BACTERIAL PNEUMONIA

Azar. Dastranji

Assistant Professor .Tabriz University of medical Sciences


بسم الله الرحمن الرحیم

Hospital-acquired (or nosocomial) pneumonia (HAP) is pneumonia that occurs 48 hours or more after admission and did not appear to be incubating at the time of admission.

Ventilator-associated pneumonia (VAP) is a type of HAP that develops more than 48 hours after endotracheal intubation.

Pediatric community-acquired pneumonia:

CAP is defined as ‘‘the presence of signs and symptoms of pneumonia in a previously healthy child due to an infection which has been acquired outside hospital.

Two prospective population-based studies estimate that incidence of CAP is 32.8–33.8 cases per 10 000 children under the age of 5 years or 14.4–14.7 cases per 10 000 children under the age of 16 years in northern Europe.

Hospitalization rates for CAP in children range from 9.5% to 42%.

Community-acquired pneumonia (CAP) is still a leading cause of death among children aged less than 5 years worldwide. Annually, there are 4–5 million deaths reported in children younger than 5 years of age, and pneumonia is estimated to account for approximately 1 million of these.

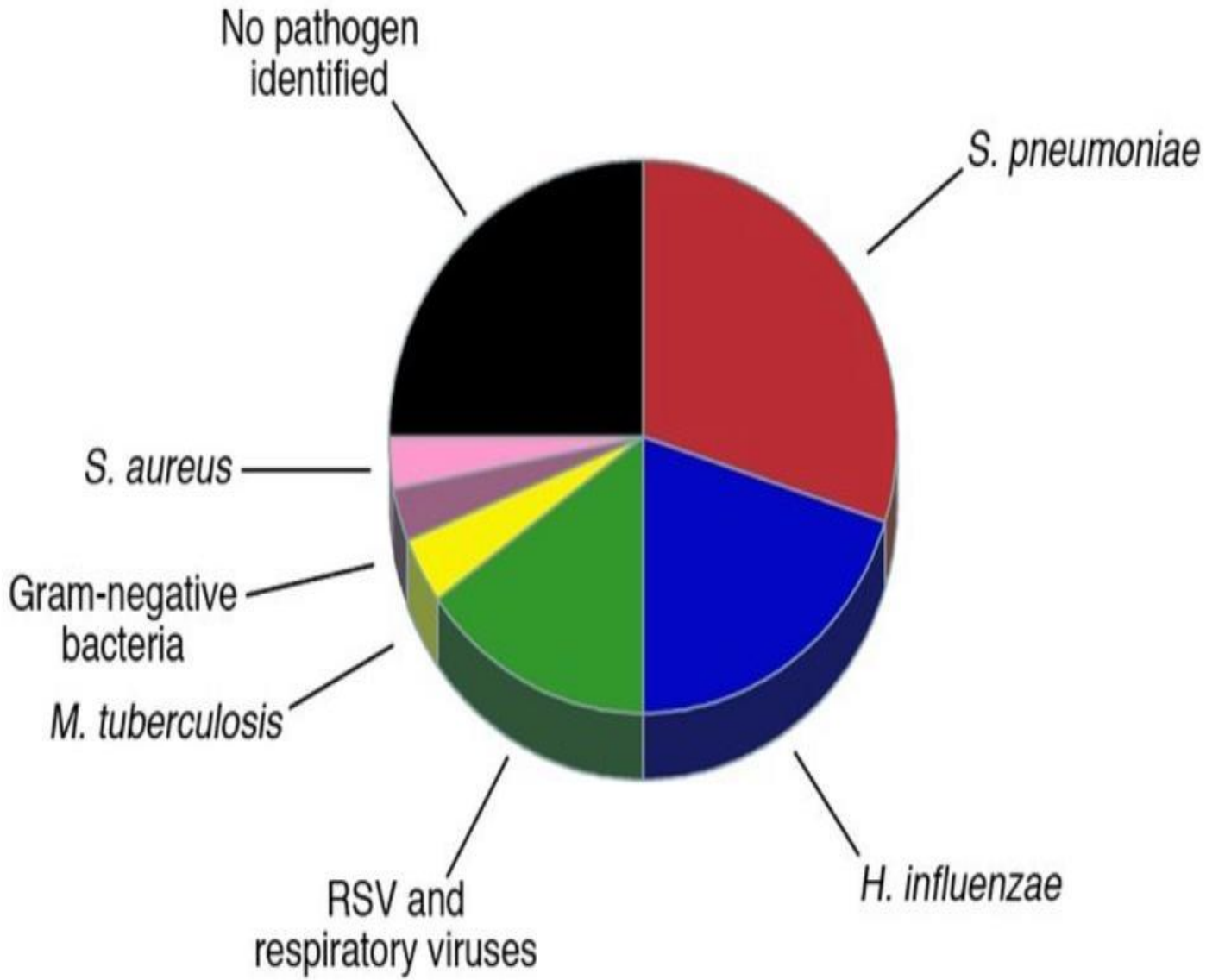
Important associations with CAP include: low birth weight, preterm birth, malnutrition, incomplete vaccination and low socioeconomic status .

