



**Pneumothorax and pneumomediastinum:
“New etiological classification with an overview
of clinical and radiological findings”**

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Introduction

- The entering of gas in pleural space with normally lower pressure than the lung cavity results in partial or complete collapse of the lung
- A tension pneumothorax is caused when air enters the pleural space during inspiration but cannot exit by exhalation
- Pneumomediastinum is pathologic located gas in mediastinum originated from outside, mediastinal organs or from bronchopulmonary system
- The usual mechanism of non-traumatic pneumomediastinum is thought to be alveolar rupture with tracking of air toward lung hilum into mediastinum and upwards into the subcutaneous emphysema
- Severe cases of pneumothorax can be associated with pneumomediastinum

Clinical presentation of pneumothorax

- The clinical signs and symptoms of pneumothorax depends on severity, primary pulmonary changes and patient condition
- In cases with primary spontaneous pneumothorax the complaint is limited to sudden onset of unilateral chest pain (100%) and dyspnoea (40%)
- In more complicated cases as secondary pneumothorax a greater cardiopulmonary distress is to be expected.

In such group of patients tachycardia, tachypnoea, hypoxia and hypotension are to be observed

Clinical presentation of pneumomediastinum

- The clinical symptoms of pneumomediastinum is usually less severe than pneumothorax
- The typical sign is sudden complaint of retrosternal pain that increases with respiration
- Depending on severity and patient condition other symptoms can be observed such as sore throat, coughing, dyspnoea and neck pain as well as vomiting, low grade fever, dysphagia, dysphorea in severely affected children especially by traumatic patients
- Subcutaneous emphysema and abdominal extension due a retropneumoperitoneum are other specific signs of pneumomediastinum

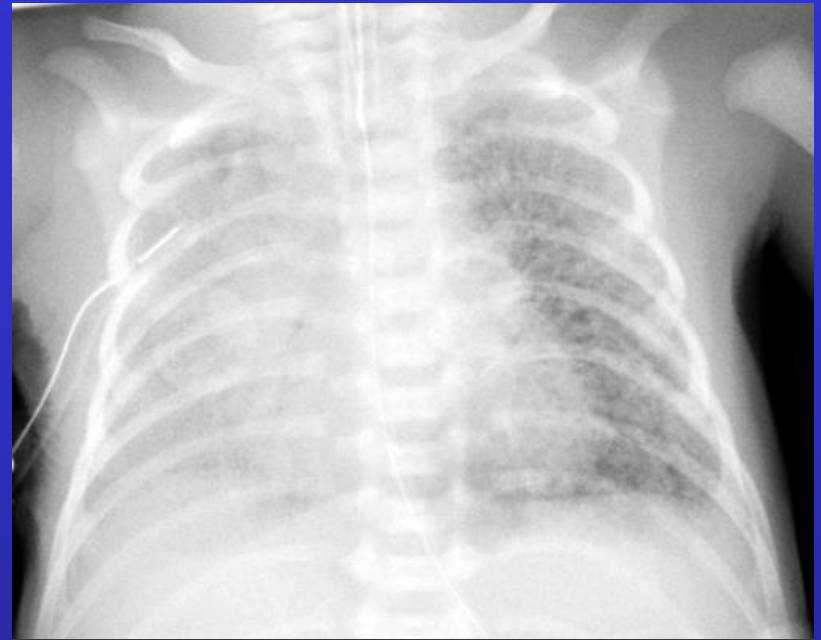
Imaging procedures

- Plain film is the gold standard for diagnosis of pneumothorax and pneumomediastinum
- 80% sensitivity and specificity of plain film.
- CT scan with a more sensitivity should be used in more complicated cases especially by traumatic or iatrogenic condition as well as primary pathology
- There are some reports about usefulness ultrasound in diagnosis of pneumothorax especially for detection of pleural effusion
- MRI can be an useful modality only in exceptional cases

