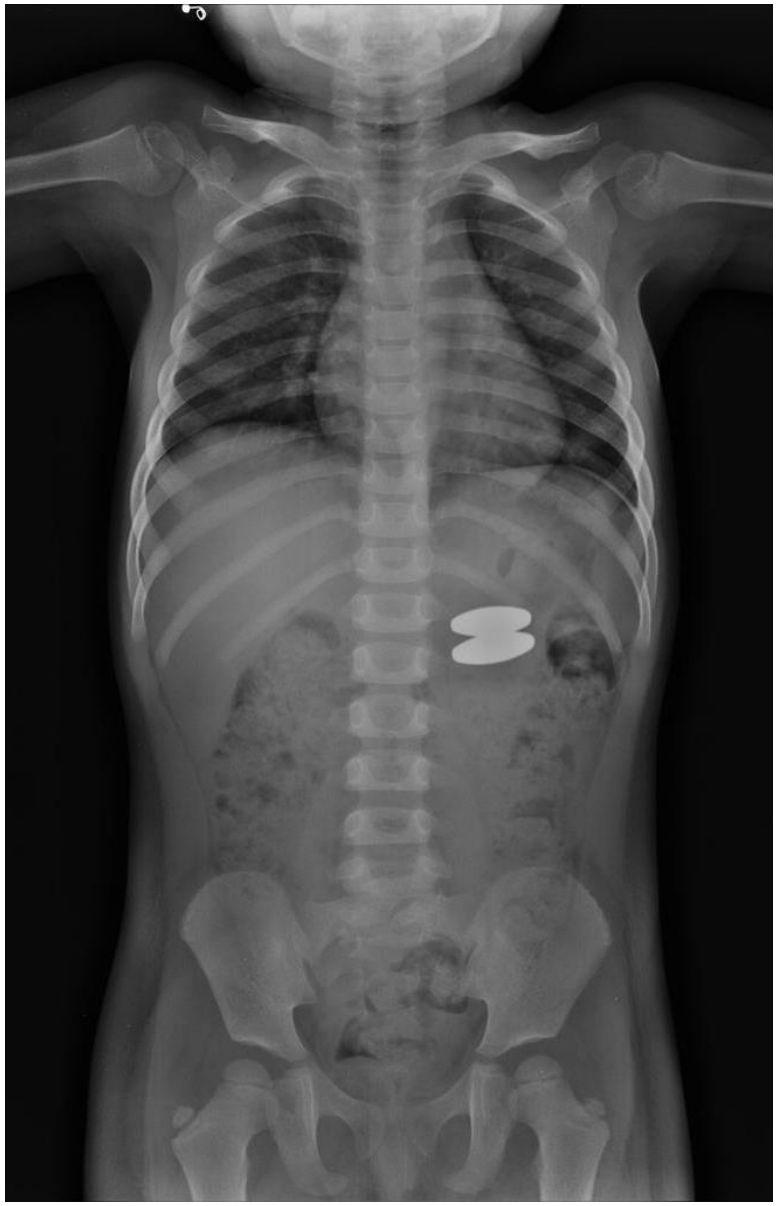
Foreign body?
At what level?





