Pulmonary Parenchymal Opacities Other Than Infection

Alan S. Brody, MD
Cincinnati Children’s Hospital
Opacities Other Than Infection

- Multiple choice questions
- Review causes of opacities other than infection
- Three specific cases
Multiple Choice Questions
Seventeen Year Old With Fever
Seventeen Year Old

- Five days of fever and pleuritic chest pain
- Taking oral contraceptives
- Recently returned from Australia
Most Likely Diagnosis Other Than Pneumonia?

A. Pulmonary sequestration
B. Pulmonary thromboembolism
C. Aspiration
D. Hypersensitivity pneumonitis
Best Excludes Thromboembolism?

A. Serum D-dimer level
B. Arterial blood gas
C. Nuclear medicine ventilation/perfusion scan
D. Lower extremity Doppler ultrasound
Four Year Old With Low-Grade Fever and Decreased Activity
Most Likely Diagnosis

A. Benign Teratoma
B. Neuroblastoma
C. Bronchopulmonary foregut cyst
D. Pleuropulmonary blastoma
Pleuropulmonary Blastoma

A. occurs most often in the second decade of life
B. is the same lesion as pulmonary blastoma
C. can arise in a previously existing lung cyst
D. is a slow growing lesion usually found incidentally
Causes of Opacities Other Than Infection
Opacities other than Infection

- **Alveolar Space**
  - Blood
  - Pus or Protein
  - Water
  - Cells
    - Tumor, Inflammation (aspiration), Repair

- **Interstitial Space**
  - Fluid
    - Pulmonary edema, Lymph
  - Infiltration
    - cells, products
Neonatal Pulmonary Hemorrhage
Pulmonary Hemorrhage

- Neonatal
- “Idiopathic”
- Treatment related
Neonatal Pulmonary Hemorrhage

- Usually confluent opacities
- Cannot be distinguished radiographically from pneumonia
- Usually clinically obvious; imaging input and further evaluation rarely impact care
Idiopathic Pulmonary Hemorrhage
Idiopathic Pulmonary Hemorrhage

- This term preferred to pulmonary hemosiderosis
- Usually 1–7 years old, M=F
- Classic triad: pulmonary infiltrates, iron deficiency anemia, hemoptysis
- Can occur without hemoptysis
- Diagnosis by finding hemosiderin-laden macrophages on bronchoscopy
Idiopathic Pulmonary Hemorrhage

- Diffuse bilateral infiltrates, often symmetrical “bat wing”
- In recurrent cases reticular or nodular diffuse interstitial opacities may develop
2 years later, after 6 episodes
Pulmonary Hemorrhage

- Acute idiopathic pulmonary hemorrhage of infancy (AIPHI)
  - Possibly associated with mold exposure
- Associated with sensitivity to cow’s milk
- Associated with anti basement membrane antibodies
  - Goodpasture’s; young adult males
- Associated with other antibodies
  - Connective tissue disorders
- Idiopathic
Diffuse Alveolar Hemorrhage Following Bone Marrow Transplantation
Diffuse Alveolar Hemorrhage Following Bone Marrow Transplantation

- Usually within first month post transplant
- Rapid radiographic and clinical progression
- Frequently simulates pulmonary edema
- Mortality 75%
- Responds to steroids
Diffuse Alveolar Hemorrhage
14 yo With Shortness of Breath
Pulmonary Alveolar Proteinosis

- In infants usually due to surfactant protein dysfunction
  - Congenital
- In older children and adults usually an autoimmune disease with antibodies to granulocyte-macrophage colony stimulating factor (GMCSF)
  - Primary
- Can occur as a complication of other diseases
  - secondary PAP
2 Children
3 months and 14 years old with PAP
Pulmonary Alveolar Proteinosis

- No effective treatment for surfactant protein dysfunction
- Other forms can be treated with whole lung lavage
- Treatment of underlying abnormality in cases of secondary PAP
5 year old 60 Days after Bone Marrow Transplant, CMV+
Pulmonary Edema