Low and middle income countries endure higher rates of morbidity and mortality than high income countries and account for more than 90% of severe CAP cases worldwide.

Pathogens:

- Streptococcus pneumoniae was the most common cause 33–50% of all cases
- Haemophilus influenza was the second most common cause (7–16% of cases)
- Staphylococcus aureus (4–10%)
- Klebsiella (4–10%)
- Pseudomonas (0.8–4.5%)
- Moraxella (1.2–3.5%)

Newborns :
Group B Streptococcus
Enteric Gram-negative


No pathogen identified
S. pneumoniae
S. aureus
Gram-negative bacteria
M. tuberculosis
RSV and respiratory viruses
H. influenzae

Pneumococcal infections are thought to spread from person to person via droplets and nasopharyngeal colonization is a prerequisite for pneumococcal disease.

The carriage rate peaks around 1 –2 years of age and diminishes thereafter to ,10% in the adult population. However, adults with small children may have a higher carriage rate.

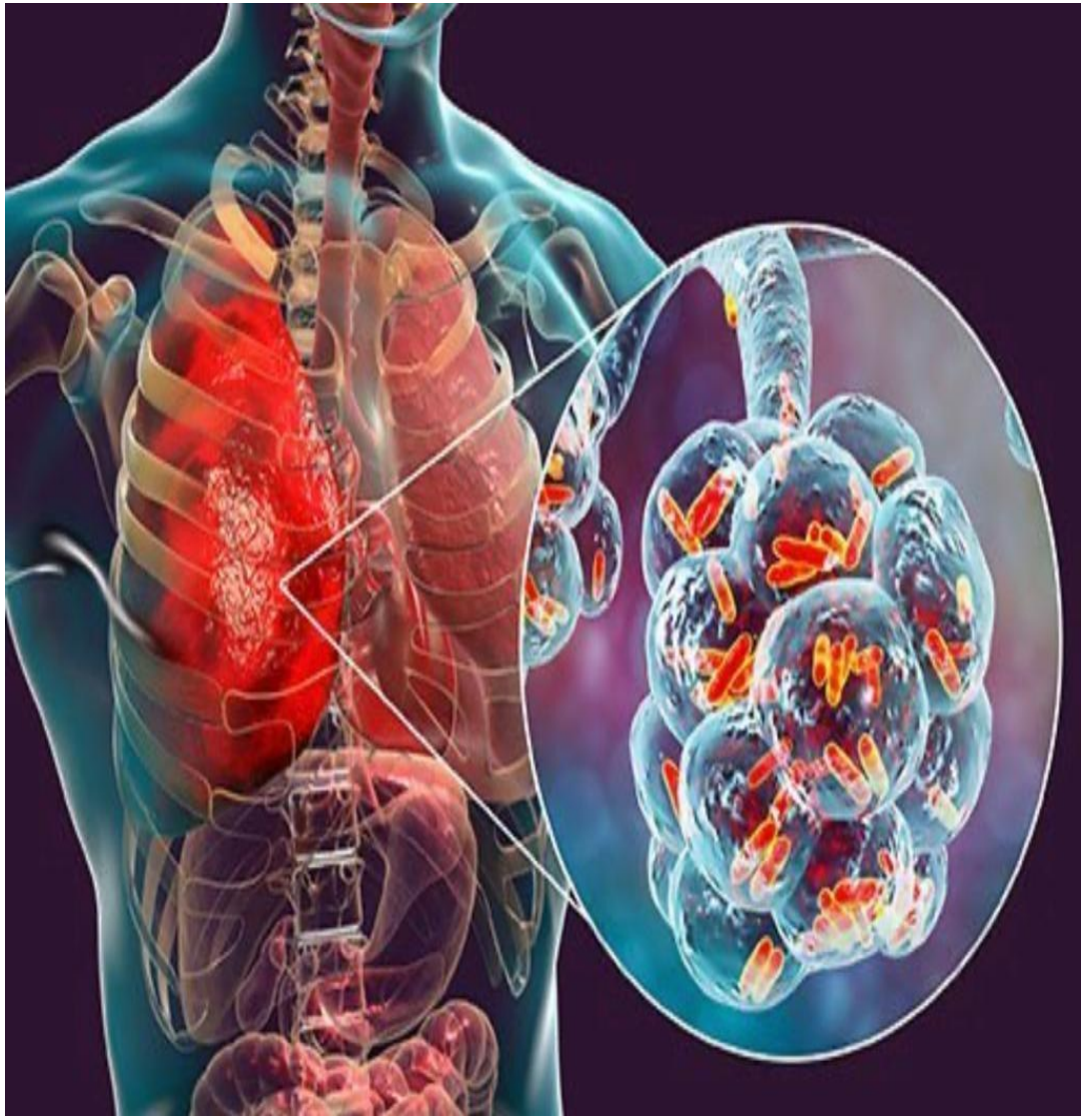
The bacteria may be isolated from the nasopharynx of 5–90% of healthy persons, depending on the population and setting.