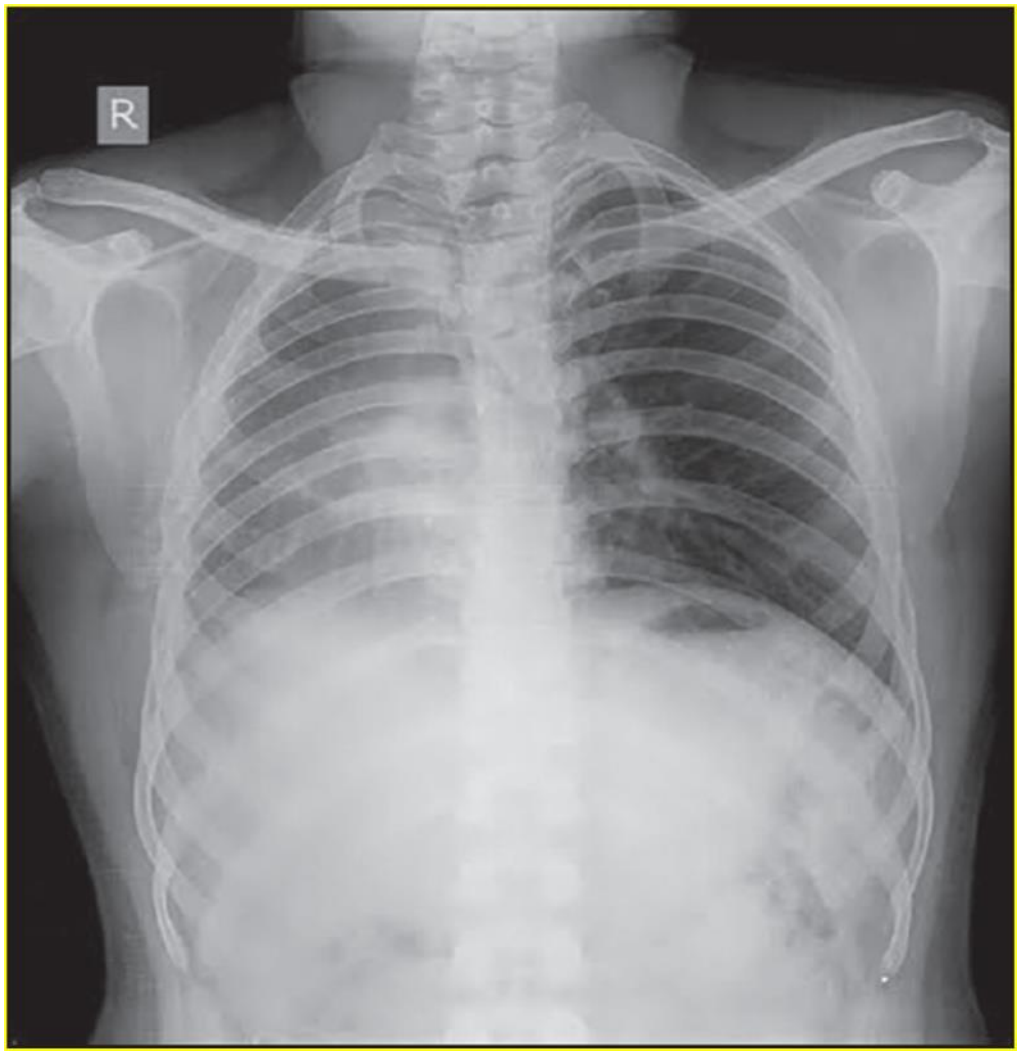


•coins lying in the esophagus tend to lie in the coronal plane, whereas coins lying in the trachea lie in the sagittal plane
•associated features of airway foreign bodies include atelectasis or hyperinflation as well as respiratory distress