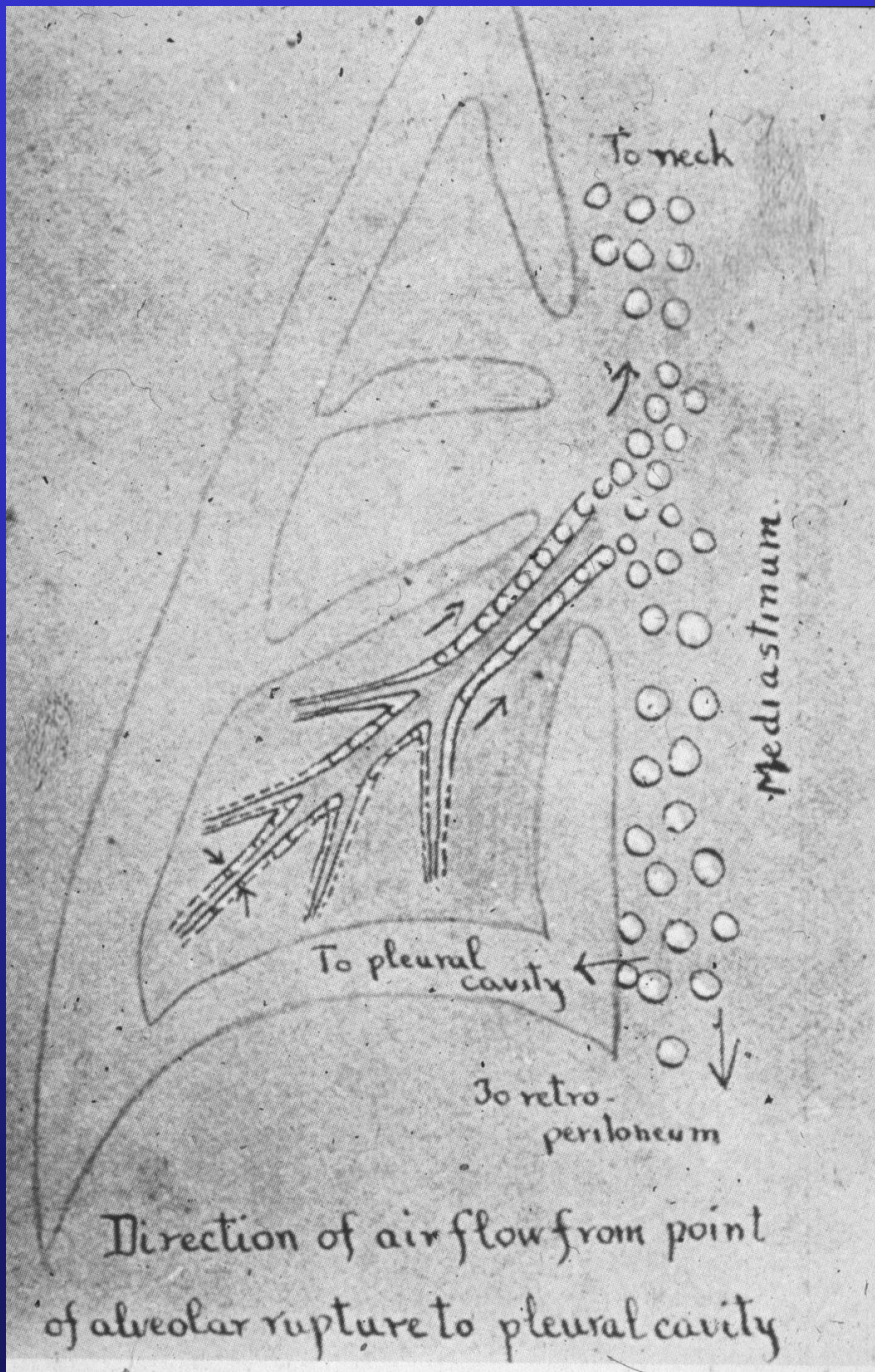
Radiological findings

- Radiological signs of pneumothorax:
 - Visceral pleural margin with absence of the lung vascular marking peripheral to the pleural line
- Tension pneumothorax with mediastinal shift and compression of the diaphragm.
- Radiographic signs of pneumomediastinum:
 - Subcutaneous emphysema
 - Thymic sail sign
 - Pneumopericardium
 - Ring around the artery sign
 - Tubular artery sign
 - Double bronchial wall sign
 - Continuous diaphragm sign
 - Extrapleural sign
 - Air in the pulmonary ligament

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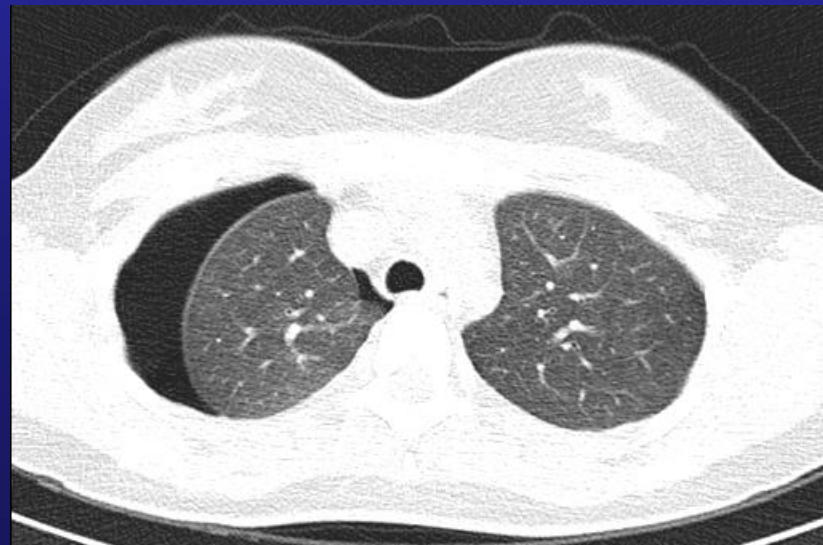
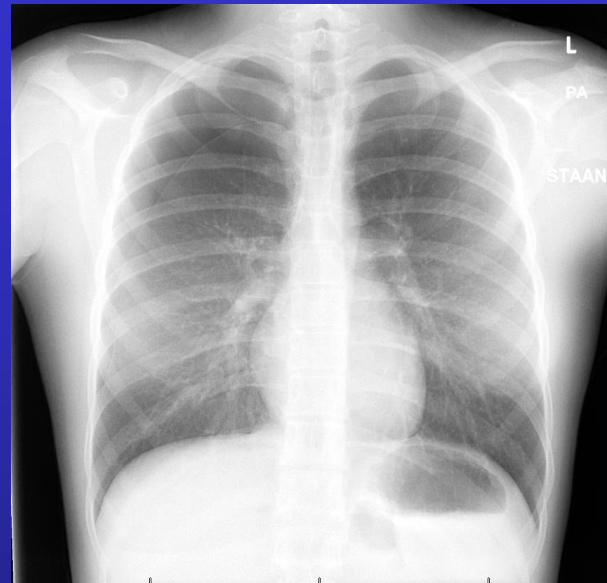
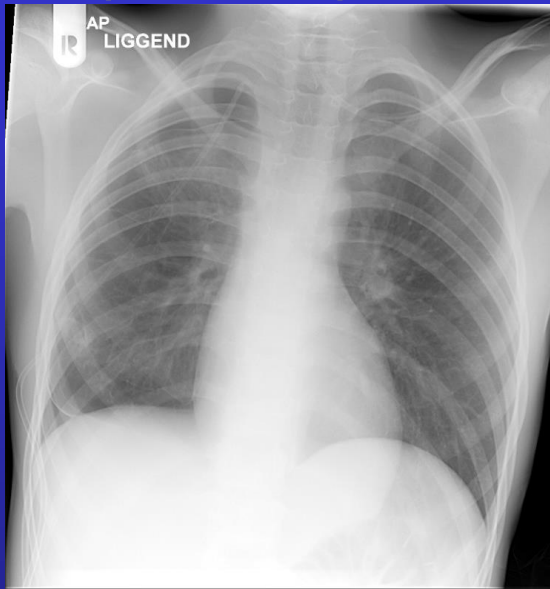


Etiological classification of pneumothorax (PTX) and pneumomediastinum (PM)

