DCMC Emergency Department Radiology Case of the Month

These cases have been removed of identifying information and are intended for peer review and educational purposes only.

Welcome to the DCMC Emergency Department Radiology case of the month!

In conjunction with our pediatric radiology specialists from ARA we hope you enjoy these monthly radiological highlights from the case files of the Emergency Department at DCMC. These cases are meant to highlight important chief complaints, cases, and radiology findings that we all encounter every day.

If you enjoy these reviews we invite you check out Pediatric Emergency Medicine Fellowship Radiology Rounds, which are currently offered quarterly and are held with the outstanding support of the pediatric radiology specialists at Austin Radiologic Association.

If you have any questions or feedback regarding the Case of the Month format, feel free to email Robert Vezzetti, MD at rvuzzetti@seton.org.

This month: It was inevitable! Coughing season is here and children are in the middle of a full and productive (pardon the pun) upper respiratory infection. Most of these children have a viral cause of their symptoms; some do not. Sorting out who needs chest imaging and who doesn’t can be tricky. Let’s ring in the New Year by looking at some chest films....
CASE 1
Cough, cough everywhere...Ah Winter and Pediatrics! They do together like mac & cheese, peas & carrots, you get the idea. First up is a 7 year old male who has had cough and fever (up to 103) for the past 2 weeks. He has had some mild congestion. He also has begun to complain about right upper and epigastric abdominal pain for the past 7 days. He was seen several times by his Pediatrician. This last visit, which was 3 days ago, ended with a prescription for Amoxicillin for a throat infection (no strep test done per his mother). They deny travel or sick contacts, but he’s in school.

His exam shows an afebrile child who has a respiratory rate of 22 (without retractions) and a room air pulse oximetry of 95%. He is nontoxic and conversing. His ears and throat look completely normal. He is not meningitic. His heart sounds fine (no murmur, rub) and his chest exam is relatively ok too. He does not have wheezing or crackles, but he does have slightly decreased breath sounds on the right. His abdomen is benign. The thought crosses you that this child may have pneumonia. Does he need an imaging test? He is on Amoxicillin and he continues with fever. Is this a reason to get a xray? Mom is demanding answers!

CASE 2
A 20 month old female with an extensive past medical history (GERD with Nissen and G button, ASD, Coarctation of the aorta, now repaired) presents to the ED with cough and congestion for 4 days. She was seen at an outside ED where an CBC was obtained that revealed a WBC of 13 with 66 segs and 18 lmphs; she had a normal CMP and a negative influenza test; the treating ED physician said an RSV test was negative but he “doesn’t believe it.” A chest xray was obtained and this showed pneumonia for which she was given a dose of Ceftriaxone. Today, she developed fever to 101.5 and increased work of breathing. There has been no vomiting or diarrhea. Her exam demonstrates a well-appearing child with respiratory distress. She has a temperature of 101.5 and a respiratory rate of 75, with moderate intercostal retractions and scattered bilateral rhonchi and wheezing, without crackles, grunting or stridor. Oxygen saturation is 93% on room air. The outside chest films were not sent and the ED from which the patient came is 4 hours away...great. Mom wants to know if her daughter does indeed have pneumonia and if so, what antibiotics should you continue? She also wants to know if admission is necessary. Should you repeat the film?

CASE 3
A 17 month old female with a past history of bronchiolitis presents with cough, congestion, and fever to 104 for the past 3 days. She has had nonbilious emesis and decreased po intake; in fact she has had only 1 wet diaper in 24 hours. On exam, she is listless and in respiratory distress. Her mucus membranes are dry; she has moderate intercostal retractions and scattered rhonchi; there is decreased breath sounds to the right and crackles to the right lower lobe. Her respiratory rate is 60 and her oxygen saturation is 97% on 3L nasal cannula. You obtain IV access and give her a fluid bolus. Labs are obtained; her CBC shows a white blood cell count of 23 with 85 segs and 15 bands. Her flu test is negative. Does this child need an imaging study?

HERE’S A BRIEF OXYGEN DELIVERY SYSTEM OVERVIEW. NOTE HIGH FLOW: A BLEND OF HUMIDIFIED OXYGEN AND AIR...GREAT FOR BRONCHIOLITIS!

Nasal Cannula
2-6 L/min
40% oxygen

Simple Face Mask
5-8 L/min
Hard to provide a known/stable FIO2; 50% oxygen

Nonrebreather
8-10 L/min
60% O2

CPAP and BiPAP

High Flow Oxygen

2008 gave the world a new Ball for New Years! This one is a geodesic sphere, 12 feet in diameter and weighing 11,875 pounds. It is built to withstand high winds and fluctuating temperatures. Waterford Crystal introduces a different pattern for each New Years celebration.
What's with that cough? The differential diagnosis of cough in Pediatrics can be enormous, involving intrapulmonary and extrapulmonary disease. For the purposes of this month's newsletter, we are going to focus on cough due to an infectious etiology. Always keep in mind, though, that cough sometimes is gastroesophageal reflux disease, a foreign body, an anatomic issue (vascular ring or sling), a mass...one could keep going.

Imaging for Pneumonia
Looking for pneumonia on a plain radiograph? Then consider the following:
Aeration pattern, lung expansion, pleural spaces, diaphragmatic margins, costophrenic angles, cardiothymic silhouette, and name of the patient (gotta make sure it's the right kiddo).