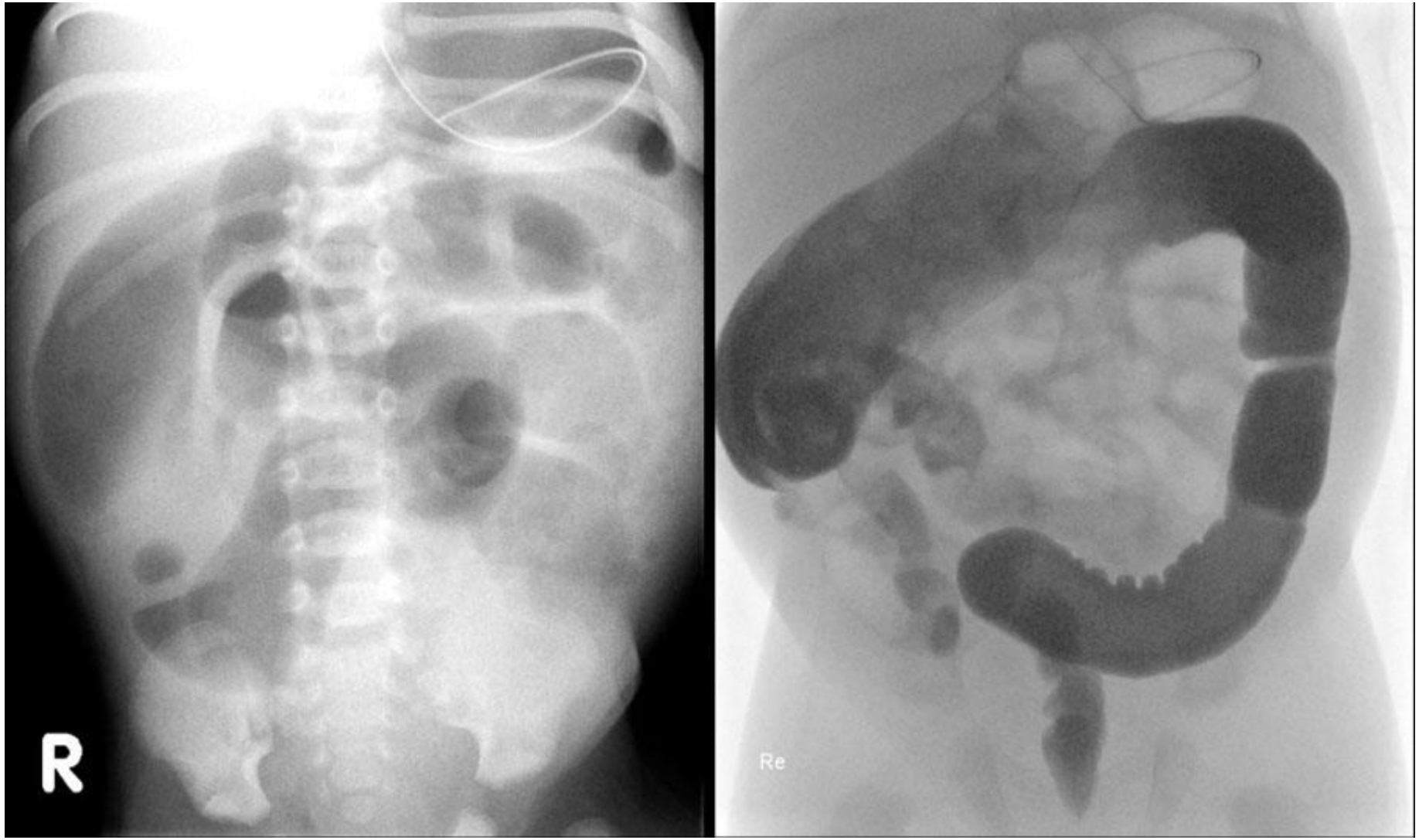


PULMONARY HYPOPLASIA

- Hypoplasia of the right lung with displacement of the mediastinal organs to the right
- Ascension of the right hemidiafragm
- Hypertransparence of the left lung – vicar pulmonary emphysema



Hirsprung's disease



Hirschsprung disease

- In Hirschsprung disease ganglion cells are absent in the distal part of the colon.
  Because the intestinal ganglion cells migrate in a craniocaudal direction, the area of aganglionosis always involves the rectum.
  More extensive disease extends orally in a contiguous fashion.
  The involved bowel has a small diameter and the bowel proximal to the affected segment is dilated.