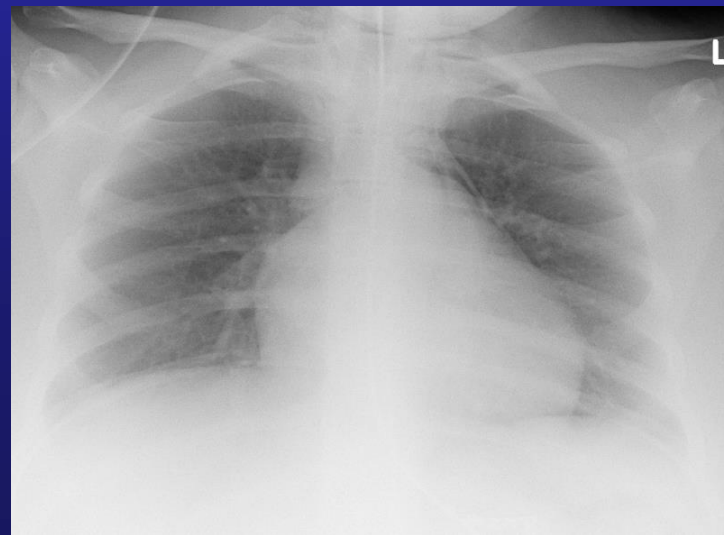
- I. Primary idiopathic spontaneous PTX and PM
- II. Secondary spontaneous PTX and PM
 - A. Pneumothorax by congenital malformation of the lung
 - B. Pulmonary diseases associated with intrathoracic pressure (PTX and PM)
 - C. Viral and bacterial lung infections complicated with PTX and PM
 - D. Pulmonary involvement in systemic diseases and pulmonary metastasis complicated with PTX
- III. Acquired iatrogenic and traumatic pathologies
 - A. Surgical iatrogenic
 - B. Non surgical
 - C. Penetrating

Primary idiopathic spontaneous PTX

Primary spontaneous PTX associated with the rupture of an apical subpleural bleb occurring without a preceding event

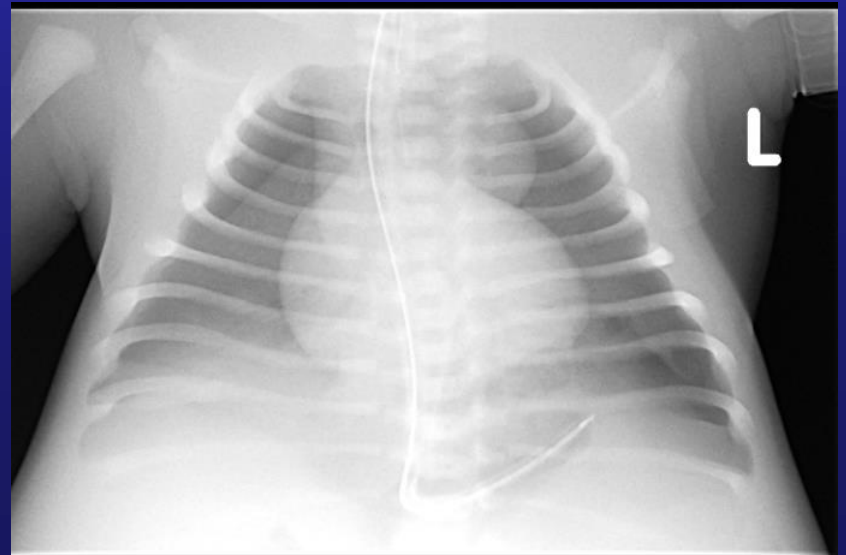
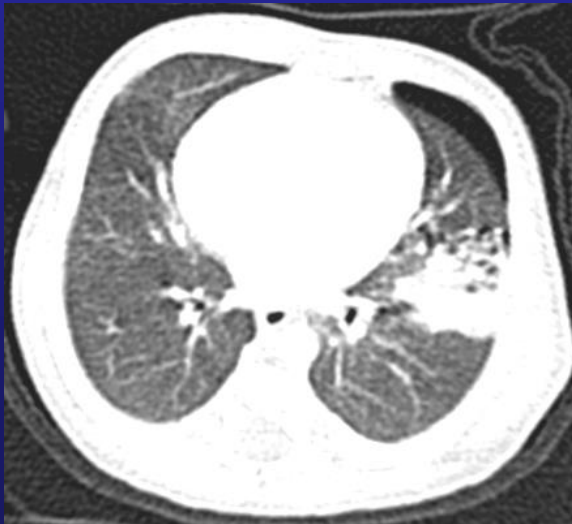
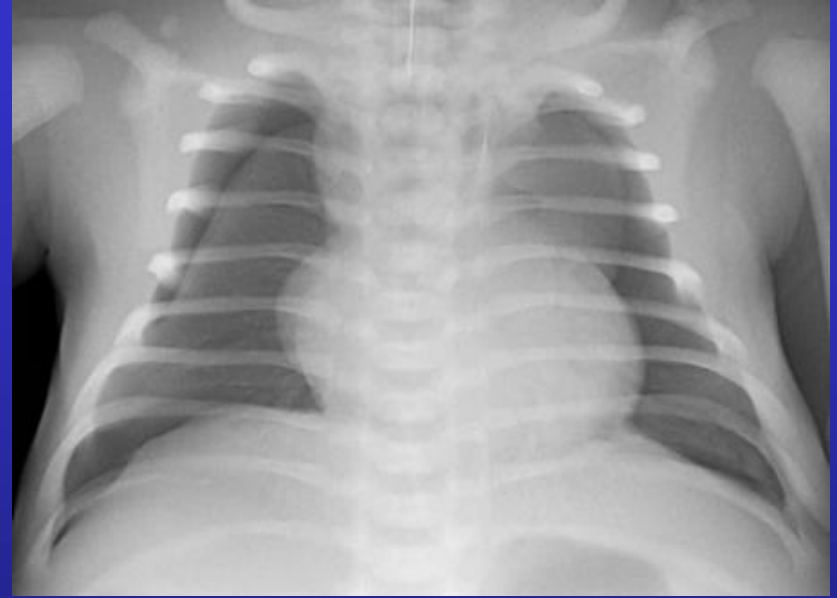


Primary spontaneous pneumomediastinum may occur by coughing or vomiting related to valsalva maneuver as precipitating factor



Secondary spontaneous pneumothorax

A. Pneumothorax caused by congenital airway or pulmonary malformation



Secondary spontaneous pneumothorax (PTX) and pneumomediastinum (PM)

B: PTX and PM precipitated by intrathoracic pressure.

