Parapneumonic effusion and empyema in children

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DEFINITIONS

- **Parapneumonic effusion** is defined as an exudative pleural effusion associated with lung infection (pneumonia).
- Early in the disease course, the effusion usually is free-flowing (also known as a "simple" effusion) and sterile.

DEFINITIONS

- **Loculated parapneumonic effusion** refers to the presence of septations within the effusion, which interfere with the free flow of fluid. Loculations can be detected by imaging (ultrasonography or computed tomography [CT]).
- Loculations are caused by accumulation of proteinaceous debris in the fluid as the disease progresses.

DEFINITIONS

Empyema is defined as the presence of bacterial organisms on Gram stain and/or grossly purulent fluid in the pleural cavity.

DEFINITIONS

- **Complicated parapneumonic effusion** is often used to refer to either loculated effusion or empyema with changes in the pleural fluid due to bacterial invasion into the pleural space.
- Because bacteria are cleared rapidly after antibiotic therapy, cultures of fluid from complicated parapneumonic effusions are often negative.

ETIOLOGY

- **Bacterial infections** : Common bacterial pathogens associated with parapneumonic effusion/empyema are *S. pneumoniae* (pneumococcus) and *S. aureus*, including methicillin-resistant *S. aureus* (MRSA).

ETIOLOGY

- **Other pathogens** — Parapneumonic effusions have also been reported in up to ١٠ percent of viral and ٢٠ percent of *Mycoplasma* pneumonia.
- However, these effusions are typically small and rarely require intervention in the absence of other underlying diseases

PATHOPHYSIOLOGY

- Uncomplicated effusion : In the first stage, the exudate is a simple effusion that is characterized by normal glucose concentration, normal pH, and a low cellular count.
- The pleural fluid usually layers out on lateral decubitus chest radiographs.
- This stage tends to last approximately ٢٤ to ٧٢ hours.

PATHOPHYSIOLOGY

- Fibrinopurulent is triggered by bacterial invasion of the pleural space, causing empyema.
- large numbers of polymorphonuclear cells accumulate in the pleural fluid; fibrin deposition on the pleural surfaces leads to thickening of the exudate and the formation of loculations, making drainage difficult.

This stage may last up to ٧ to ١٠ days.

PATHOPHYSIOLOGY

- Organization: fibroblasts grow on both parietal and visceral pleural surfaces, forming an inelastic membrane "pleural peel" that restricts lung reexpansion, impairs lung function, and creates a persistent pleural space with ongoing potential for infection.
- At this stage, thoracentesis may yield a "dry tap".
- This stage typically occurs by two to four weeks after initial development of the empyema

EVALUATION

- **History and examination**: It is important to assess the severity of illness and look for underlying conditions that predispose to the development of parapneumonic effusion/empyema, including immunodeficiencies.
- Pulse oximetry is useful in determining the presence and severity of hypoxia.
- Oxygen saturations <۹۲ percent suggest severe disease The child's state of hydration should be assessed so that fluid therapy can be initiated, if necessary.

EVALUATION

- **Plain radiographs**: Posteroanterior or anteroposterior and lateral decubitus radiographs can help in making the diagnosis of pleural effusion and in determining the need for thoracentesis and/or chest tube placement.
- In older children and adults, a decubitus layer of >١ cm is considered sufficient volume to enable extraction of fluid by thoracentesis.

EVALUATION

- **Ultrasonography**: Ultrasonography is the preferred imaging modality in the evaluation of patients with moderate to large parapneumonic pleural effusions.
- It is useful in confirming the presence of fluid in the pleural space ,determining the nature of the effusion and quantifying the amount of effusion.

EVALUATION

- **Chest computed tomography** — Chest CT also can identify the presence of pleural fluid.
- However, studies have suggested that CT findings lack the accuracy to characterize the nature of fluid and the presence of empyema and do not generally affect management decisions

EVALUATION

- **Blood and sputum cultures** — Blood cultures are recommended for children presenting with parapneumonic effusion and are sometimes helpful in identifying the causative organism if pleural fluid culture is negative.
- Blood cultures are positive in ٢ to ٢٠ percent of children with complicated parapneumonic effusions; the yield may be influenced by a history of previous antibiotic treatment

EVALUATION

- **Pleural fluid analysis** — Drainage of pleural fluid is indicated for some moderate and most large pleural effusions.
- For patients with no respiratory compromise and with small to moderate pleural effusions, treatment with antibiotics but without pleural drainage is a reasonable alternative.

Management

Hospitalization: The majority of patients with pneumonia complicated by parapneumonic effusions will require hospitalization.

Transfer to a facility with specialists in pediatric pulmonology, pediatric surgery, and pediatric anesthesia should be considered early in the care of children who may require video-assisted thoracoscopic surgery (VATS) or fibrinolytic therapy

Management

- **SUPPORTIVE CARE:** include antipyretics, analgesia, and early ambulation
- Children with parapneumonic effusions may become dehydrated as a result of poor intake and increased losses from fever and tachypnea.
- Bronchodilator therapy has no role in treatment of children with parapneumonic effusions and may potentially worsen their ventilation-perfusion (V/Q) mismatch, exacerbating hypoxemia.
- Chest physiotherapy is not recommended

Management

- **ANTIBIOTIC THERAPY:** For inpatients, suggested empiric therapy is IV ceftriaxone or cefotaxime (where available), **plus** clindamycin or vancomycin if *Staphylococcus aureus* or anaerobes are a consideration.
- For ill-appearing children, it is particularly important to include vancomycin or clindamycin in the regimen because of the increasing frequency of parapneumonic effusions caused by community-associated methicillin-resistant *S. aureus* (CA-MRSA)

Duration

- Common practice is to continue antibiotics for at least ١٠ days after resolution of fever.
- antibiotics may be changed from the IV to oral route when the child has been afebrile and without a chest drain for two to five days, or possibly sooner if close clinical follow-up is assured

SMALL PARAPNEUMONIC EFFUSION

- A small pleural effusion is generally defined by its appearance on chest radiograph, as fluid occupying <١ cm on lateral decubitus radiograph or opacifying less than one-fourth of the hemithorax.

Treatment

- Children with effusions of this size who are well-appearing and in no respiratory distress can be managed as outpatients, with broad-spectrum oral antibiotics and close observation with chest radiographs
- Even if the effusion is small, hospital admission and intravenous (IV) antibiotics are appropriate for patients who are ill-appearing, in respiratory distress, under six months of age, have evidence of bacteremia/sepsis, or have failed outpatient management.

MODERATE OR LARGE SIMPLE EFFUSION (NOT LOCULATED)

- moderate or large pleural effusion is typically defined as fluid occupying >١ cm on lateral decubitus radiograph or opacifying more than one-fourth of the hemithorax

Treatment

- Thoracentesis
- Chest tubes
- Size of tube
- Removal of chest tube

Loculated effusion

- Loculation of fluid on initial or follow-up imaging, or other evidence of fibrinopurulent effusions (eg, positive gram stain, frank pus, or pH <٧.٠, glucose <٤٠ mg/dL [٢.٢٢ mmol/L], lactate dehydrogenase [LDH] >١٠٠٠ international units.

Treatment

- Chest tubes
- Fibrinolytic
- video-assisted thoracoscopic surgery