The bacteria enter the nasal cavity and attach to the nasopharyngeal epithelial cells and may then either stay as a colonizer or spread further to other organs, such as the ears, sinuses, or via bronchi down to the lungs and then potentially penetrate the mucosal barrier to enter the blood stream and/or cross the blood–brain barrier to cause meningitis.

Pneumococcal infections are more common during the winter and in early spring when respiratory diseases are more prevalent.

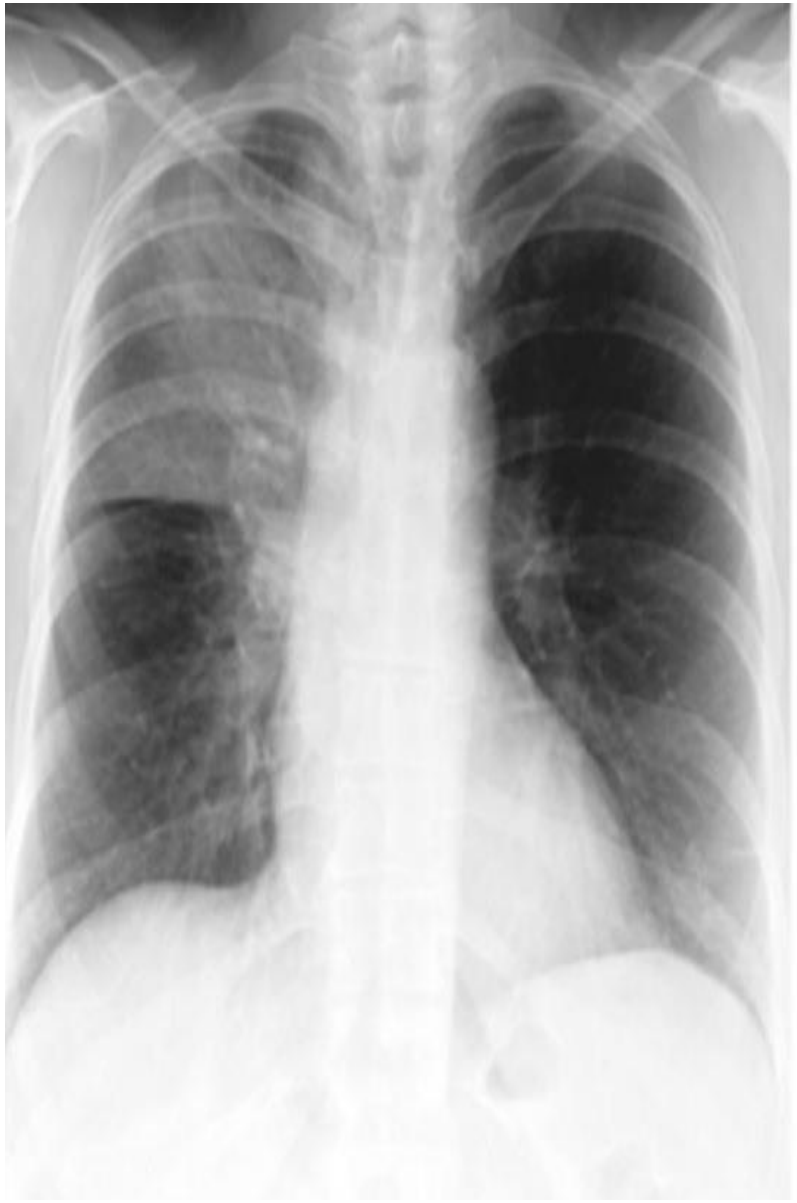
Clinical manifestations:

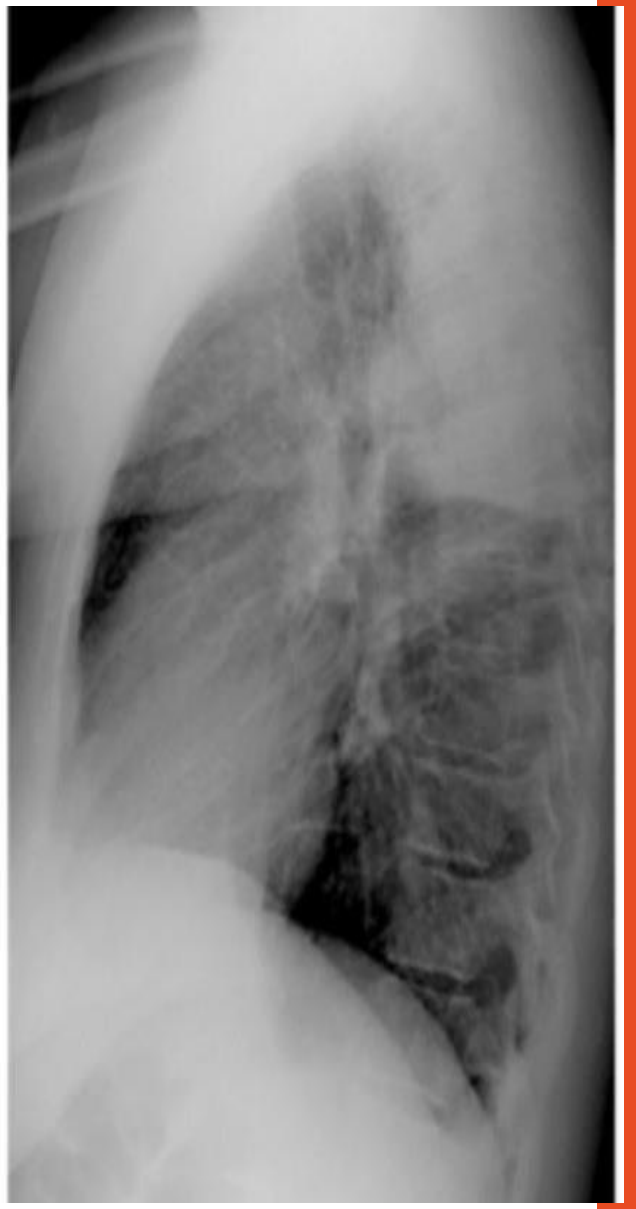
- Fever
- Tachypnea
- Lethargy
- Hypoxemia
- Retractions
- Grunting
- Chest pain
- Crackles
- Decrease breath sounds



Radiographic Feature:

- Lobar pneumonia
- Round pneumonia
- Bronchopneumonia





complications of Bacterial Pneumonia

Risk factor of complications of Bacterial Pneumonia :

- Immuno deficiencies
- Mal-nutrition
- Chronic lung diseases
- Cystic congenital thoracic malformation
- Inhaled foreign bodies
- Age younger than 2 years
- Long prehospital duration of fever
- Asymmetric chest pain at presentation
- High acute phase reactants
- Low white blood cell count
- Iron deficiency, anemia
- Pretreatment with ibuprofen or acetaminophen.