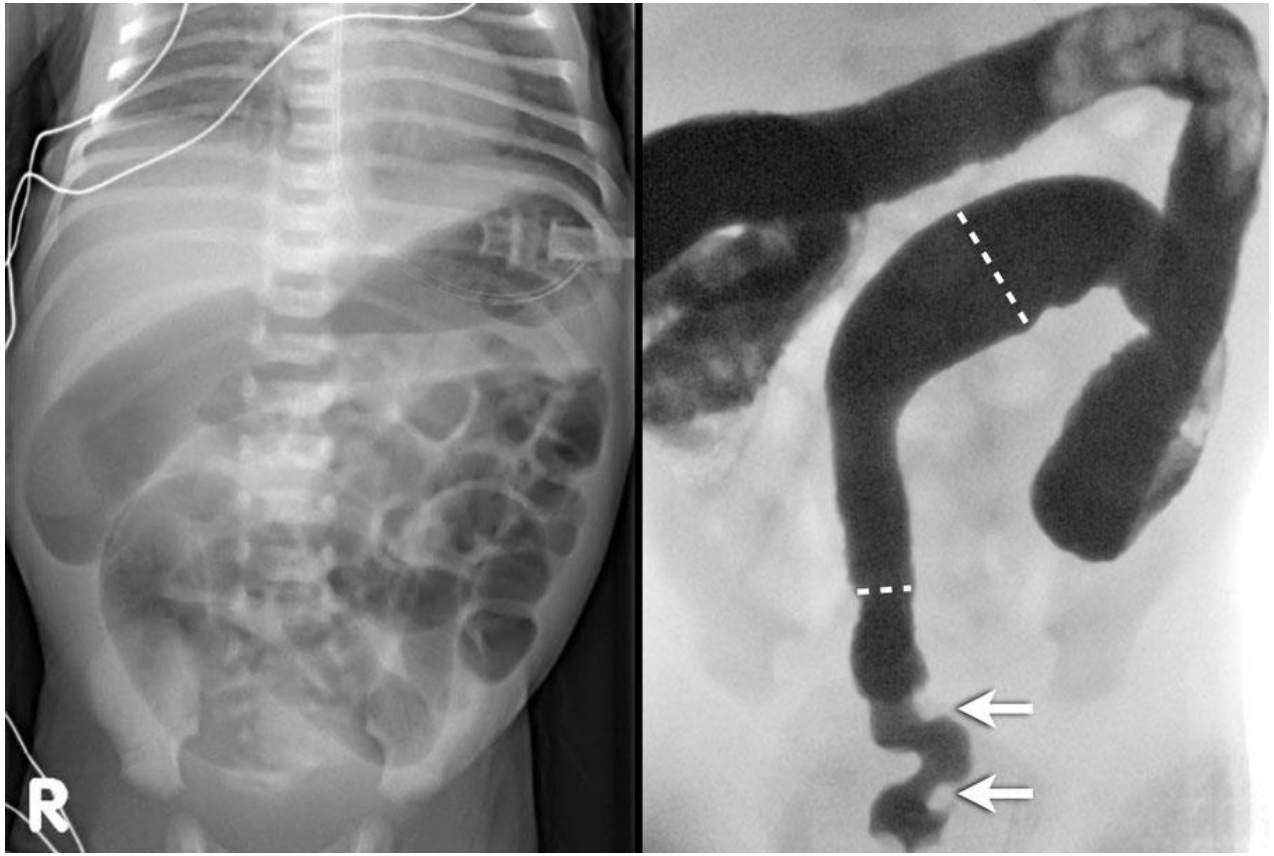
75% short rectum segment or sigma
20% long segment partially extends into the colon
5% total aganglionosis of the entire colon or even the small intestine

- In Hirschsprung disease the ratio between the denervated and the non-affected bowel is <1.
- It is important to describe the length of the affected segment.
  Most cases are short-segment and total aganglionosis is rare.
  In case of total aganglionosis the diagnosis is difficult, because the entire colon has a small caliber and resembles a microcolon.
- Normally the rectum should be wider than the sigmoid.

Short segment Hirschsprung disease.

The findings are:

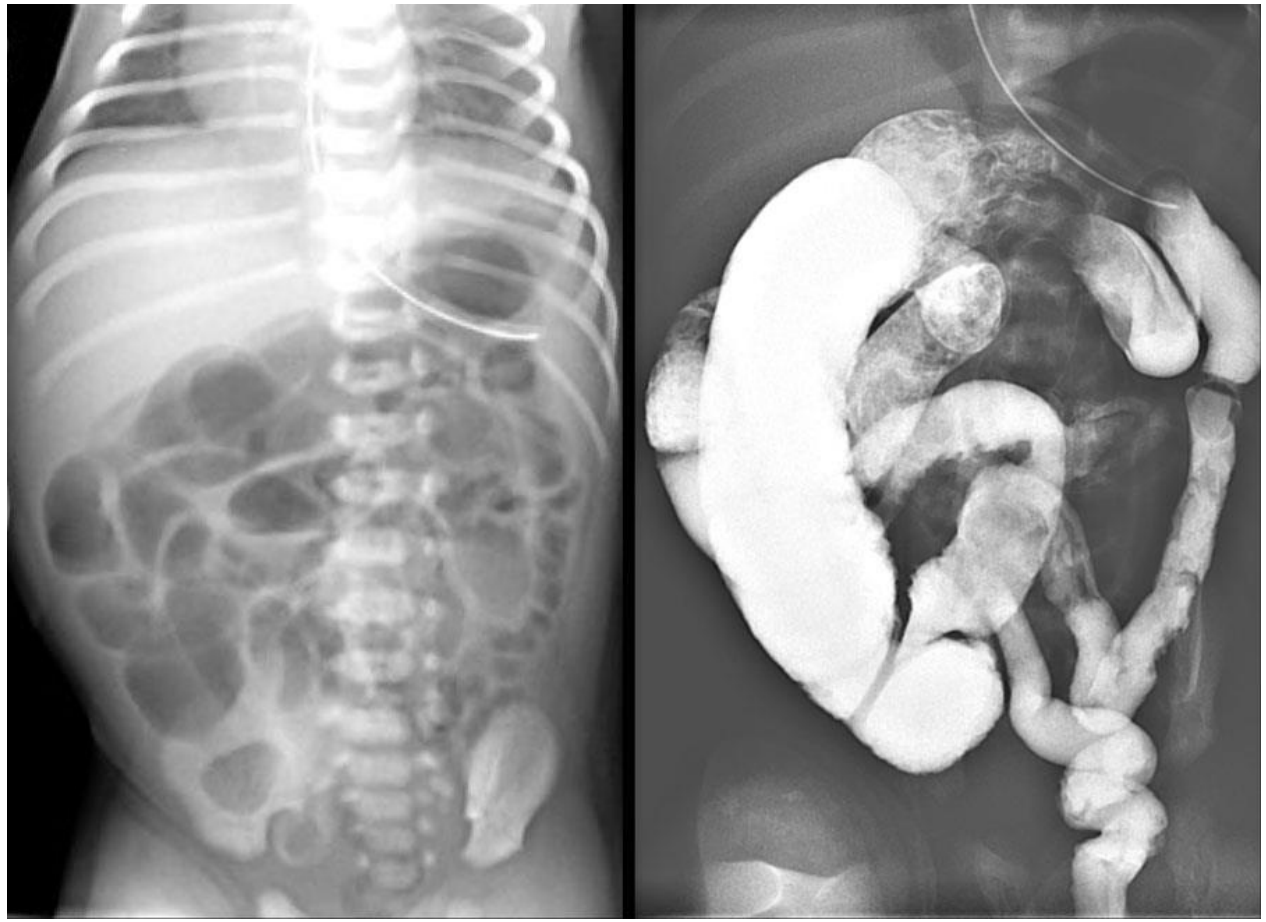
- Multiple dilated small bowel loops indicate a low obstruction
- Contrast enema show a small caliber of the rectum compared to the caliber of the sigmoid
- The rectum shows saw tooth contractions.



Long segment Hirschsprung disease

The findings are:

- Multiple dilated small bowel loops indicate a low obstruction
- Contrast enema show a small caliber in the rectum, sigmoid and colon descendens



Juvenile rheumatoid arthritis.

- **Pathology**
- There are several subtypes of JIA
- **oligoarticular JIA**
  - affected ≤4 joints in the first six months of illness
  - peak age: 1-6 years
  - mainly affects medium and large joints
- **polyarticular JIA (pJIA)**
  - ≥5 joints are affected
  - peak age: 1-4 years; 7-10 years
  - mainly affects small and medium joints
- **systemic onset JIA**
  - arthritis may present weeks to months after the onset of systemic symptoms

Radiographic features

Imaging shows a varied spectrum of involvement, based on the severity and duration of the disease. There is usually a predilection for large joints rather than small joints.

Plain radiograph

- Findings on x-ray include soft tissue swelling, osteopenia, loss of joint space, erosions, growth disturbances (epiphyseal overgrowth or "ballooning") and joint subluxation.
- Cervical spine radiographs may demonstrate: atlantoaxial subluxation, odontoid erosions, ankylosis, especially of the facet joints.
- Hepatosplenomegaly may be seen on abdominal radiographs, and pericardial or pleural effusions may be seen on chest radiographs.
- Hips: can be common (reported range ~ 35-63%) especially with enthesitis-related arthritis and polyarticular subtypes
- Knee: Widened intercondylar notch is a sign associated with JIA (and haemophilic arthropathy and tuberculous arthropathy).

