

# Complications of Metastatic Malignancy

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RAD 4001

# Clinical History

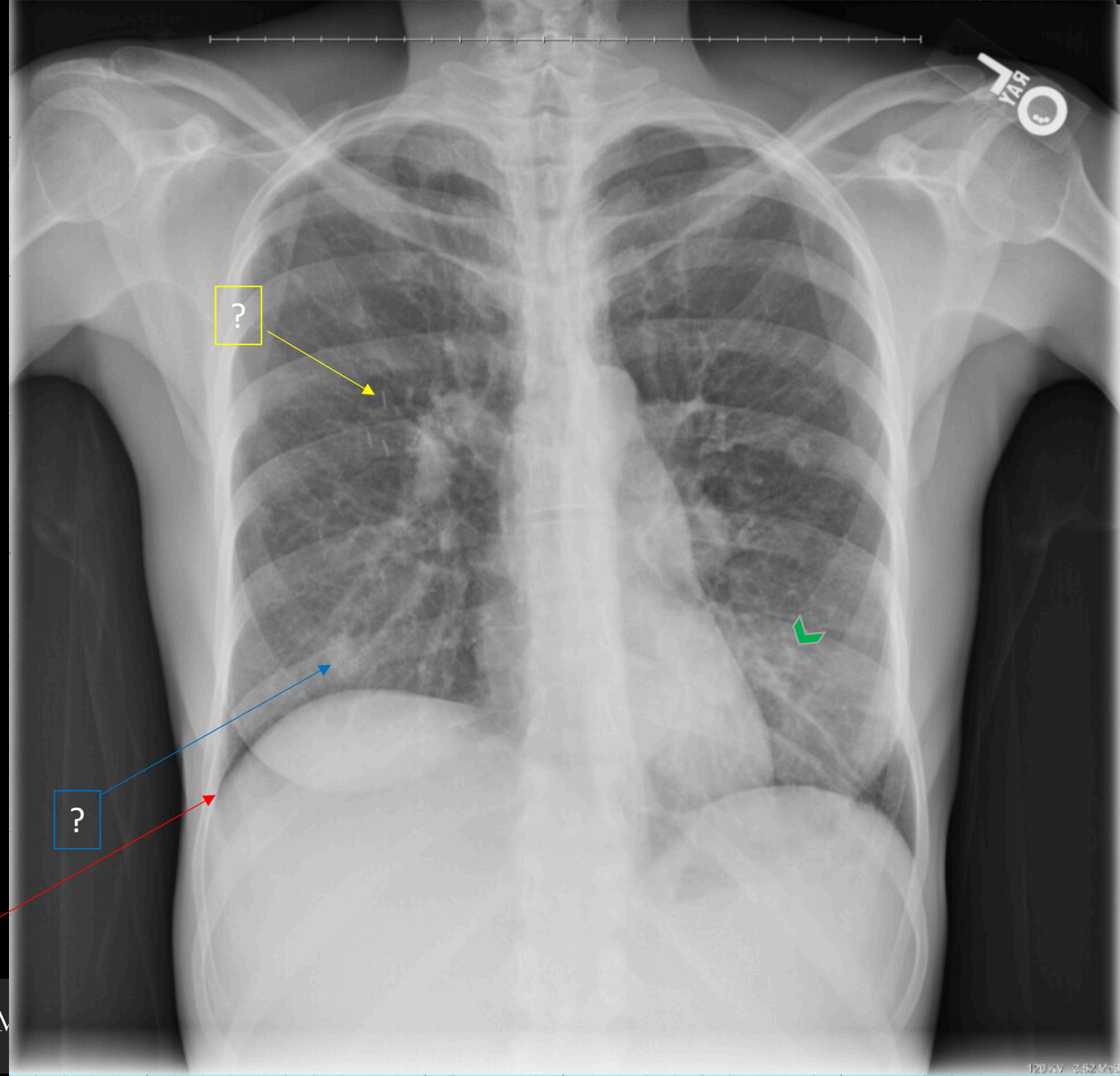
06/01/2019 21:21	Temperature Oral	102.1 DegF HI
	Peripheral Pulse Rate	69 bpm Normal
	Respiratory Rate	16 BRMIN Normal
	SpO2 percent	98 % Normal
	Systolic Blood Pressure	120 mmHg Normal
	Diastolic Blood Pressure	69 mmHg Normal