Who Should Get A Chest Xray?
This is a little more controversial, but here are some guidelines:
Tachypnea
Retractions
Nasal Flaring
Grunting
Rales
Decreased Breath Sounds
Respiratory Distress
Any child who is not progressing clinically as expected.

Assessing Heart Size:
Greatest Diameter from midline to right heart border (red arrow) PLUS the diameter from the midline to the left heart border (blue arrow) DIVIDED by the total diameter of the chest (green arrow). This will vary with age, and can vary with technique.

Obtaining a lateral view is ALWAYS a good idea, providing that your patient is stable. This view is extremely useful when looking at the retrocardiac space, as well as heart size!
You decide to obtain a film. This child is on antibiotics that, if pneumonia is present, is appropriate treatment. However, could he have developed pneumonia after being prescribed the Amoxicillin for his throat infection? His film is seen here on the right. Notice anything? The PA view is not terribly impressive; there appears to be some perihilar thickening, looking most consistently viral. The lateral is another matter. There is a finding consistent with an infiltrate without effusion. See? Lateral films are helpful!

Case 1
There may be some thickening seen on this view, concerning for a retrocardiac process.

HMM...Looks concerning, doesn’t it? This film is tricky, because there are multifocal areas of consolidation (red arrow) that may represent infiltrate, but most likely atelectasis given this film’s appearance (for a discussion about how to determine one from the other, see below).

Case 2

Radiographic Patterns of Pneumonia: While not absolute, there are recognizable patterns of pneumonia on plain radiography. Infants may demonstrate air bronchograms or a “ground glass” appearance (Chlamydia can cause this). Densities that obscure structures may reflect a bacterial etiology and the presence of an effusion is very suggestive of an infectious process. Lobar consolidation with air bronchograms is often seen in bacterial pneumonia. Mycoplasma infections can look like anything, so history is very important.

BY the way, notice the sternotomy wires (blue arrow) and PDA clip (yellow arrow)?
**Atelectasis vs Infiltrate: How Can You Tell?**

Atelectasis is very commonly seen on pediatric chest x-rays and, more often than not, confused with infiltrate. Generally, atelectasis will displace fissures of the lung and cause opacification of involved lobes. There can be displacement of the hilum, loss of volume, and will silhouette structures (such as the diaphragm or major blood vessels).

Infiltrate refers to an accumulation of an abnormal substance that is foreign to the lung or is a substance that is present in a greater quantity than normal. Use of the term is increasingly discouraged. On radiographs, involved structures are obscured or (in the case of round pneumonia) the appearance can be pretty distinct.

The problem is that the two can often be difficult to distinguish on chest x-ray, so clinical history and exam are important!

### Case 3

Clinically, this child has pneumonia. Do you really need a film? In this case, one was obtained because of the concern of more than pneumonia, possibly a large effusion or empyema, given the exam and toxicity of the child. Here's the film. There is an overall viral pattern (orange arrow) but there is also an opacity in the right lower lobe that may be atelectasis, but infiltrate is also possible (blue arrow). There is also blunting of the right costophrenic angle, suggesting fluid/effusion (red arrow).

The films on the left are from an 8 year severely hypoxic child with cough and emesis. Note the patchy pulmonary opacities bilaterally (yellow arrow) and the pneumomediastinum (orange arrow). This child was admitted to the PICU secondary to hypoxia. This is often seen with atypical pneumonia (mycoplasma); the child is also the usual age for this illness. She was treated with Zithromax and aggressive pulmonary toilette; she did well after a week in the hospital.

This 5 year old child presented with fever, cough, and decreased po intake for the past 5 days. The films on the right demonstrate a lobar opacity of the left lower lobe. This is a good example of the value of a lateral view. One can make out the density on the AP view (red arrow), but the lateral view shows it quite clearly. She was treated with high dose Amoxicillin and did well. See below for a discussion on pneumonia etiology and treatment.

**Treatment for bacterial pneumonia depends on several factors, including age, clinical history and exam, and co-morbidities (immune compromise, etc). The most common cause of pneumonia in children is VIRAL; bacterial causes are usually due to S. pneumoniae, S. aureus (especially following influenza infection) and Mycoplasma or C. pneumoniae (older children especially).**
Teaching Points

1. Pneumonia in most children is a clinical diagnosis, supported by history and physical examination findings. Imaging is not indicated in all patients with pneumonia. 

2. Plain radiography is typically sufficient for imaging children with pneumonia. Obtaining two views is ideal, especially to evaluate the retrocardiac space.

3. When suspecting emphyema or abscess, Ultrasound is a good first choice for evaluation. CT may also be used. (See the JUNE 2015 issue for a more detailed discussion of this).

4. Most pneumonia in children is caused by viral infections. When bacterial infections are suspected, then the most common causes are S. pneumoniae, S. aureus, and, especially in older children, M. pneumoniae and C. pneumoniae.

5. Amoxicillin is the first line antibiotic choice in children whom bacterial pneumonia is suspected. For complicated pneumonia/empyema, or when MRSA is suspected, Clindamycin or Vancomycin are typically added. (See the DCMC PNeumonia and Complicated Pneumonia Pathway, available on the DCMC website).

References