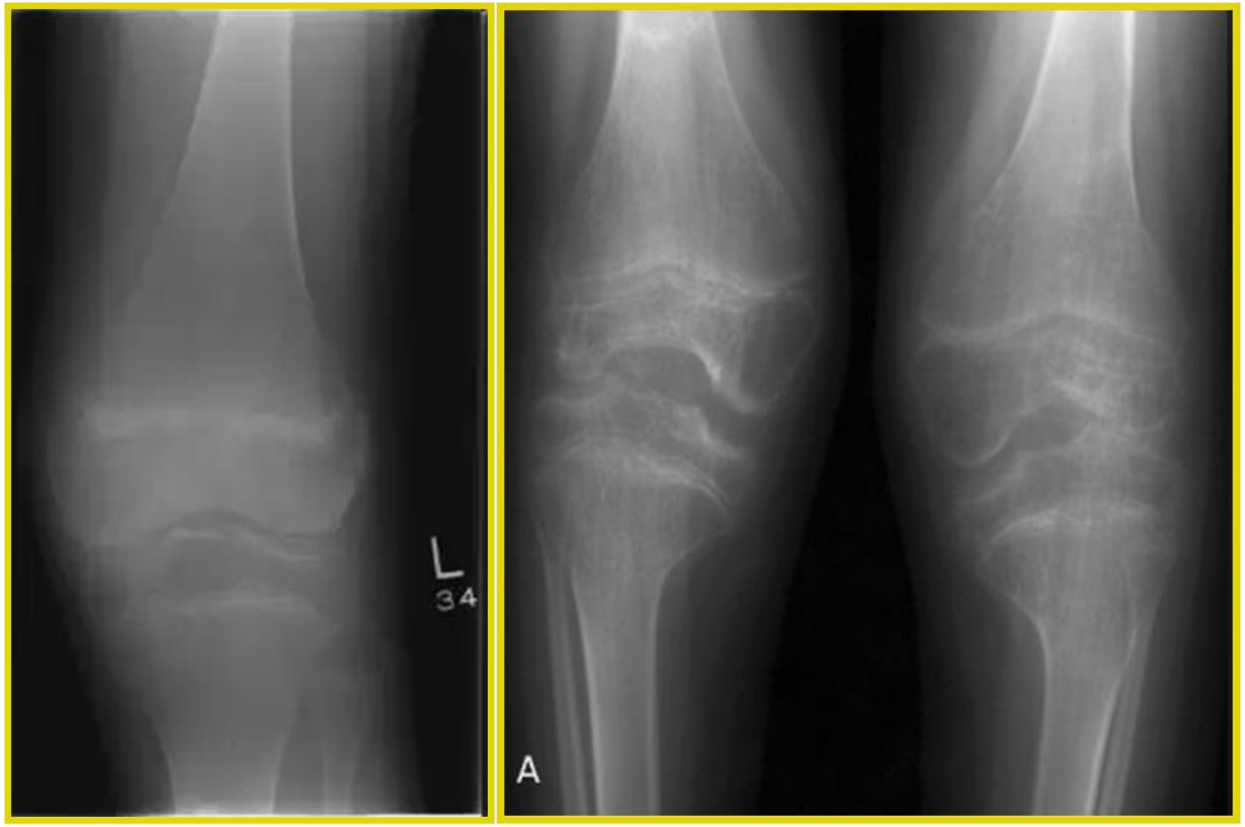
Radiological stages:

I – epifizar osteoporosis

II – epiphyseal osteoporosis with narrowing of the joint interlination and unique wear and tear