In neonatal age	On later life
Hyaline membrane disease	Asthma
Wet lung disease	Cystic fibrosis
Meconium aspiration	ARDS and others

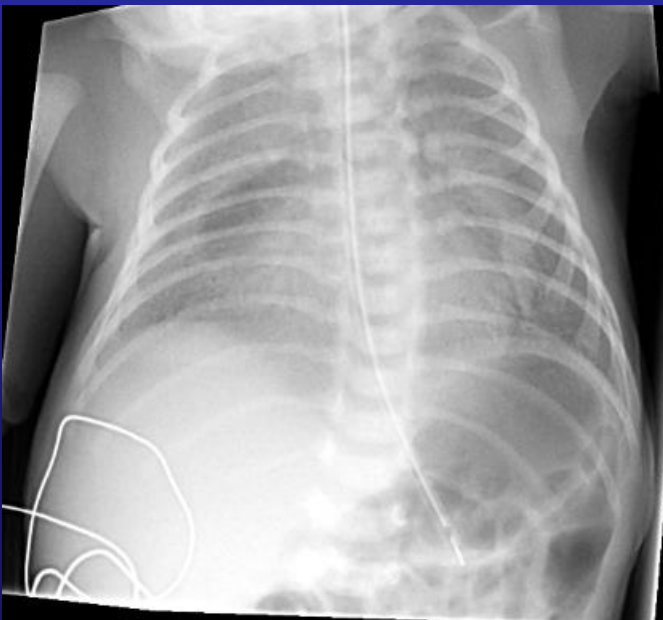
I



II



III



I. Tension pneumothorax. HMD.

II. Meconium aspiration. PM.

III. Wet lung disease. PM.

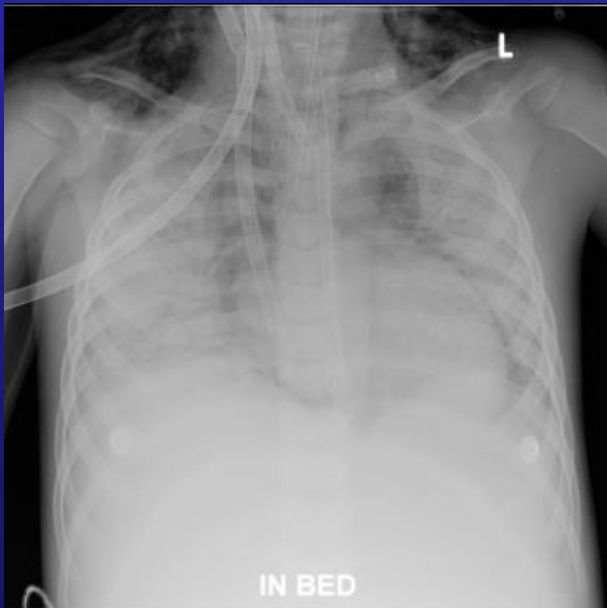
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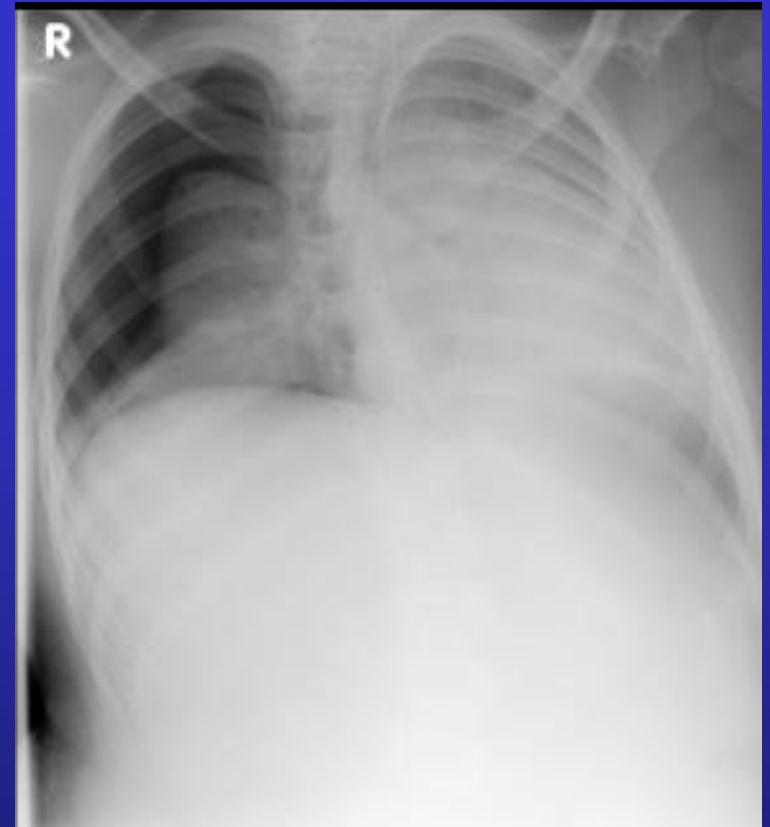
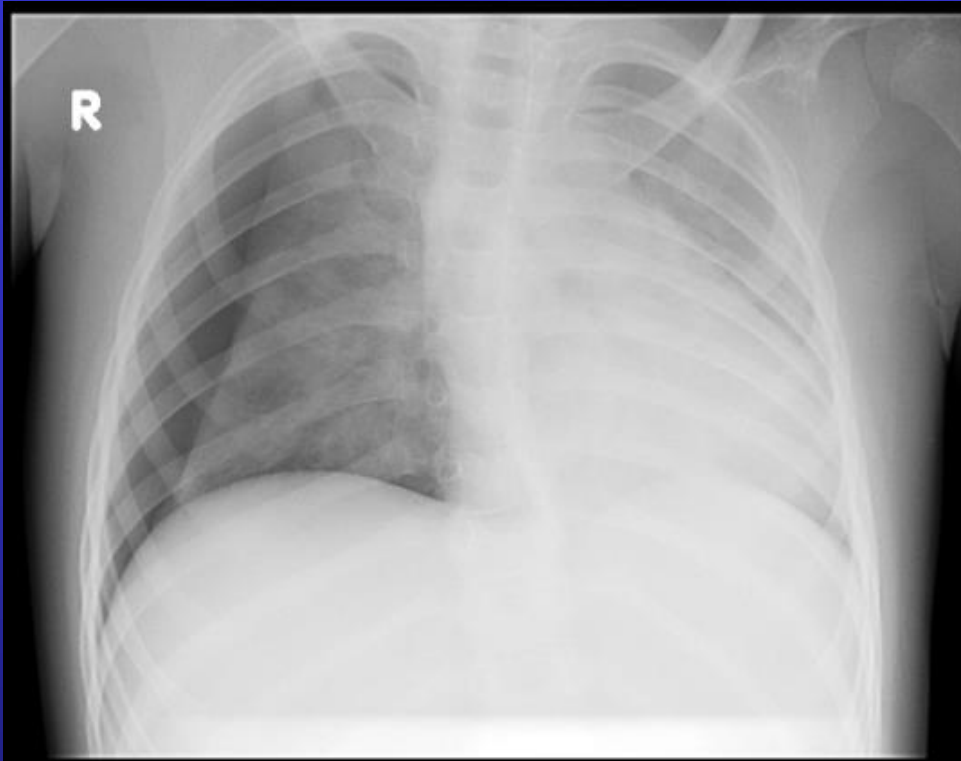
- I. Asthma exacerbation with PM and PTX.
- II. Cystic fibrosis with PTX on CT.
- III. ARDS with PM.

