International Foundation for Pediatric Imaging Aid
Causes of pleural effusion and its imaging approach in pediatrics

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Pleural fluid

- A tiny amount of fluid in the pleural cavity is physiological.
- Fluid is formed primarily from parietal pleura.
- Fluid is absorbed through the visceral pleura via an extensive network of subpleural lymphatics.
- These lymphatics extend into the lung, traveling along pulmonary veins in the interlobular septae.
- From the interlobular septae they eventually drain into the hilar and mediastinal lymph nodes.
- Finally the draining ends in either the right lymphatic or the thoracic duct.
Pleural effusion

- Physiological amount of pleural fluid is unknown.
- An injection of 5 cc of saline or contrast media could be visualized as fluid in adult cadavers.
- The term pleural effusion is unspecific.
- The nature of effusion can be chyle, blood, transudate of exudate.
Four main factors account for an increase in pleural fluid (with exception of iatrogenic and traumatic causes):

1. Increased hydrostatic pressure (left heart failure)
2. Decreased osmotic pressure (hypoproteinemia)
3. Increased capillary permeability (inflammation neoplastic)
4. Lymphatic obstruction
Causes of pleural effusion

- Congenital
- Cardiac
- Renal
- Infection
- Traumatic
- Iatrogenic
- Neoplastic
- Other (ascites, hypoproteinemia)
The cause of pleural effusion can be suspected clinically.

Imaging procedures are essential for adequate diagnosis as well as therapy.

Laboratory examination should be used to differentiate the characteristics of the fluid.
9-years-old boy with a normal chestfilm
Transient dyspnea of newborn

Pleural effusion on the right side
Congenital chylothorax with unknown etiology

Follow-up a few weeks later
Neonatal chylothorax right-sided.
Pneumothorax left-sided.
Chylothorax and vanishing bone disease by Gorham syndrome.
Hematothorax in a neonate. Traumatic? Iatrogenic?
Cardial causes

Pericarditis purulenta
Cardiac decompensation in a case of Duchenne disease
Nefrogenic causes (less frequent)

Nephrotic syndrome with nephritis
Infectious causes

- Main cause of pleural effusion in childhood: Infection (66%).
  In adult neoplasm is the most frequent cause of pleural effusion.
- The most common organisms are pneumococcus and staphylococcus.
- Viral infections are rarely the cause of pleural effusion.
- Sterile effusions occur in about 20 to 25% of children with primary pulmonary tuberculosis predominantly in older children.
Classification of empyema stages

1. Exudative
2. Fibrinopurulent
3. Organized
Parapneumonic pleural effusion in a case of pneumonia
Lung tuberculosis with pleuritis tuberculosa
Right-sided empyema in a case of pulmonary infection
Abscess based on pneumonia
Abscess in the lung
13-year-old girl with pleural empyema
Right-sided empyema in a case with pulmonary abscess
Battered child with multiple rib fractures and left-sided hematotherax.
Ultrasound of a post-traumatic hematothorax.
Hematotherax due to pseudoaneurysm after an open ductus Botalli operation.
1-month old boy with an iatrogenic intrathoracic perforation of the central line
Retropleural effusion due to iatrogenic perforated esophagus.
Pleural hemorrhage after resection of a ganglioneurinoma
Overloaded circular system by infusion.

Note the pleura effusion.
Neoplastic causes

Malignant teratoma
2,5-year-girl with lymphosarcoma with a large lymphoma in left hilus with huge pleural effusion.

Note the iatrogenic pneumothorax and collapsed lung after thoracocentesis.
Intrathoracic metastases of Wilms tumor with pleuritis carcinomatosa
Right-sided Wilms tumor.

Tumor infiltration of diaphragm with pleura effusion.

Liver and lung metastasis.
T-non Hodgkin lymphoma with pleural effusion
Pleuropulmonal blastoma
Other causes of pleural effusion are:

- Ascites
- Collagen-vascular disease
- Hypoproteinemia of any cause
- Fluid overload
- Ventriculopleural shunt
Pleura effusion in a septic infant with capillary leak
Conclusions

- The chest film in AP en lateral position is the first step in imaging of pleural effusion.

- Ultrasound is an additional modality in diagnostic imaging of pleural effusion:
  - amount of pleural effusion
  - aspect of pleural effusion: echogenicity, septation
  - localization
  - intervention
Conclusions

- CT is indicated in:
  - complicated pulmonary infection
  - iatrogenic causes
  - unknown etiology
  - neoplastic diseases
  - congenital diseases

- MRI is indicated in detection of congenital malformation or neoplastic disease of the chest wall.