To many outside the medical field, an X-ray or radiograph is a simple picture of the interior aspect of the body, but to many health professionals the simple picture is a complicated puzzle. However, a radiographic film can provide an enormous amount of information that, when analyzed correctly, provides an accurate diagnosis and confirms a suspicion. The relative ease with which a radiographic film can be generated and analyzed ensures a quick and reliable diagnostic tool. The saying, “A picture is worth a thousand words” holds true with regards to radiographic films.

Pediatric radiography has evolved into a sophisticated yet affordable diagnostic aid with various applications throughout the human body. With the advent of a high-resolution imaging technique, anatomic details of various body parts have become routine. Many structural densities are well visualized with the appropriate utilization of detailed “window” adjustments. Indeed, it is a cost-effective diagnostic apparatus when appropriately utilized.

Pediatric Radiology Review is not just a review of radiographs in children; it is a vast font of information on embryology, anatomy, surgery, etc. The importance of these disciplines to the understanding of radiological correlates cannot be over-emphasized. References are abundant and thus provide pertinent information for the readers with a voracious appetite for more knowledge.

It is our hope that this edition will permit medical students, residents, and clinicians who are not radiologists to recognize the anatomic details of radiological images. In our opinion, Pediatric Radiology Review includes the most common radiological problems with which students, residents, and clinicians may be confronted on a daily basis. This text is a gift for all those who provide care for children. We do humbly welcome your comments and criticisms of this edition.

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The Companion CD contains an interactive version of the test questions found in this volume. The Companion CD is compatible with both Mac and PC operating systems that run any web browser over 4.0.
Chest Radiographs

The following chapter will focus on radiographs of the chest. Pertinent questions, answers, and rationale will be reviewed.

**Key Words:** Heart; lungs; pneumonia; lobar; effusion; pneumothorax; cardiomegaly.

**QUESTIONS 1–3:** A 16-month-old male presents with a 3-day history of coughing. Vital signs: pulse 120, respiratory rate 38, temperature 101.3°F, pulse oximetry 97%. The following X-ray is obtained.

1. The correct interpretation of this X-ray is:
   a. Right middle lobe infiltrate.
   b. Left lower lobe infiltrate.
   c. Left upper lobe infiltrate.
   d. Both a and b.
   e. Both b and c.

2. Common causes of pneumonia for this age and presentation include all the following except:
   a. Respiratory syncytial virus and other respiratory viruses.
   b. *Streptococcus pneumoniae.*
   c. *Escherichia coli.*
   d. *Haemophilus influenzae.*

3. Admission criteria would include:
   a. Persistent hypoxia.
   b. History of cyanosis or apneic episodes.
   c. Age less than 3 months.
   d. Impaired immune function.
   e. All of the above.
QUESTIONS 4–6: A 3-year-old male presents to the emergency department, accompanied by his babysitter and 5-year-old brother. Chief complaint is coughing with difficulty breathing. On exam the child is afebrile, pulse oximetry is 99%, and there is bilateral stridor with a brochospastic cough.

4. This X-ray would be best described as:
   a. Normal.
   b. Hyperexpansion.
   c. Right middle infiltrate.
   d. Right-side rib fractures.

5. Further information from the 5-year-old brother reveals that the children were eating peanut candies and jumping on the bed prior to the coughing episode. This leads you to suspect:
   a. Asthma.
   b. Foreign-body aspiration.
   c. Rupture of bronchus.
   d. Aspiration pneumonia.

6. After stabilization of the airway, breathing, and circulation, management of this case includes:
   a. Antibiotic coverage.
   b. Nebulized albuterol treatments.
   c. Foreign-body removal.
QUESTIONS 7–8: A 10-week-old male presents with a history of cough for 2 days, fever, and congestion. The child continues to nurse well, and the parents report no decrease in the number of wet diapers. Vital signs reveal a pulse of 142, respiratory rate of 36, temperature of 102.1°F rectally, and pulse oximetry 97%.

7. The correct interpretation of this X-ray is:
   a. Normal.
   b. Cardiomegaly.
   c. Retrocardiac infiltrate.
   d. Right upper lobe infiltrate.