Secondary spontaneous PTX and PM

C. Pulmonary infections

- I. Bacterial infection
- II. Viral infection
- III. TBC and others

I



7 year old boy with right-sided bacterial infection and pneumothorax.

II



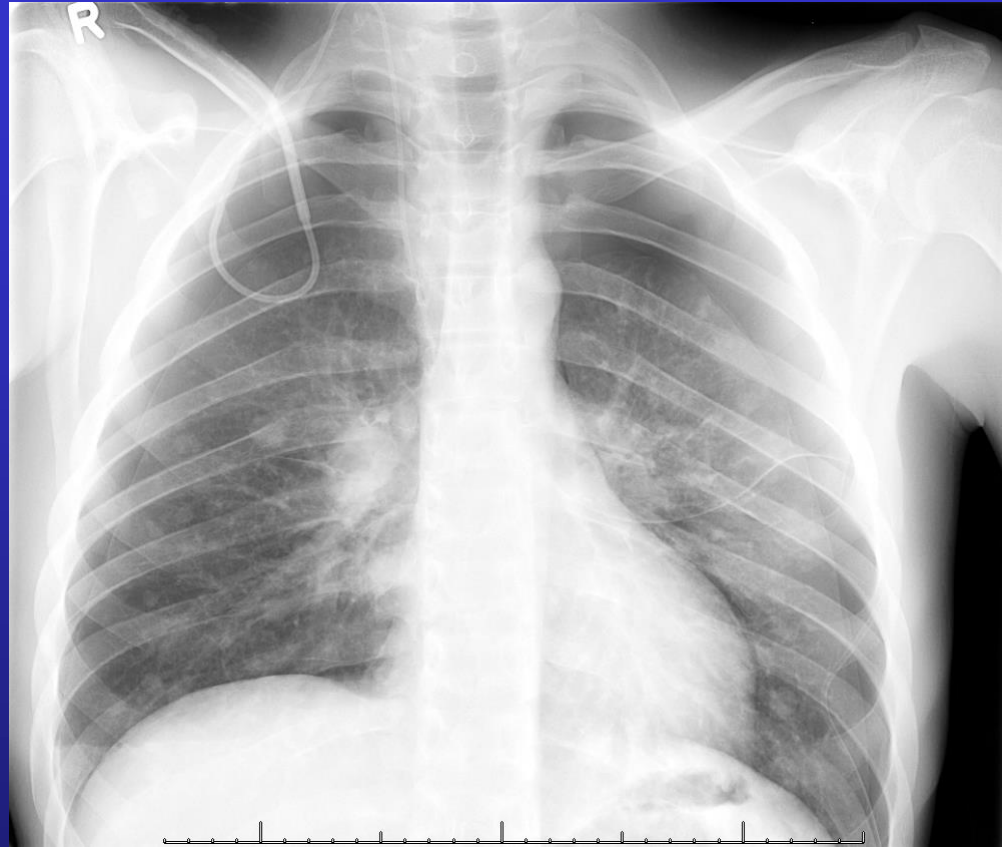
2 year old girl with Bocavirus infection complicated with bacterial superinfection and pneumomediastinum.

Secondary spontaneous PTX and PM

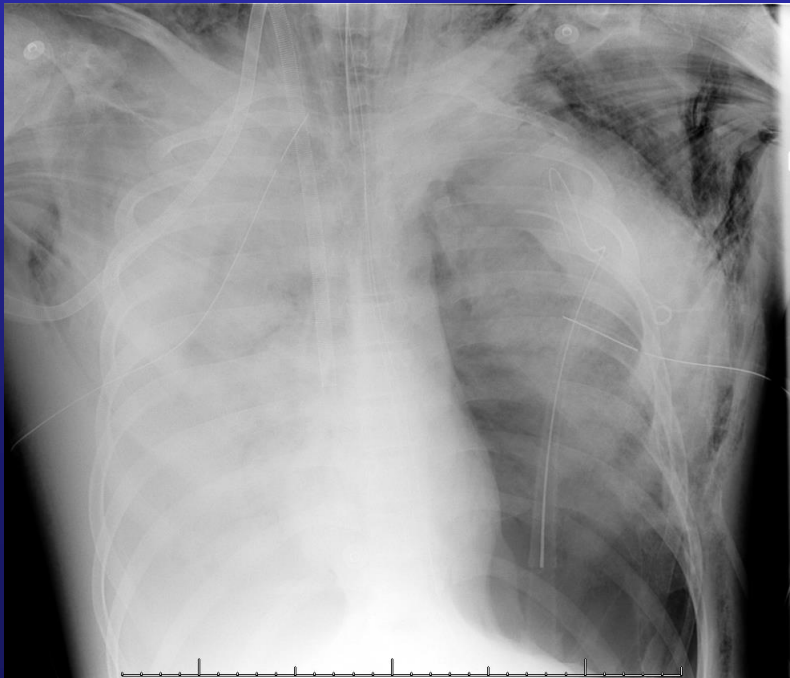
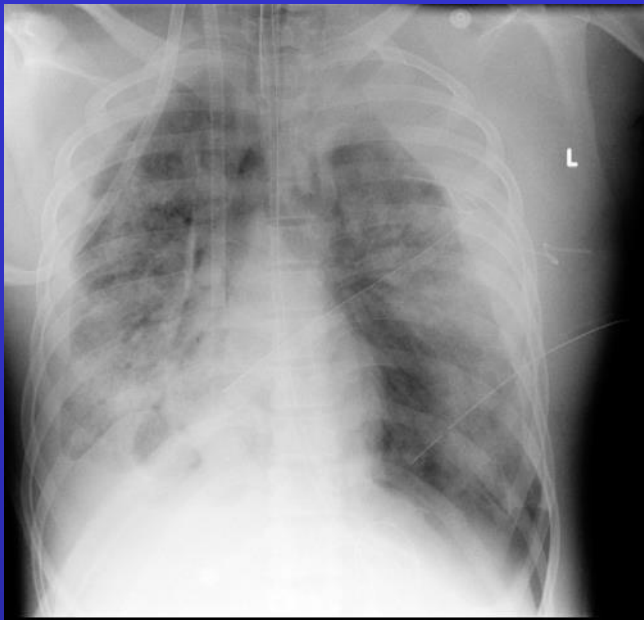
D. Pulmonary involvement in systemic diseases and pulmonary metastasis of malignant tumors complicated with PTX



17 year old boy with hemofagocytosing lymphohistiocytosis and left-sided pleuropneumothorax.



