



SPR 2015 POSTGRADUATE COURSE

Chest Imaging

For further study

Visualize the Future



4 month old infant born prematurely at 30 weeks. At what stage of lung development did the patient's injury most likely initiate?

- A. Embryonic
- B. Pseudoglandular
- C. Canalicular
- D. Saccular**
- E. Alveolar



Visualize the Future



Former 30 week infant. At what stage of lung development did the patient's injury initiate?

- A uniform pattern of coarsened interstitial opacities without large cystic lucencies or disordered aeration, is typical of the "new" BPD pattern.
- Option D is **CORRECT**. The saccular phase of lung development is between 28 to 34 weeks gestation.
- Option A is **NOT** correct. The embryonic phase of lung development is between 26 days to 6 weeks gestation.
- Option B is **NOT** correct. The pseudoglandular phase approximates 6 to 16 weeks gestation.
- Option C is **NOT** correct. The canalicular phase predominates in the 16 to 28 weeks gestation.
- Option E is **NOT** correct. The alveolar phase of lung development extends from approximately 36 weeks gestational age to 18 months.

Visualize the Future



4 month old infant born prematurely at 30 weeks. At what stage of lung development did the patient's injury most likely initiate?

- Agrons GA, et al. From the archives of the AFIP: Lung disease in premature neonates: radiologic-pathologic correlation. Radiographics 2005; 25: 1047-73
- Jobe AJ. The new BPD: an arrest of lung development. Pediatr Res 1999; 46: 641-3

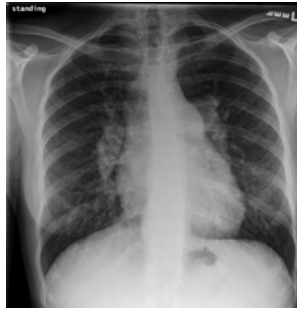
Visualize the Future





An intern shows you this chest radiograph and asks what he should order next. What would be the **WORST** answer he might come up with?

- A. No test, do a physical exam
- B. Place a PPD
- C. **CT angiogram**
- D. Catheter angiogram
- E. Echocardiogram



Visualize the Future



What would be the **WORST** answer he might come up with?

- Option C is **CORRECT** (the least reasonable test). CTA would show enlarged vessels but would not allow for a specific diagnosis of pulmonary HTN.
- Option A is **NOT** correct. Physical exam is always a part of the work up.
- Option B is **NOT** correct. The hila are prominent, and TB could be considered.
- Option D is **NOT** correct. While invasive, angiogram would allow measurement of pulmonary arterial pressures.
- Option E is **NOT** correct. Echocardiogram is a commonly used screening test for pulmonary HTN.

Visualize the Future



What would be the **WORST** answer he might come up with?

- Nicolarsen J, Ivy D. Progress in the diagnosis and management of pulmonary hypertension in children. *Curr Opin Pediatr.* 2014;26(5):527-35.
- Colvin KL, et al. Biomarkers for pediatric pulmonary arterial hypertension - a call to collaborate. *Front Pediatr.* 2014; 3;2:7.

Visualize the Future



Gadofosveset (Ablavar) can be reasonably safely administered in which one of the following scenarios?

- A. GFR < 30 ml/min/1.73 m sq.
- B. 1 week old infant
- C. Long QT syndrome.
- D. Prior serious allergic like reaction to conventional gadolinium based agents
- E. **1 year-old patient with concern for vascular ring**

Visualize the Future





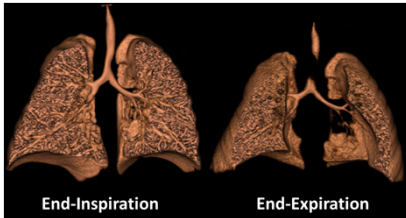
Gadofosveset (Ablavar) can be reasonably safely administered in which one of the following scenarios?