- Pt was a 39 yo F with widely metastatic breast cancer currently being treated, presenting to ED 6.1.19
  - CC: started IV chemo yesterday and around 2 pm today I developed fever to 101 and it isn't going down
- Pt reports recent history of possible pneumonia and endorses abdominal pain.
- CXR and RUQ US ordered. NS, Tylenol, cefepime given and admitted to IMU with dx sepsis.



# PA CXR 6.1.19

- Patchy LLL airspace disease (arrowhead)
- Nodular density RLL vs nipple



Elevated Hemidiaphragm

# RUQ US

- Small volume perihepatic and pericholecystic ascites
- Hepatomegaly, steatosis



# Clinical History Continued

- At the IMU, enoxaparin is started for dvt prophylaxis.
- On 6.2.19 CT chest without contrast ordered for fever, history of malignancy, cough
- On 6.3.19, procalcitonin returns at 4.87; hgb downtrends from 9.3 on admit to 7.3
- While receiving 1 unit prbcs for continued tachycardia and the low hgb, pt experiences respiratory distress and placed on bipap and 100% fio2, to ICU.
- Sometime during day on 6.3.19, pt reports increased SOB and **hemoptysis.**

Code blue called, for increased resp distress, patient never lost her pulse. Placed on vapotherm. CXR done with drastic worsening of L lung infiltrates. Patient was receiving blood transfusion, doubt TRALI given unilateral involvement. Will give 40 mg IV lasix x1, check an ABG. Discussed with ID will add linezolid to cefepime. Will check a CTA chest to r/o a PE.

# Learning Point – DDX Hemoptysis

- Hemoptysis has a very broad differential (see table)
  - Most common causes of massive hemoptysis vary
    - Western Countries - Bronchogenic carcinoma and chronic inflammatory lung diseases due to bronchiectasis, cystic fibrosis, or aspergillosis
    - Non-western countries - pulmonary tuberculosis, including tuberculosis bronchiectasis
  - 90% of massive hemoptysis is due to the bronchial circulation
- In this patient, the differential is limited given the acute onset, cancer history, recent chemotherapy and fever.
  - Bleeding metastasis
  - Ruptured aneurysm / avm / other vascular
  - Infection
  - Pneumonitis (chemotherapy/aspiration)
  - Pulmonary Embolism (cancer)
  - Coagulopathy (liver mets)

## Etiologies of Hemoptysis

### Pulmonary Causes

Airways disease

Bronchiectasis

Bronchogenic tumor

Bronchitis

Parenchymal disease

Cystic fibrosis

Tuberculosis

Aspergillosis

Histoplasmosis

Pneumonia

Lung abscess

Pneumoconiosis

Vasculitides (Behcet's syndrome, Wegener's granulomatosis)