8. Proper management may include all of the following except:
   a. Supplemental oxygen.
   b. Admission to the hospital.
   c. Intravenous diuretics.
   d. Oral antibiotics.
QUESTIONS 9–10: A 7-week-old male arrives via EMS. His parents report a shaking episode involving all extremities lasting 1–2 minutes. He has a previous history of a ventricular septal defect. Physical exam reveals an alert child in no distress, a systolic murmur, lungs clear to auscultation, and no appreciated neurological abnormalities. The following X-ray is obtained.

9. Your interpretation of this X-ray is which of the following?
   a. Mediastinal shifting.
   b. Situs inversus.
   c. Right lower lobe infiltrate.
   d. Presence of a thymic shadow.

10. While the child is in the emergency department, you witness a second seizure lasting approximately 50 seconds, consisting of generalized extremity movement. The child does not appear drowsy after the seizure subsides. In which of the following serum electrolytes would you expect to see an abnormality?
    a. Sodium.
    b. Chloride.
    c. Calcium.
    d. Potassium.
QUESTIONS 11–13: A 15-year-old male with a history of asthma presents with a 2-day history of worsening difficulty in breathing. Vital signs reveal an afebrile patient with pulse of 90, respiratory rate 26, pulse oximetry 93%. Physical exam reveals diffuse wheezing with poor air movement. After two nebulized treatments of albuterol and atrovent, the patient feels symptomatically better. Pulse oximetry is 95% with continued poor air movement. The following X-ray is obtained.

11. Your interpretation of this X-ray is best described as:
   a. Hyperinflation.
   b. Possible bilateral infiltrates.
   c. Pneumomediastinum.
   d. Atelectasis.
   e. All of the above.

12. Possible complications of asthma include which of the following?
   a. Muscle fatigue.
   b. Respiratory failure.
   c. Pneumomediastinum.
   d. Pneumonia.
   e. All of the above.

13. All the following represent asthma admission criteria except:
   a. Persistent oxygen requirement.
   b. Steroid therapy in emergency department or office.
   c. Underlying cardiopulmonary disease.
   d. Large pneumomediastinum.
**QUESTIONS 14–16:** An 11-year-old child presents with a history of cough and fever for 2–3 days. Vital signs: pulse 86, respiratory rate 20, pulse oximetry 97%, and temperature of 100.2°F orally. Physical examination notes poor breath sounds throughout the left lung.

14. Your interpretation of this X-ray is best described as:
   a. Normal.
   b. Tension pneumothorax on right.
   c. Pneumomediastinum.
   d. Atelectasis.
   e. Hemothorax.

15. Further history from the child now reveals that 4 days ago he swallowed a “plastic bullet.” The best explanation for the X-ray findings is:
   a. Complete obstruction of left main stem bronchus.
   b. Overinflation of the right lung, resulting in barotrauma.
   c. Consolidation from pneumonia.
   d. Blunt trauma.

16. The next diagnostic and/or therapeutic step is:
   a. Bronchoscopy.
   b. Left chest tube thoracotomy.
   c. Intravenous antibiotics and admission.
   d. CT scan of the chest.
QUESTIONS 17–19: A 12-month-old female arrives with both parents, who relate a history of fever and coughing at home. Vital signs: pulse 130, respiratory rate 32, pulse oximetry 99%, and temperature of 100.4°F rectally. Physical exam reveals mild wheezing throughout and occasional rales.

17. Your interpretation of this X-ray is best described as:
   a. Normal.
   b. Bilateral central infiltrates.
   c. Retrocardiac infiltrate.
   d. Atelectasis.

18. The X-ray findings are most consistent with a diagnosis of:
   a. No acute disease.
   b. Viral pneumonia.
   c. Bacterial pneumonia.
   d. Acute asthma exacerbation.

19. Therapy for this child would include:
   a. Intravenous antibiotics.
   b. Admission to the hospital.
   c. Fever control and hydration.
   d. Endotracheal intubation.
QUESTIONS 20–21: A 6-week-old female is brought to the emergency department with a 1-day history of coughing and congestion. Parents state that she had an episode of frequent coughing in the waiting room, but is better now. Vital signs: pulse 150, respiratory rate 40, pulse oximetry 99%, temperature of 99.8°F rectally. Physical exam reveals a normal lung and chest exam.

20. Your interpretation of this X-ray is best described as:
   a. Normal.
   b. Abnormal thymus.
   c. Right upper lobe infiltrate.
   d. Mediastinal shift to the right.