- Option E is **CORRECT**. Anatomical vascular imaging is clearly the role for a blood-pool contrast agent.
- Options A and D are **NOT** correct. Ablavar should be prescribed using the same guidelines as other MRI contrast agents with respect to renal function and allergic like reactions.
- Option B is **NOT** correct. Due to immature renal function of young infants (<2 months of age) Ablavar use should likely be restricted in this age group until further data is collected.
- Option C is **NOT** correct. Alavar is associated with an increase in QTc



Gadofosveset (Ablavar) can be reasonably safely administered in which one of the following scenarios?

- Rigsby C, et al. Safety of a blood pool contrast agent in children and young adults. *Pediatr Radiol* 2014; 44: S81
- Ablavar package insert from Lantheus Medical Imaging



Which one of these lung findings is often associated with the large airway disorder shown?

- A. Peripheral lung cysts
- B. Air trapping**
- C. Ground glass opacity in the right middle lobe and lingula
- D. Hyperinflation in all lobes



Which one of these lung findings is often associated with the large airway disorder shown?

- Option B is **CORRECT**. Pediatric patients with tracheomalacia have a higher frequency and greater severity of air trapping than do children without tracheomalacia.
- Option A is **NOT** correct. Peripheral lung cysts are associated with Down's syndrome.
- Option C is **NOT** correct. Ground glass opacity in the right middle lobe and lingula is seen in pediatric patients with neuroendocrine cell hyperplasia of infancy (NEHI).
- Option D is **NOT** correct. Hyperinflation involving all lobes is seen in pediatric patient with filamin A mutation.





Which one of these lung findings is often associated with the large airway disorder shown?

- Lee EY, et al. Expiratory volumetric MDCT evaluation of air trapping in pediatric patients with and without tracheomalacia. *AJR Am J Roentgenol* 2010; 194(5): 1210 – 1205
- Lee EY, Greenberg SB, Boiselle PM. Multidetector computed tomography of pediatric large airway diseases: state-of-the-art. *Radiol Clin North Am* 2011; 49(5): 869 – 893

Visualize the Future



What is the most common early complication following this procedure?

- A. Mediastinitis
- B. Pneumothorax**
- C. Hemothorax
- D. Pericarditis
- E. Overcorrection



Visualize the Future



What is the most common early complication following this procedure?

- Option B is **CORRECT**. Pneumothorax is the most common early postsurgical complication of the Nuss procedure. Additional common complications include infection and hardware displacement.
- Options A, C, D and E are **NOT** correct because they are much less common complications.

Visualize the Future



What is the most common early complication following this procedure?

- Goretsky MJ, et al. Chest wall anomalies: pectus excavatum and pectus carinatum. *Adolesc Med* 2004; 15: 455-471
- Fefferman NR, Pinkney LP. Imaging evaluation of chest wall disorders in children. *Radiol Clin N Am* 2005; 43: 355-370

Visualize the Future





Childhood interstitial lung disease is often characterized by:

- A. Diffuse infiltrates on imaging
- B. Disordered gas exchange
- C. Respiratory distress
- D. **All of the above.**



Childhood interstitial lung disease is often characterized by:

- Option D is **CORRECT**. The hallmark features of ChILD include abnormalities on imaging, hypoxemia, increased work of breathing and often nutritional failure.
- These features are nonspecific, so a high index of suspicion for ILD is necessary.



Childhood interstitial lung disease is often characterized by...

- Fan LL, et al. Pediatric interstitial lung disease revisited. *Pediatr Pulmonol* 2004; 38: 369–378
- Fan LL, Kozinetz CA. Factors influencing survival in children with chronic interstitial lung disease. *Am J Respir Crit Care Med* 1997; 156: 939–942
- Deterding R. Evaluating infants and children with interstitial lung disease. *Semin Respir Crit Care Med* 2007; 28: 333–341



Which of the following is true regarding imaging of congenital lung anomalies?

- A. Location is a reliable differentiator between the types of foregut duplication cysts.
- B. **Bronchial atresia is commonly associated with other congenital anomalies.**
- C. MRI offers no advantage over CT and serves no useful role in evaluating foregut duplication cysts.
- D. Multiplanar reformations are of limited value in imaging congenital lung anomalies.





