Introduction

- The purpose of this module is to present straightforward patient cases in order to:
  - Augment your understanding of the core anatomy
  - Enhance your ability to distinguish normal vs. not normal
  - Provide image interpretation practice
  - Introduce concepts not explicitly taught in the core anatomy module

- We expect pre-clinical medical students to be challenged by some of these cases. It is okay not to know the diagnosis!
  - Even if you are not familiar with the disease presentations, try and use the imaging studies to create an educated guess concerning what may or may not be “pathological.”
Case 1
“A 35 year old G0P0 Female visits the hospital ED. She reports experiencing chills + fever for approximately 1 week, followed shortly by a dry cough. She denies recent travel or sick contacts.

The patient endorses a PMH significant for multiple sinus and ear infections. She was born in India, and has had poor access to healthcare until recently. She is not currently taking any medications.

Her vitals are wnl; physical exam is notable for mild crackles in the lower lung fields bilaterally.”
“The ED physician orders a CXR, demonstrated to the right.”

What is the likely diagnosis?
Diagnosis: Primary Ciliary Dyskinesia

• Primary Ciliary Dyskinesia, also known as Kartagener’s Syndrome, is characterized by symptoms such as:
  • Situs inversus totalis
  • Recurrent ear, sinus, and/or pulmonary infections
  • Reduced or absent fertility

• The syndrome results from mutations that impair proper function of the molecular dynein arm, which impedes ciliary function

• Please see the next slide for an explanation of diagnostic details provided by the CXR
Primary Ciliary Dyskinesia: Imaging Clues

Aortic knob is indicative of a right sided aorta

Dextrocardia demonstrated by the prominent right heart border

Right-sided gastric bubble suggests L-> R transposition of the stomach

There are no consolidations indicative of active pneumonia
Case 2
Patient Presentation - HPI

“A 5 year old male w/o significant PMH is brought to the ED by his mother due to 3 days of sore throat, rhinorrhea, nonproductive cough, and general malaise. The patient endorses sick contacts at his daycare, but denies recent travel.

The patient’s mother reports that his vaccinations are up-to-date, and that he is not currently taking any medications.

The patient’s vitals are wnl; physical exam is notable for moderate crackles in the lower right lung field.”
“The ED physician orders a CXR demonstrated to the left.”

What is the differential diagnosis following this imaging?

Are there any incidental findings?
Diagnosis:

This CXR does not demonstrate consolidations indicative of active pneumonia. As such, the differential diagnosis includes URI vs. bronchitis; further clinical workup is necessary.

Incidental Findings:

Note the right-sided aortic knob in the context of a normal, left sided heart. This represents a right-sided aortic arch, a variant that arises during embryogenesis.

In many cases, a right sided aortic arch remains asymptomatic. It can also be associated with pathology such as DiGeorge Syndrome.
Case 3
“A 24 year old male presents to the ED with acute onset chest pain and shortness of breath. He reports that he was playing basketball with his friends when his symptoms suddenly started. His chest pain is sharp in quality, and increases when he attempts to take a deep breath.

The patient’s PMH is significant for severe myopia. He was adopted at a young age, and is unsure of his family history. He is not currently taking any medications.

The patient is tachycardic with a HR of 110, but otherwise vitals are wnl. Physical exam is notable for tall stature and decreased breath sounds in the right lung fields.”
“Concerned, the ED physician orders a CXR, shown to the right.”

What is the diagnosis?
Diagnosis:

Spontaneous Pneumothorax

Note how the partially collapsed lung can be visualized in the CXR, as denoted by the white arrows.
Diagnosis: Spontaneous Pneumothorax

• A spontaneous pneumothorax involves build-up of air in the intrapleural space, leading to separation of the lung from the chest wall
  • Severity of symptoms and hemodynamic status is often tied directly to how large the pneumothorax is
    • Large pneumothoraxes can begin to compress nearby vascular structures (i.e. the IVC), compromising blood flow to the heart

• Most spontaneous pneumothoraxes are idiopathic
  • However, certain conditions such as connective tissue disorders can predispose individuals
    • The patient in this case may suffer from Marfan’s syndrome, given the tall stature and severe myopia
Patient Presentation - HPI

“A 65 year old G2P2 Female is recovering in post-op following a cardiac surgery when she develops labored breathing.

The patient has a PMH significant for diabetes mellitus type 2, congestive heart failure, and osteoarthritis. Prior-to-admission medications include Metformin 1000 mg QD and Lisinopril 20 mg QD.