### Cardiovascular causes

Pulmonary arteriovenous malformation

Bronchial artery aneurysm

Pulmonary embolism

Pulmonary artery hypertension

Ruptured thoracic artery aneurysm

Aortobronchial fistula

### Other

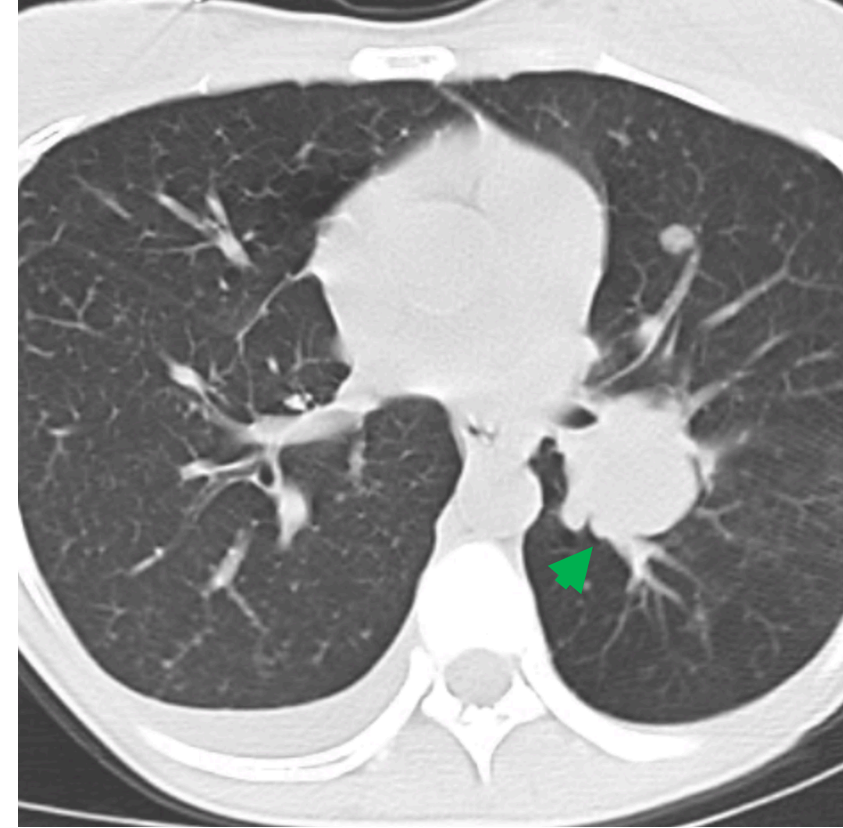
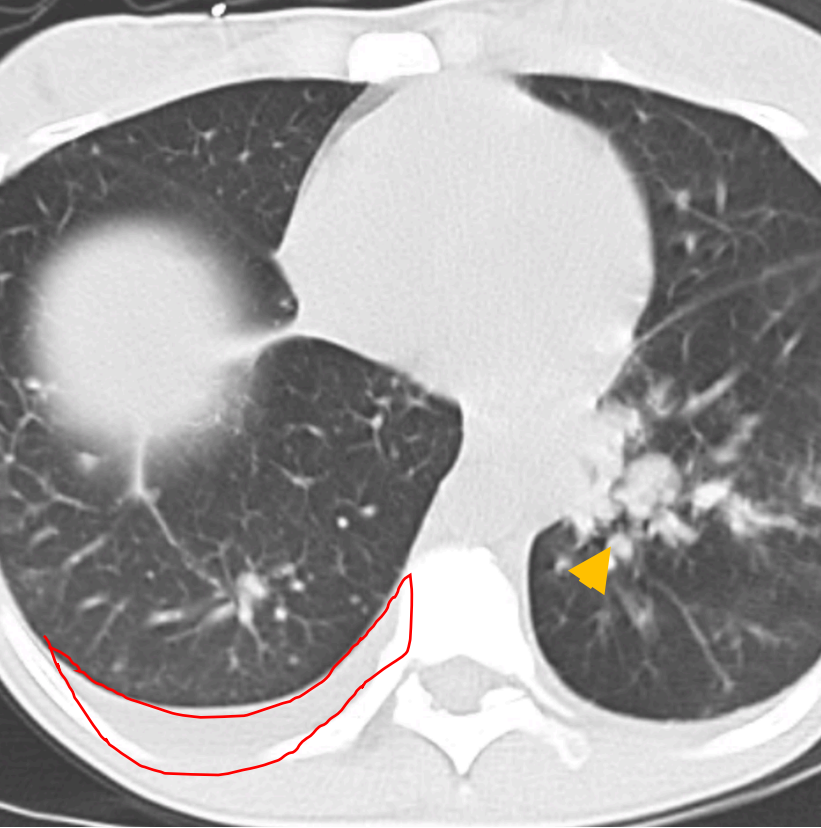
Trauma