Bacterial super infection :

S .Pneumonie is the main cause of Bacterial super infection in the patients with influenza .

Pneumococcal disease frequently is facilitated by viral respiratory tract infection:

- Produce mucosal injury
- Diminish epithelial cell ciliary activity
- Depress the function of alveolar macrophages and neutrophils.

Para pneumonic effusion/empyema:

Injury to the lung parenchyma due to infection can lead to increased capillary permeability and accumulation of fluid in the pleural space.

A causative organism is isolated S. pneumoniae (primarily serotype 1) accounts for 68% .

Pericardial effusion:

Accumulation of fluid between the heart and the pericardial sac, or pericardial effusion, is rare in childhood but may co-exist with
Para pneumonic effusion, particularly left-sided cases, simply due to the proximity of the pleura and pericardium .

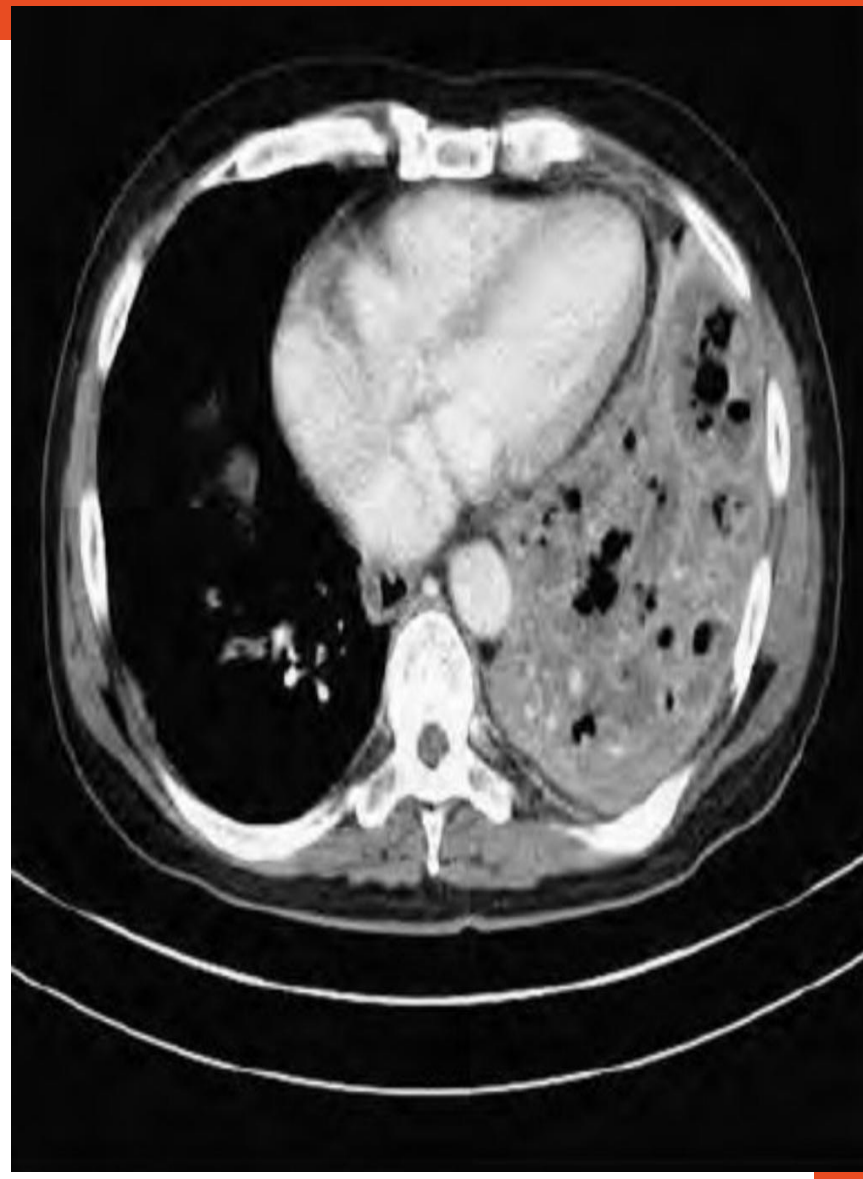
Most of these associated pericardial effusions improve with treatment of the underlying infection but urgent echocardiography should be considered in cases of hemodynamic compromise as pericardiocentesis may be required .