Which of the following is true regarding imaging of congenital lung anomalies?

- Option A is **NOT** correct. Different types of foregut duplication cysts do have a predisposition for certain locations, but the exact diagnosis is based on histology.
- Option B is **CORRECT**. Bronchial atresia is commonly found with other congenital lung anomalies.
- Option C is **NOT** correct. CT and MRI are both useful. MRI can better characterize the cysts contents.
- Option D is **NOT** correct. Multiplanar reformations and 3D reconstructions add diagnostic value in detecting associated anomalous vessels.



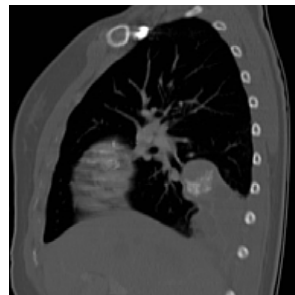
Which of the following is true regarding imaging of congenital lung anomalies?

- Riedlinger WF, et al. Bronchial atresia is common to extralobar sequestration, intralobar sequestration, congenital cystic adenomatoid malformation, and lobar emphysema. *Pediatr Dev Pathol* 2006; 9: 361-373
- Lee EY, et al. Preoperative MDCT evaluation of congenital lung anomalies in children: comparison of axial, multiplanar, and 3D images. *AJR AM J Roentgenol* 2011; 196: 1040-1046
- Thacker PG, et al. Developmental lung malformations in children: recent advances in imaging techniques, classification system, and imaging findings. *J Thoracic Imaging* 2015; 30: 29-45



13 year old female with recurrent pneumonia. What is the most likely diagnosis?

- Bronchogenic carcinoma
- Metastatic osteosarcoma
- Bronchoalveolar carcinoma
- Bronchial carcinoid tumor**
- Hamartoma



13 year old female with recurrent pneumonia. What is the most likely diagnosis?

- Option D is **CORRECT**. Bronchial carcinoid is associated with the tracheobronchial tree and is usually symptomatic with wheezing, pneumonia and atelectasis, but is rarely hormonally active in children.
- Option A and C are **NOT** correct. These tumors are extremely rare in children.
- Option B is **NOT** correct. There is no history of prior malignancy.
- Option E is **NOT** correct. Hamartoma usually contains "popcorn" calcifications and areas of fat.





13 year old female with recurrent pneumonia.
What is the most likely diagnosis?

- Curtis JM, et al. Endobronchial tumors in childhood. Eur J Radiol 1998; 29: 11-20



What is the earliest corrected gestational age that a patient can be diagnosed with bronchopulmonary dysplasia according to the NIH consensus criteria?

- A. 28 weeks
- B. 32 weeks
- C. **36 weeks**
- D. 40 weeks
- E. 44 weeks



What is the earliest corrected gestational age that a patient can be diagnosed with bronchopulmonary dysplasia according to the NIH consensus criteria?

- Option C is **CORRECT**. The NIH consensus criteria for bronchopulmonary dysplasia for infants born before 32 weeks is defined as:
 - O₂ requirement at 36 weeks' corrected gestational age
 - supplemental oxygen for at least 28 days
 - severity of disease (mild, moderate, severe) is based on the amount of supplemental oxygen at 36 weeks CGA
- Options A, B, D, and E are **NOT** correct. The NIH criteria for bronchopulmonary dysplasia cannot be applied until the patient is 36 weeks corrected GA.



Timing of the diagnosis of bronchopulmonary dysplasia according to the NIH consensus criteria...

- Ehrenkranz RA, et al. Validation of the National Institutes of Health consensus definition of bronchopulmonary dysplasia. Pediatrics 2005; 116: 1353-60.
- Parad RB. Update on the diagnosis and management of bronchopulmonary dysplasia/chronic lung disease of infancy: what the radiologist should know. Pediatr Radiol 2012;42 Suppl 1:S92-100





The properties of Gadofosveset (Ablavar) would be best utilized in which of the following scenarios?