Osteosarcoma by a child with pulmonary metastasis and left-sided pneumothorax.

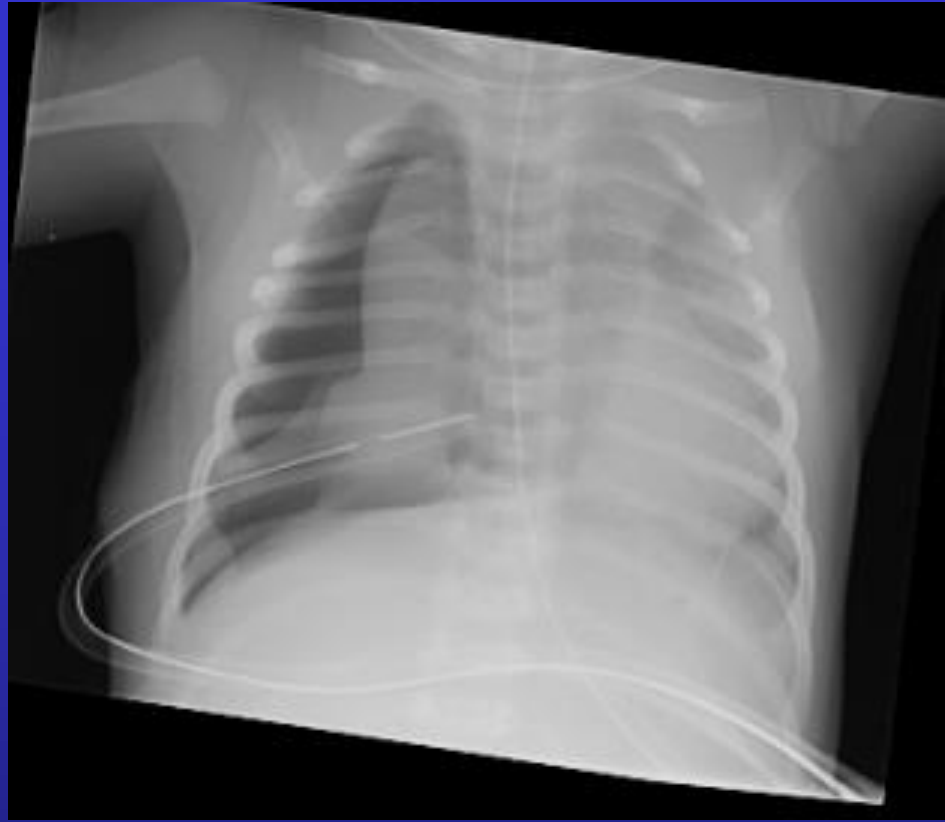
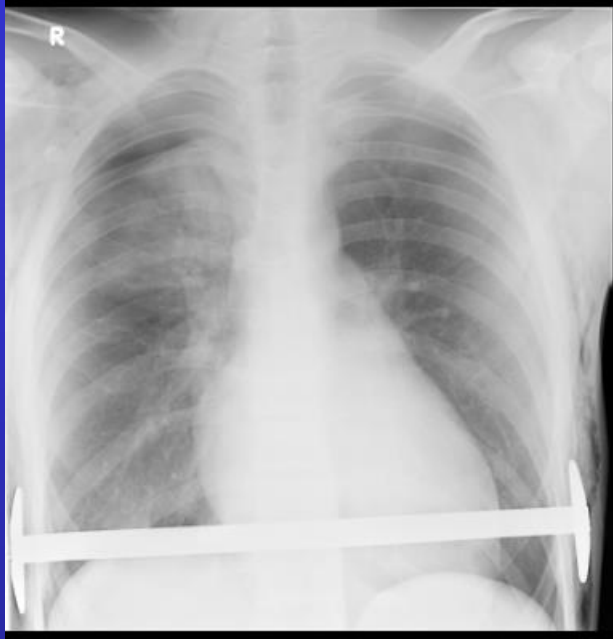


17 year old boy with Wegener disease complicated with hemoptoe and pneumomediastinum.

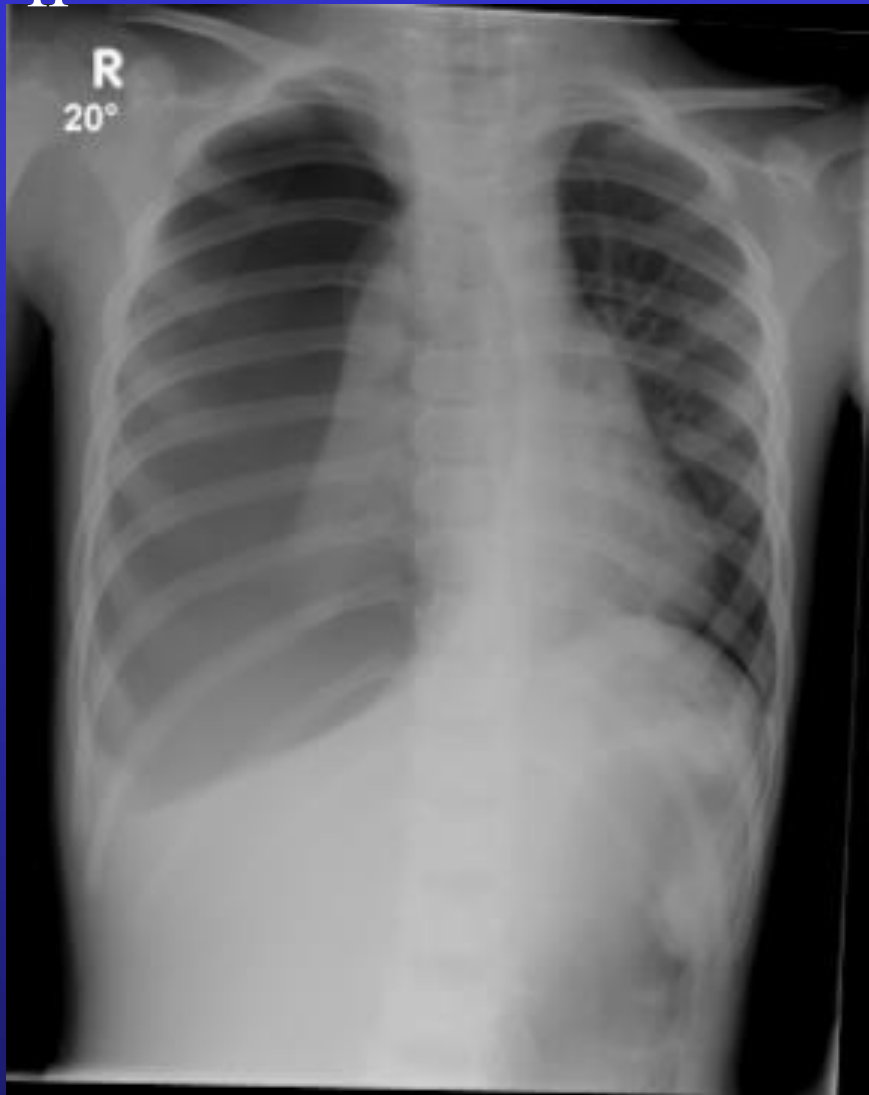
Acquired iatrogenic and traumatic pathologies with PTX or PM