Necrotizing pneumonia

An increasingly recognized sequela of pediatric CAP is necrotizing or cavitary pneumonia, which was first described in 1994 , and has recently been shown to complicate up to 20% of childhood empyema .It is characterized by necrosis and liquefaction of lung parenchyma, which is thought to be secondary to ischemia caused by thrombosis of intrapulmonary vessels.

Pneumatocoeles lead to pneumothorax

Bronchopleural fistula.



In pulmonary gangrene of single or multiple lobes.

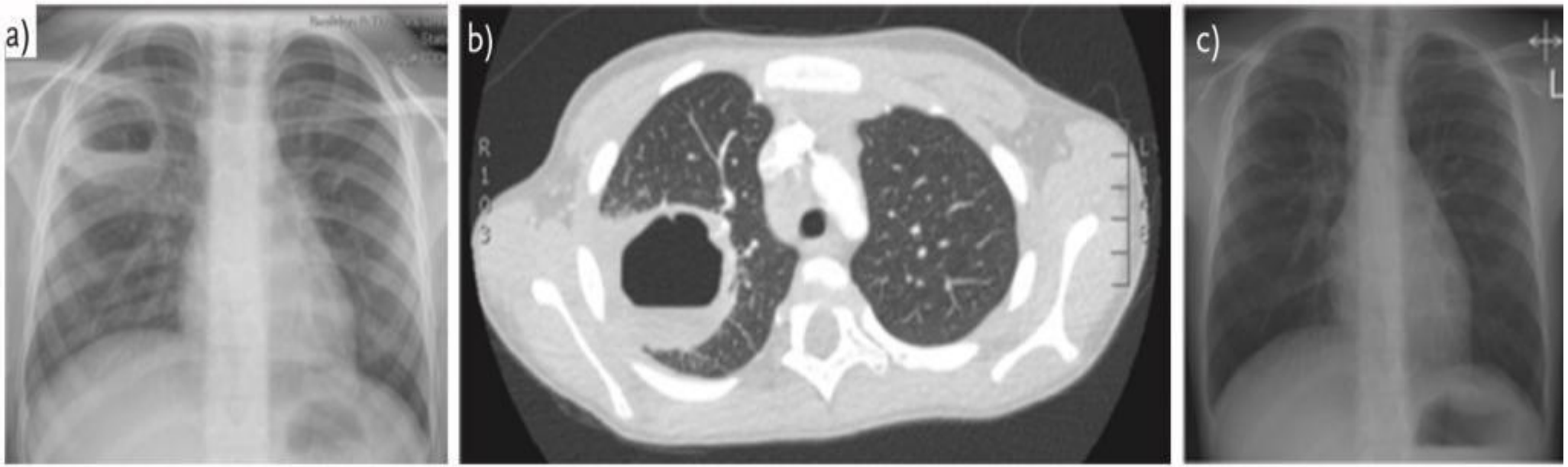
Necrotizing pneumonia is usually secondary to **S. pneumoniae**, particularly serotypes **1, 3, 9V** and **14**, *S. aureus*, or, less commonly, *Pseudomonas aeruginosa* infections.

Diagnosis is usually made on CT, as plain chest radiographs will not accurately demonstrate the typical disruption of normal parenchymal architecture where multiple air or fluid-filled cavities replace the normal lung.

66% of children required thoracotomy for decortication, bronchopulmonary fistula repair or partial pneumonectomy

Lung abscess:

Lung abscesses are thick-walled cavities (>2 cm) containing purulent material that are the result of acute destruction of the lung parenchyma following inflammation, necrosis and cavitation .
occurring as sequelae of pneumonia.



Primary abscesses due to:

- gram-positive cocci (S. pneumoniae, S. aureus, S. pyogenes)
- gram-negative bacteria (P. aeruginosa and Klebsiella).