- A. Tissue characterization of a solid thoracic tumor
- B. Anatomical assessment of complex post-surgical vasculature**
- C. Assessment for late gadolinium enhancement in the setting of suspected myocardial infarction
- D. Assessment for vessel wall enhancement in the setting of vasculitis
- E. Anatomical assessment of the airway



The properties of Gadofosveset (Ablavar) would be best utilized in which of the following scenarios?

- Option B is **CORRECT** as anatomical vascular imaging is clearly the role for a blood-pool contrast agent.
- Option A, C and D are **NOT** correct. Ablavar remains largely within the blood-pool which will limit tissue characterization/enhancement.
- Option E is **NOT** correct as Ablavar has no specific role in airway imaging.



The properties of Gadofosveset (Ablavar) would be best utilized in which of the following scenarios?

- Farmakis SG, Khanna, G. Extracardiac applications of MR blood pool contrast agent in children. *Pediatric Radiology* 2014; 44: 1598–1609
- Thouet T, et al. Visualization of Chronic Myocardial Infarction Using the Intravascular Contrast Agent MS-325 (Gadofosveset) in Patients. *Scientific World Journal* 2012. doi: 10.1100/2012/236401



Askin's tumor of the chest wall is histologically most similar to which of the following tumors?

- A. Fibrous dysplasia
- B. Osteosarcoma
- C. Ewing sarcoma**
- D. Enchondroma
- E. Langerhans' cell histiocytosis





Askin's tumor of the chest wall is histologically most similar to which of the following tumors?

- Option C is **CORRECT**. Askin's tumor and Ewing sarcoma are both members of the primitive neuroectodermal tumor (PNET) family. These lesions are malignant "small round cell tumors."
- Options A, B, D and E are **NOT** correct. None of these options are PNETs.



Askin's tumor of the chest wall is histologically most similar to which of the following tumors?

- Farsak B, et al. Cervical aortic arch with aneurysm formation. Eur J Cardiothoracic Surg 1998; 14(4): 437-439



Which one of these CT parameters is NOT optimal for dynamic 4D airway imaging with MDCT?

- A. mA determined by patient weight
- B. 80 kVp
- C. Continuously scanning for 1.4 seconds (4 cycles at 350 ms/rotation)
- D. Reconstruction of 8 phases of the obtained CT data set for image review in static mode**



Which one of these CT parameters is NOT optimal for dynamic 4D airway imaging with MDCT?

- Option D is **CORRECT**. The most important benefit of 4D airway large airway imaging with MDCT is its capability for the real time review of anatomic structures. Images review should be performed in cine mode instead of static mode.
- Options A, B, C are all appropriate for 4D airway imaging with MDCT.





Which one of these CT parameters is NOT optimal for dynamic 4D airway imaging with MDCT?

- Lee EY, Greenberg SB, Boiselle PM. Multidetector computed tomography of pediatric large airway diseases: state-of-the-art. Radiol Clin North Am 2011; 49: 869 – 893.
- Lee EY, et al. Advanced large airway CT imaging in children: evolution from axial to 4-D assessment. Pediatr Radiol 2013; 43: 285 – 297



14 year old girl with chronic lung disease and decreased exercise tolerance. No history of cardiac disease. Which of the following would be the most concerning set of results?

- A. Normal echocardiogram, cardiac MRI and angiogram
- B. Normal echocardiogram and cardiac MRI. Mean pulmonary artery pressure equal to systemic on catheter angiogram.
- C. Moderate Tricuspid regurgitation on echocardiogram, pulmonary artery pressure estimate $\frac{1}{4}$ systemic on MRI, normal angiogram.
- D. Mild tricuspid regurgitation on echocardiogram, pulmonary artery pressure estimate $\frac{1}{4}$ systemic on cardiac MRI, mean pulmonary artery pressure twice systemic on catheter angiogram
- E. Severe tricuspid regurgitation on echocardiogram, pulmonary artery pressure estimate 1.5 times systemic on cardiac MRI, mean pulmonary artery pressure twice systemic on catheter angiogram



14 year old girl with chronic lung disease and decreased exercise tolerance. No history of cardiac disease. Which of the following would be the most concerning set of results?