Vitals on exam are wnl; physical exam is notable for decreased breath sounds in the left lung fields.”
“The on-call attending physician orders a CXR, shown to the left.”

What is the diagnosis?

What was the likely mechanism?
Diagnosis: Left Diaphragmatic Paralysis

Normally, the diaphragm is higher on the right than the left (due to the relative positions of the liver and heart). However, note here that the left diaphragm is higher and compressing the left lung field. This is indicative of left-sided diaphragmatic paralysis.

Note the right-sided tracheal (and mediastinal) deviation resulting from compression by the paralyzed diaphragm and underlying viscera.

This was most likely the result of damage to the left phrenic nerve during cardiac surgery.
Case 5
“A 72 year old male is brought into the ED by his nursing home staff due to chief complaint of chills and fever ($T_{max} = 103.4$ °F) persisting for at least one week. The patient also endorses a concurrent cough productive of dark green sputum. He endorses multiple sick contacts at his nursing home, but denies recent travel.

The patient’s PMH is notable for peripheral artery disease, persistent atrial fibrillation, and diabetes mellitus type 2, all well controlled with medication.

Vitals on exam are notable for temperature of 101.6 °F, but otherwise wnl; Physical Exam is notable for rales in the lower left lung field.”
“Concerned with this clinical presentation, the ED physician orders a CXR, shown to the right.”

What is the diagnosis?
Diagnosis:

Pneumonia

Note the infiltrate in the left lung consistent with pneumonia.

This is most likely a consolidation in the left lower lobe given the distinct cardiac margin.
Diagnosis: Pneumonia

• Pneumonia is usually an infectious process that impacts the alveoli of the lungs
  • The infection can be viral, bacterial, or fungal in nature
  • Some patients may have no symptoms; others can present with symptoms such as:
    • Productive Cough
    • Chest Pain
    • Chills/Fever

• On CXR, the pus generated by the infection appears as a consolidation, providing diagnostic clues

• Older patients, such as the one in this case, are particularly at risk of mortality from pneumonia
Case 6
Patient Presentation - HPI

“An unresponsive 28 year old male is brought into the ED by EMS services. The patient is accompanied by his mother, who reports that the patient was eating a meal when he suddenly complained of debilitating chest pain, subsequently losing consciousness.

The patient does not have a significant PMH. His mother does report that the patient was experiencing hoarseness for the past few months, ascribed to GERD by his PCP. He was taking OTC omeprazole PRN as a result.

The patient’s family history is notable for a father that passed away suddenly at the age of 35 due to ‘heart problems.’

The patient’s vitals are notable for a BP of 80/50, as well as a HR of 145 bpm. GCS on admission was 5. Physical exam is notable for tall stature.”
“In the ED, the patient receives a chest CT w/ contrast”

A single axial cross-section from this CT is shown to the right.

What is the diagnosis?
Diagnosis:

Thoracic Aortic Dissection

In the axial CT cross-section, note the enlarged aorta with two separate lumen, separated by an intimal flap
Diagnosis: Thoracic Aortic Dissection

• Aortic dissections occur when the intima of the aorta separates from the underlying aortic layers, creating a separate “lumen” for blood to flow into:

![Aortic Dissection Diagram]

• Aortic dissections are medical emergencies, with high morbidity/mortality rates even after timely intervention

• A variety of conditions, such as connective tissue disorders, can predispose individuals to these dissections

• In this particular case, the patient’s family history of early cardiac death and tall stature could suggest a diagnosis of Marfan’s Disease
  • The fact that the patient was suffering from hoarseness for a few months could be indicative of an expanding thoracic aortic aneurysm that now ultimately dissected
Case 7
Patient Presentation - HPI

“A 19 year old male presents to the ED with chief complaint of severe non-radiating substernal chest pain, exacerbated when he takes a deep breath. The patient notes that he had been scuba diving the day prior.

The patient has no significant PMH. He is not currently taking any medications.

Vitals on exam are wnl; Physical exam was not performed prior to imaging.”
“As a part of the diagnostic work-up, the attending physician in charge of this patient’s care orders a CXR, shown to the left.”

What is the diagnosis?
Diagnosis:
Pneumomediastinum

Pneumomediastinum refers to the presence of free air in the mediastinum, or space between the lungs. A wide variety of causes, from trauma to scuba diving, can lead to this pathology. See below for diagnostic clues provided by the CXR:

Note the presence of gas under the skin above the clavicles bilaterally (subcutaneous emphysema)

Notice how sharp the border of the heart appears; this is due to the difference in density between soft tissue of the heart and free air within the mediastinum
END