Secondary abscesses due to:

- *S.* Pneumoniae
- S. Aureus
- P. aeruginosa
- Anaerobic bacteria
- Fungi also cause

Lung abscess treatment:

- The mainstay of treatment of primary lung abscess has traditionally been intravenous penicillin and clindamycin for 2–3 weeks followed by a further 4–8 weeks of oral antibiotics . 90% of children with primary lung abscess will respond to medical management and make a full recovery.

- Surgical intervention : If prolonged medical therapy was unsuccessful or if there was respiratory compromise, such as mediastinal shift, necessitating mechanical ventilation.

- CT-guided percutaneous aspiration

- Thoracoscopic drainage

Acute respiratory distress syndrome:

Acute respiratory distress syndrome (ARDS) as severe hypoxemia refractory to supplemental oxygen therapy that usually occurs with in 72 h of an acute inflammatory lung injury that increases vascular permeability and decreases lung compliance .

ARDS can be categorized as mild, moderate or severe and bilateral radiographic opacities are typically present.

Pneumonia and septic shock can both lead to ARDS and these children will typically require conventional mechanical or high-frequency oscillation ventilation.

Published mortality rates from ARDS vary from 10% to 90%.

Syndrome of inappropriate antidiuretic hormone secretion

The syndrome is characterized by excessive release of antidiuretic hormone from the posterior pituitary gland leading to dilutional hyponatremia.

It occurs in around one-third of children hospitalized with CAP , the mechanism for which remains unclear, and is associated with higher inflammatory markers and poorer outcomes .

Severe hyponatremia can cause confusion or seizures and for this reason fluid restriction (between 50% and 66% of maintenance) is recommended in children who are hemodynamically stable and not dehydrated.

Hemolytic uremic syndrome:

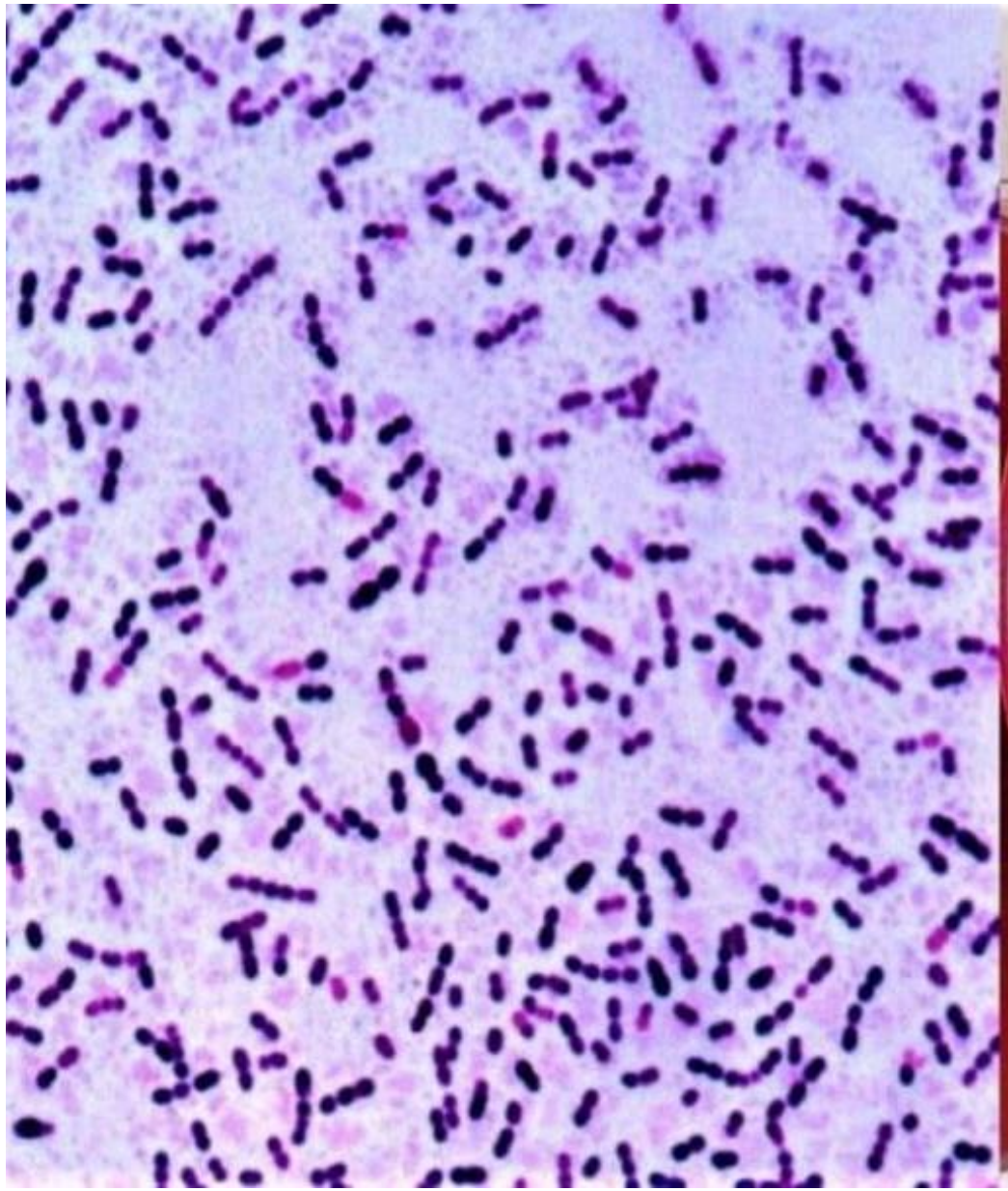
Hemolytic uremic syndrome (HUS) is one of the main causes of acute renal failure in the pediatric population and has been described following invasive S. pneumonia infection.