- Option A is **CORRECT**. This does not make sense and likely an error has occurred.
- Options B, C, and D are **NOT** correct. These reflect inconsistent results among the three modalities that are not unexpected.
- Option E is **NOT** correct. With this degree of pulmonary artery enlargement normal pulmonary arterial pressure would be extremely unlikely.



Pulmonary hypertension. Which of the following would be the most concerning set of results?

- Nicolarsen J, Ivy D. Progress in the diagnosis and management of pulmonary hypertension in children. Curr Opin Pediatr. 2014;26(5):527-35.
- Colvin KL, et al. Biomarkers for pediatric pulmonary arterial hypertension - a call to collaborate. Front Pediatr. 2014; 3;2:7.





Regarding developmental interruptive lung lesions, which of the follow is the best answer?

- A. Pulmonary agenesis and aplasia are largely the result of developmental arterial occlusion.
- B. Primary pulmonary hypoplasia results from intrinsic etiologies resulting in limited fetal lung development.
- C. In pulmonary hypoplasia, the affected hemithorax is increased in size due to herniation of the contralateral lung.
- D. Oligohydramnios is a secondary cause of pulmonary hypoplasia.**



Regarding developmental interruptive lung lesions, which of the follow is the best answer?

- Option A is **NOT** correct. The cause of pulmonary agenesis and aplasia remains unknown.
- Option B is **NOT** correct. Primary pulmonary hypoplasia has no identifiable etiology. Causes of secondary pulmonary hypoplasia include congenital diaphragmatic hernia, oligohydramnios, thoracic dystrophy and congenital pulmonary masses.
- Option C is **NOT** correct. In pulmonary hypoplasia, the affected hemithorax is asymmetrically small with the exception of mild pulmonary hypoplasia where the hemithoraces are relatively symmetric in size.
- Option D is **CORRECT**. Oligohydramnios represents an extrinsic cause of secondary pulmonary hypoplasia.



Regarding developmental interruptive lesions, which of the follow is the best answer?

- Thacker PG, et al. Developmental lung malformations in children: recent advances in imaging techniques, classification system, and imaging findings. J Thoracic Imaging 2015; 30: 29-45
- Lee EY, et al. Congenital pulmonary malformations in pediatric patients: review and update on etiology, classification, and imaging findings. Radiol Clin North Am 2011; 49: 921-948
- Thacker PG, et al. Congenital lung anomalies in children and adults: current concepts and imaging findings. Radiol Clin North Am 2014; 52: 155-181



A systematic approach to the diagnosis of childhood interstitial lung disease is preferred over directly proceeding to VATS or open lung biopsy.

- A. True**
- B. False





A systematic approach to the diagnosis of childhood interstitial lung disease is preferred over directly proceeding to VATS or open lung biopsy.

- Option A (true) is **CORRECT**.
- Childhood interstitial lung diseases are markedly different from those of adults.
- Developments in genetic testing allow for various forms of ILD related to surfactant dysfunction to be diagnosed without need for lung biopsy (eg. SFTPB, SFTPC, NKX2B).
- Radiologic trends have been established allowing for diseases such as NEHI to be diagnosed without lung biopsy.
- Rheumatologic associated ILD can often be diagnosed with imaging and serologic results +/- biopsy of organs other than the lung (eg. Kidney).



A systematic approach to the diagnosis of childhood interstitial lung disease is preferred over directly proceeding to VATS or open lung biopsy.

- Fan LL, et al. Evaluation of a diagnostic approach to pediatric interstitial lung disease. *Pediatrics* 1998; 101: 82–85
- Brody AS, Crotty EJ. Neuroendocrine cell hyperplasia of infancy (NEHI). *Pediatr Radiol* 2006; 36: 1328
- Guillerman RP, Brody AS. Contemporary Perspectives on Pediatric Diffuse Lung Disease. *Radiol Clin N Am* 2011; 49: 847–868