III – destruction of cartilage and bone, multiple wear and tears, subluxations

IV – fibrous or bone ankylosing

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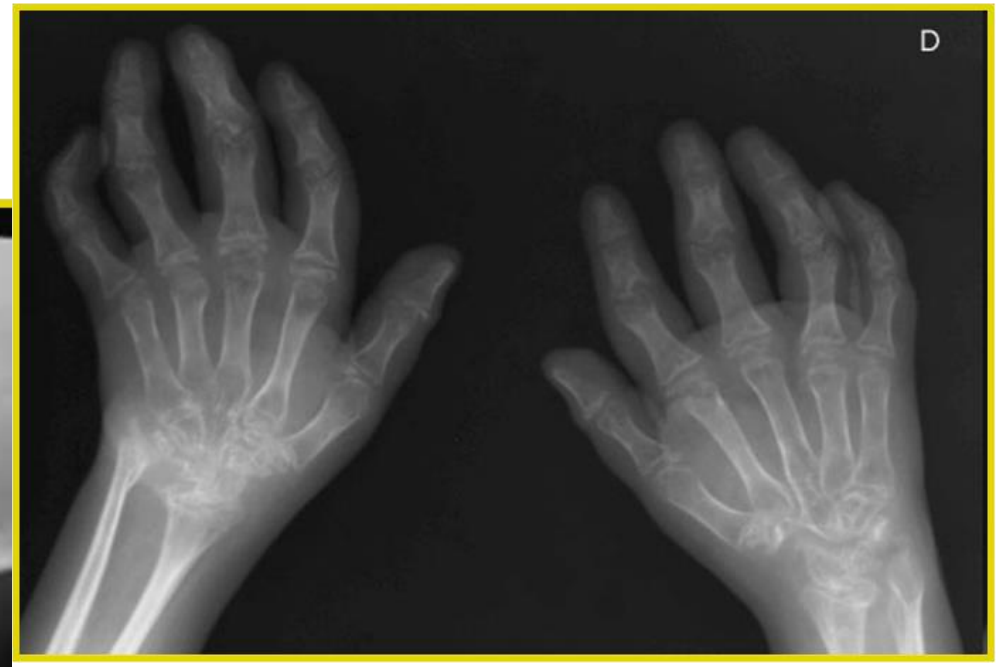
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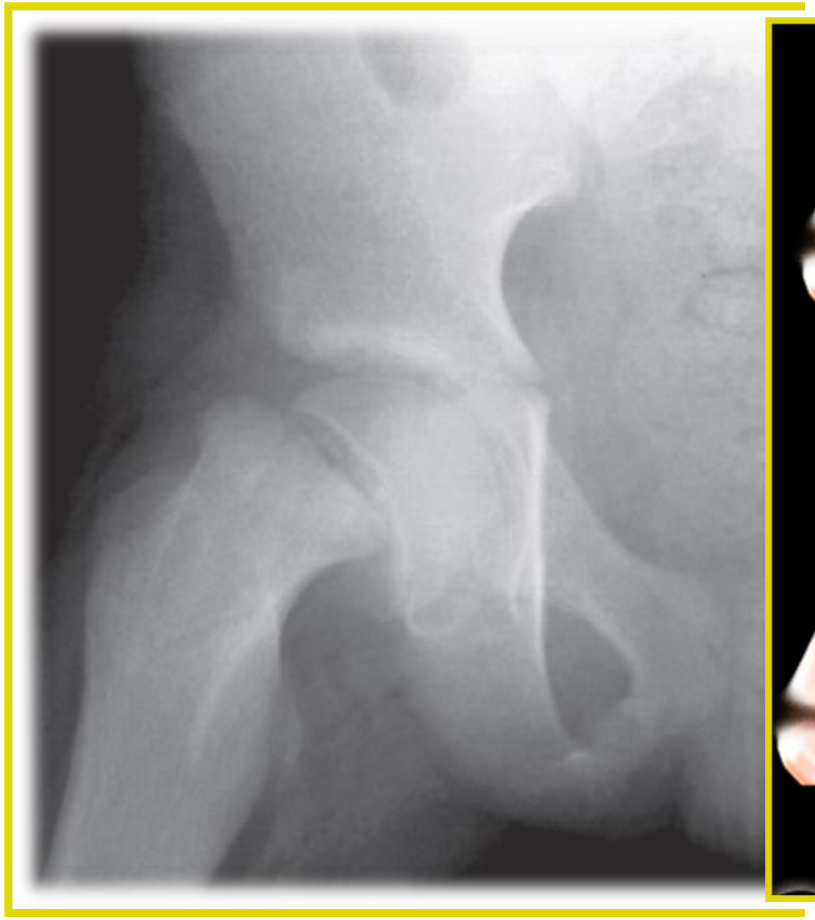
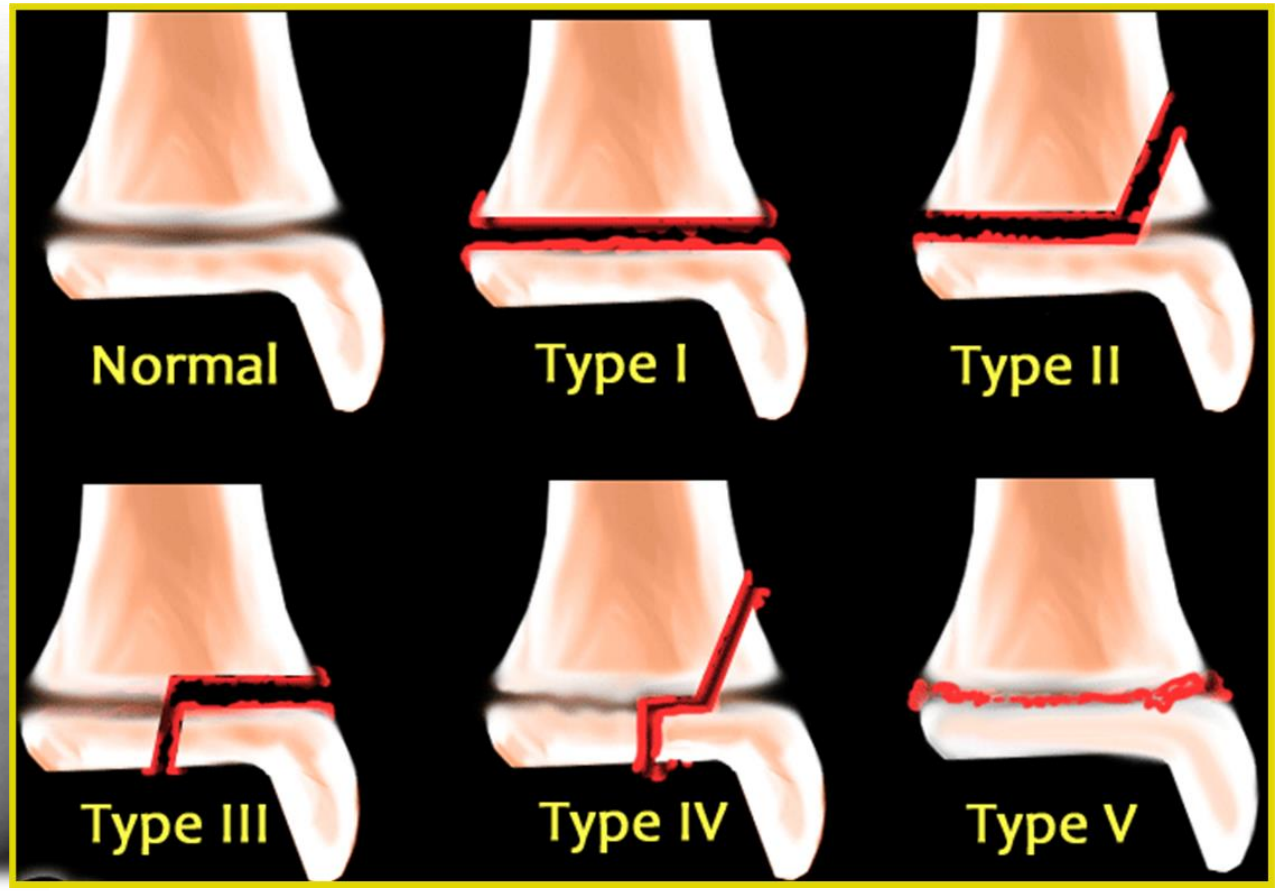
Greenstick fracture

- Incomplete fractures
- Most often they are found in children up to 10 years old
- Often they are located in the diaphysal middle portion of the forearm and foot.

Epifiziolizis or ostioepifiziolizis





Salter-Harris Clasification

Homework

- Imaging features and appeal of pneumonia.
- Optimal methods and posture of examination of aspirated and swallowed foreign bodies.

Thank You for yource ~~not~~ attention