These cases of ‘‘atypical’’ HUS have a much higher morbidity and mortality than those due to typical organisms such as enterotoxigenic Escherichia coli O157 .

HUS should always be suspected early in cases of CAP associated with anemia, thrombocytopenia and renal dysfunction (anuria) as 75% of these cases are likely to require dialysis and early intervention may be associated with better outcome .

DIAGNOSIS:

1) BAL(gold standard)
2) Blood culture :<10% of hospitalized children
3) Pleura fluid cultures
4) Sputum Gram stain and culture
5) Polymerase chain reaction :25% of pneumococcal Pneumonia
6) Antigen detection



Indications of hospital admission:

- SaO2 of 92% or less
- Cyanosis
- Respirator rate greater than 50 breaths per minute
- Grunting
- Difficulty breathing
- Dehydration
- Family incapable of providing appropriate observation or supervision
- Poor feeding
- Failure to respond to outpatient treatment
- Complication of Bacterial Pneumonia

Table 25.3 Choice of Antibiotic Treatment for Community-Acquired Pneumonia According to Age and Clinical Picture

Age/Clinical Picture	Inpatient	Outpatient
Newborn	Ampicillin + gentamicin	–
1 month to 5 years	Penicillin or ampicillin[a]	Amoxicillin[a]
5 years and older: alveolar infiltrate, pleural effusion, toxic appearance	Penicillin or ampicillin; add macrolide if not responding	–
5 years and older: interstitial infiltrate	Macrolides; consider adding a β-lactam if not responding	Macrolide
Necrotizing pneumonia	Oxacillin/nafcillin; vancomycin. Consider adding third-generation cephalosporin	

Treatment:(Streptococcus pneumonia)

- **Parental treatment:** Penicillin or Ampicillin

Alternative: Cefotaxime or Ceftriaxone

Hypersensitivity to beta-lactam: Clindamycin

- **Oral treatment** :Amoxicillin

Alternative : Cefuroxime or Levofloxacin

Hypersensitivity to beta-lactam: Clindamycin or Levofloxacin

Intermediate and Resistant Strains (Streptococcus pneumonia) **: MIC>4**

Parental therapy: Ceftriaxone or Cefotaxime

Alternative :Vancomycin, Linezolid , Clindamycin , Levofloxacin

Oral therapy : Linezolid ,Levofloxacin

Hypersensitivity to beta-lactam: Clindamycin or Levofloxacin

Staphylococcus aureus:

First choice :Methicilline/Oxacilline
MRSA: Vancomycin

Haemophilus influenzae:

First choice: Amoxicillin:
Other : Amoxicillin/clavulanate , Cefuroxime, Ceftriaxone

Moraxella catarrhalis:

First choice: Amoxicillin/clavulanate
Other : Cefuroxime

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