21. The clinical diagnosis is most consistent with:
   a. Normal.
   b. Pneumonic process.
   c. DiGeorge’s syndrome.
   d. None of the above.
QUESTIONS 22–24: You are called to urgently see a 6-week-old female in the pediatric ICU who has suddenly decompensated, becoming very bradycardic, cyanotic, and severely hypotensive. The child is admitted 36 hours post-op and in severe respiratory distress. A stat portable chest X-ray has just been completed.

22. Your interpretation of this X-ray includes all the following except:
   a. Endotracheal tube with distal end above the carina.
   b. Gastric tube with distal end below the diaphragm.
   c. Right mainstem intubation.
   d. Left subclavian line with the distal tip in the superior vena cava.
   e. Pneumopericardium.

23. The X-ray data and clinical presentation lead you to conclude a diagnosis of:
   a. Acute respiratory distress syndrome.
   b. Tension pneumopericardium or cardiac tamponade.
   c. Ventilatory circuit malfunction.
   d. Congestive heart failure.

24. The following intervention is most appropriate:
   a. Begin intravenous steroids.
   b. Withdraw the endotracheal tube 1–2 cm and re-evaluate.
   c. Disconnect the ventilatory circuit and begin aggressive bagging.
   d. Perform a pericardiocentesis.
QUESTIONS 25–29: A 10-year-old male presents with a history of fever and cough over the past 4 days. Vital signs: pulse 130, respiratory rate 22, temperature of 102.1°F, pulse oximetry 99% on room air. Physical exam reveals rhonchi in the left base.

25. The correct interpretation of this X-ray is:
   a. Normal.
   b. Retrocardiac infiltrate.
   c. Right middle lobe infiltrate and left lower lobe infiltrate.
   d. None of the above.

26. Proper management may include which of the following?
   a. Blood cultures.
   b. Antibiotics.
   c. Early follow-up by primary care physician.
   d. All of the above.

27. At this age, the most likely pathogen would be:
   a. Respiratory syncytial virus.
   b. *Mycoplasma pneumoniae*.
   c. Group B *Streptococcus*.
   d. *Listeria*.

28. Which of the following is/are true?
   a. Bilateral infiltrates are always “true” pneumonias.
   b. Unilateral infiltrates are always “true” pneumonias.
   c. Bilateral infiltrates are always “atypical” pneumonias.
   d. Unilateral infiltrates are always “atypical” pneumonias.
   e. None of the above.

29. All the following are true for “typical” versus “atypical” pneumonia except:
   a. Typical pneumonia is abrupt in onset and has a high-grade fever.
   b. Atypical pneumonia is gradual in onset and has low-grade fever.
   c. Localized findings and a toxic appearance are associated with the typical pattern.
   d. A productive cough is often associated with an atypical infection.
QUESTIONS 30–34: An 8-year-old child presents with recent headache, cough, fever, and nausea. Vital signs: pulse 95, respiratory rate 20, temperature of 102.1°F, pulse oximetry 98%.

30. The correct interpretation of this X-ray is:
   a. Normal.
   b. Left pleural effusion.
   c. Right-sided circular density.
   d. Left lower lobe infiltrate.

31. Clues to distinguishing a mass from an infiltrate include all the following except:
   a. An infiltrate is more likely given the clinical picture of fever, cough, and illness.
   b. Multiple circular densities would be more suspect for noninfectious lesions.
   c. The presence of costophrenic angle blunting and a “mass” near the lung fissure suggest a pseudotumor.
   d. The absence of known metastatic disease rules out a cancerous mass.

32. You suspect an infectious process, but schedule a follow-up X-ray. After the acute illness has improved, how long does it take for a pneumonic infiltrate to resolve on X-ray?
   a. 1–2 days.
   b. 4–6 weeks.
   c. 2–4 months.
   d. Up to 1 year.

33. Populations with high incidence of tuberculosis include all the following except:
   a. Immigrants from high-prevalence countries.
   c. HIV-infected patients.
   d. Crowded living conditions, such as shelters or prisons.
   e. Alcoholics or illicit drug users.

34. Chest X-ray findings in tuberculosis include all the following except:
   a. Hilar adenopathy.
   b. Upper lobe cavitary lesion.
   c. Atelectasis.
   d. Diffuse (1–3 mm) nodules.
   e. Pleural effusion.