- Identification on CXR more difficult in children than adults
- Heart size and examination often normal
- Kerley B lines rare
- Noncardiogenic causes more common;
  - near drowning
  - drug reactions
Aspiration/Inhalation

- Gastric contents
- Lipoid pneumonia
- Hydrocarbon aspiration
- Hypersensitivity pneumonitis
19 Month Old in the Emergency Department
Hydrocarbon Aspiration

Appearance of parenchymal opacities often delayed

Appear by 6 hours

Worst by 24 hours
Hydrocarbon Pneumonitis

30 min

2 hours
Eight Year Old with Cough
Hypersensitivity Pneumonitis
Hypersensitivity Pneumonitis
Extrinsic Allergic Alveolitis

- Response to the inhalation of organic antigens in a previously sensitized host
- Bird fancier’s lung (avian proteins) is most common in children
- Farmer’s lung (thermophilic actinomyces)
- Patients usually respond to removal of antigen
Hypersensitivity Pneumonitis

- Variable parenchymal opacities in acute form, often most pronounced in lung bases
- Typical appearance on HRCT with ground glass opacity and centrilobular nodules
2 yo with shortness of breath
Epithelioid Hemangioendothelioma
Three Specific Cases
Seventeen Year Old With Fever
Almost all recommendations are based on adult data.

CTPA is likely less accurate in children than adults:
- Smaller structures
- Motion
- Bolus timing

Vascular US may be more accurate in children than adults.
Serum D Dimer

- D dimer, a degradation product of cross-linked fibrin, is generated by lysis of fibrin.
- Elevated levels are common, so a positive value has very poor predictive value for thromboembolism (40%?).
- Negative values are more than 95% accurate at excluding thromboembolism in adults.
14 yo Post Bone Marrow Transplant
Cryptogenic Organizing Pneumonia

- Also called bronchiolitis obliterans organizing pneumonia (BOOP)
- Likely a reparative reaction to lung injury
- Most often seen after bone marrow transplant, can occur after mycoplasma infection and in asymptomatic children
Cryptogenic Organizing Pneumonia

- Highly variable appearance, from scattered small nodules to large cavitating mass
  - Nodular form common in children
- Should be considered when nodular opacities are seen in children post BMT
- Biopsy may decrease inappropriate treatment
Cryptogenic Organizing Pneumonia
Cryptogenic Organizing Pneumonia

- Steroids and NSAIDs have been used to treat COP
- Response is variable, may persist despite treatment
2 yo with Cough and Chest Pain
Pleuropulmonary Blastoma
Pleuropulmonary Blastoma

- Mesenchymal tumor with features of fetal lung
- Usually presents $\leq 6$ years old
- Large, rapidly growing mass
- Contiguous with pleura, often displaces the mediastinum
Pleuropulmonary Blastoma

- Three subtypes
  - Cystic; younger with better prognosis
  - Mixed and solid; older, worse prognosis
- Can arise in preexisting lung cysts
  - PPB is likely responsible for cases reported as rhabdomyosarcomas complicating CCAMs
  - Dysplastic and neoplastic conditions in patient or close relative in 25%
    - Cystic nephroma most common
Multiple Choice Questions
Seventeen Year Old With Fever

- Five days of fever and pleuritic chest pain
- Taking oral contraceptives
- Recently returned from Australia
Most Likely Diagnosis Other Than Pneumonia?

A. Pulmonary sequestration
B. Pulmonary thromboembolism
C. Aspiration
D. Hypersensitivity pneumonitis
Best Excludes Thromboembolism?

A. Serum D-dimer level
B. Arterial blood gas
C. NM ventilation/perfusion scan
D. Lower extremity Doppler ultrasound
Four Year Old With Low-Grade Fever and Decreased Activity
Most Likely Diagnosis

A. Benign Teratoma
B. Neuroblastoma
C. Bronchopulmonary foregut cyst
D. Pleuropulmonary blastoma
Pleuropulmonary Blastoma

A. occurs most often in the second decade of life
B. is the same lesion as pulmonary blastoma
C. can arise in a previously existing lung cyst
D. is a slow growing lesion usually found incidentally