- I. Iatrogenic surgical causes
- II. Iatrogenic non-surgical conditions
- III. Following penetrated and blunt trauma
- IV. Extra-thoracic causes of PTX or PM

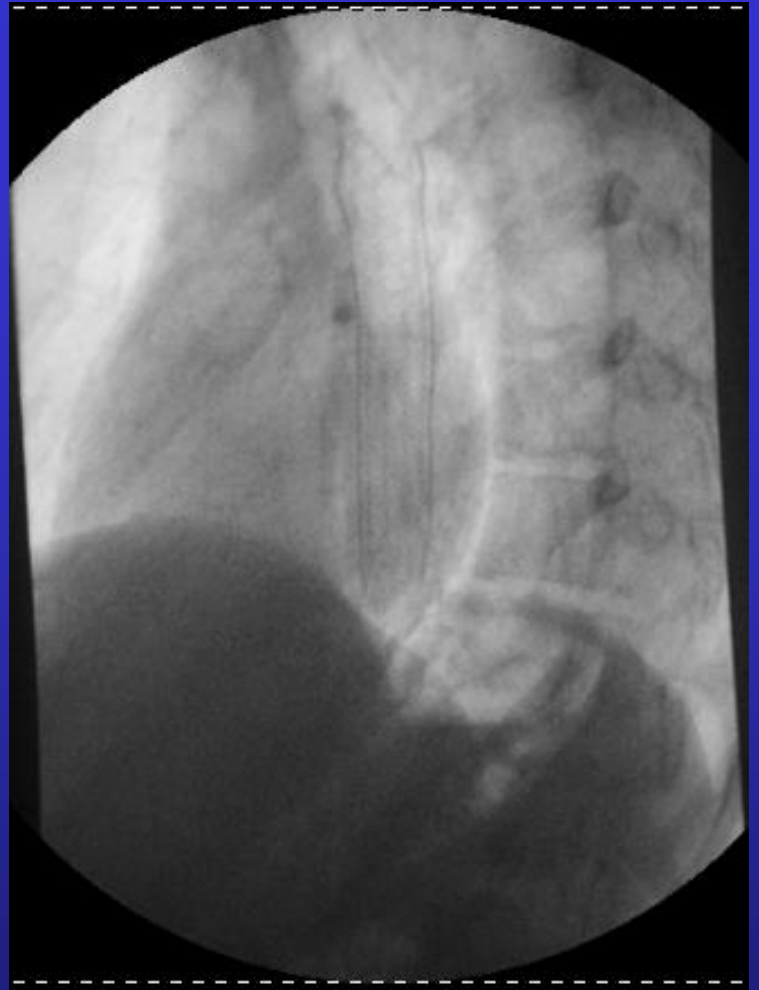
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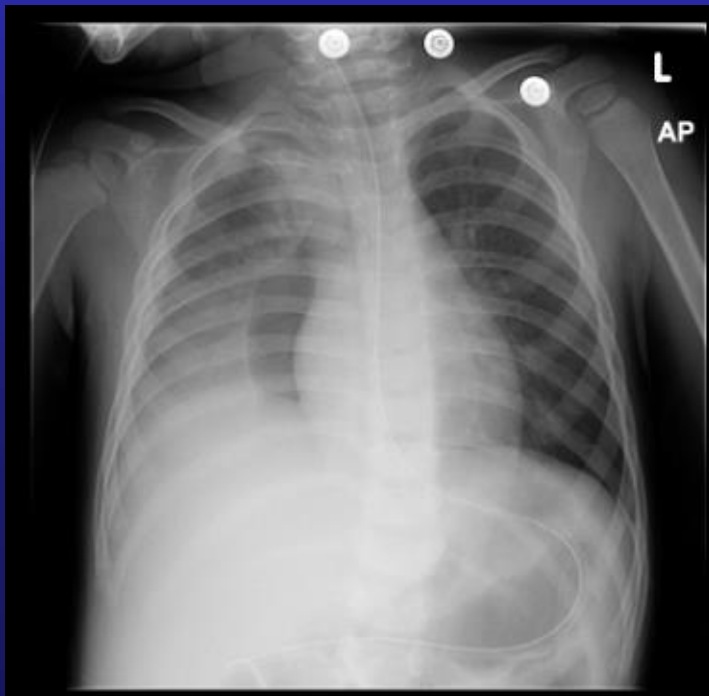


II



II





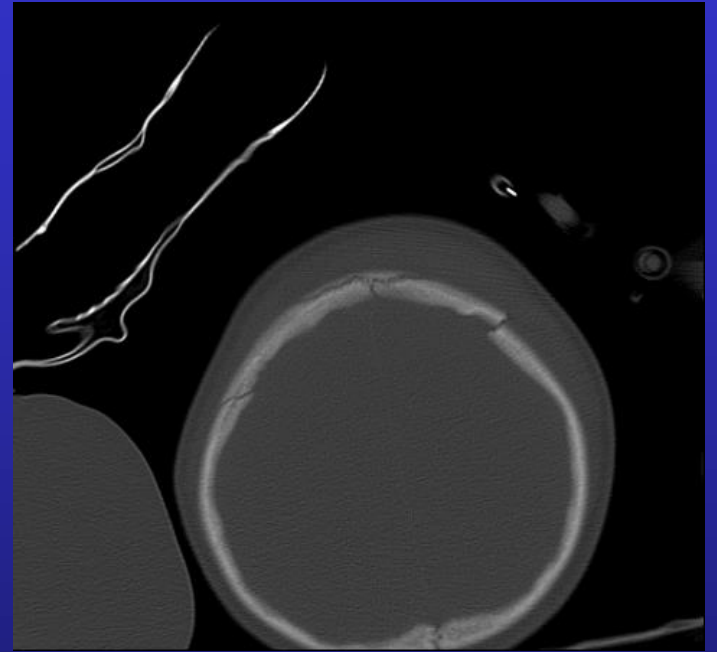
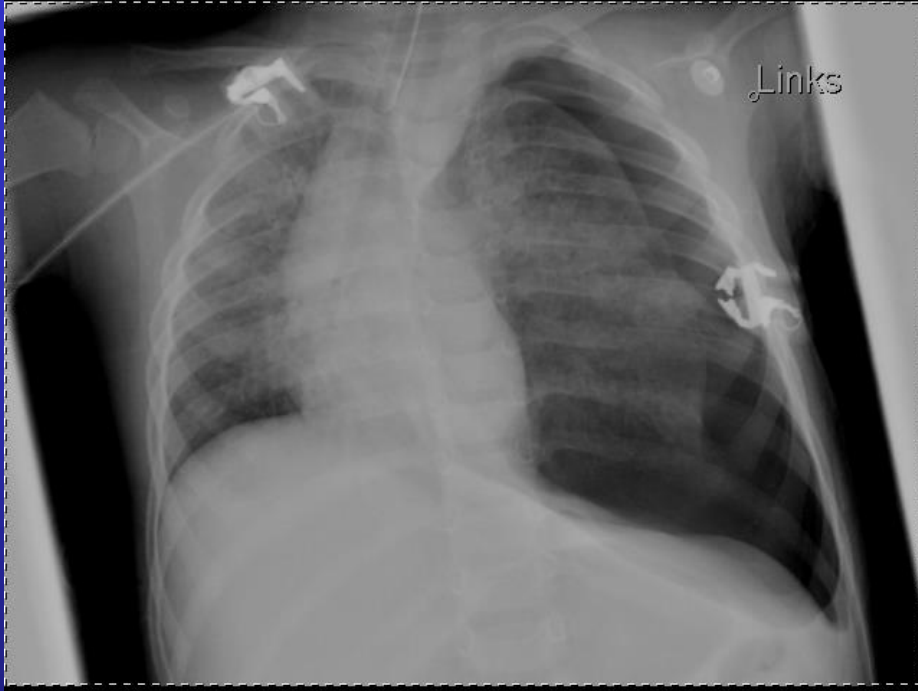
Bronchopneumonie.

Pneumothorax na pleurapunctie.

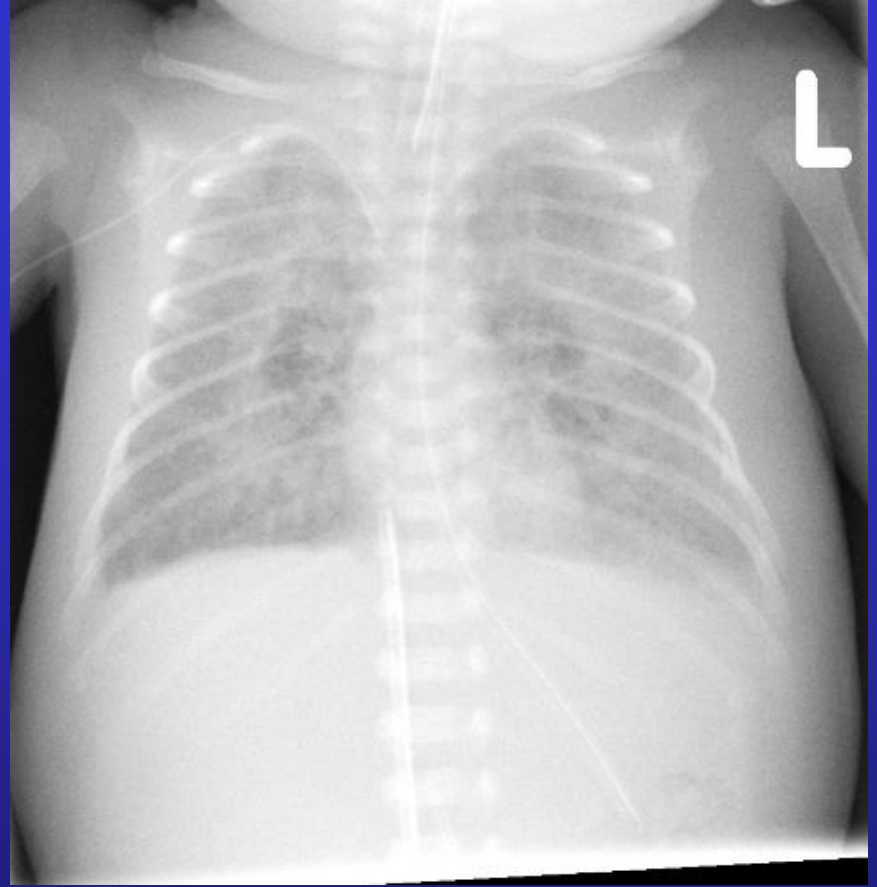


Traumatische pneumothorax
(steekwonden)

III



IV



IV



Conclusion

- Etiological classification of PTX and PM based on patient history and primary pulmonary changes
- Intensive care and interventional treatment related to increasing number of PTX and PM
- The clinical symptoms of PM is usually less severe than PTX.
- PTX and PM are both potentially life threatening complication by infection, thoracic trauma and iatrogenic conditions

Conclusion

- Differentiating of PTX from PM is a diagnostic challenge in emergency
- Traditional chest film remain the gold standard in diagnostic of PTX and PM
- Subcutaneous emphysema is an unusual finding by PM in infancy and neonatal age
- CT scanning is a valuable modality in complicated cases of PTX and PM especially by infection diseases, thoracic trauma and all iatrogenic conditions