Coagulopathy

Iatrogenic

Foreign body





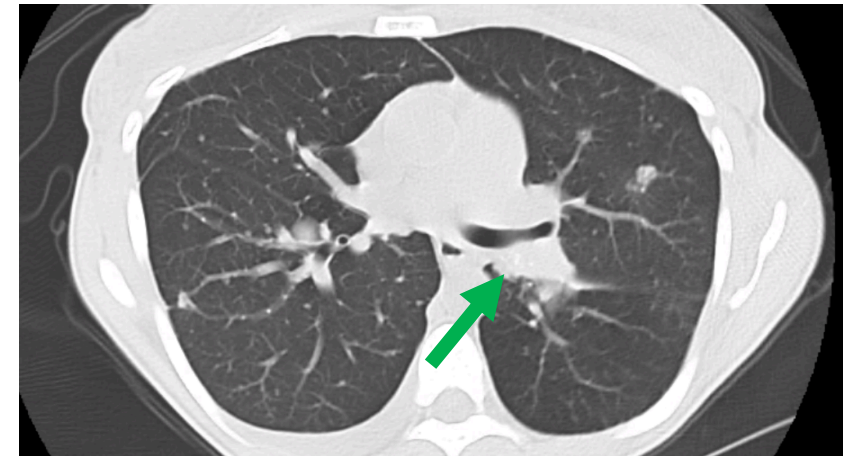
CT Chest w/o 6.2.19

Multiple lesions

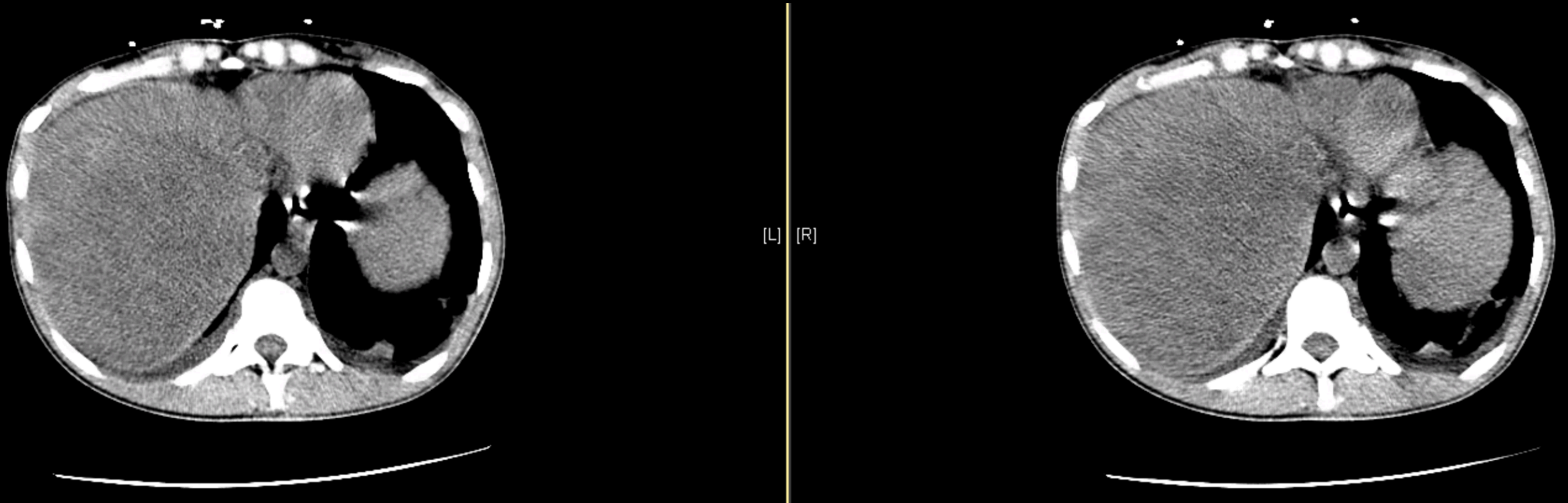
Left sided "irregular groundglass opacities" may represent post-obstructive pneumonitis

Note the lesion abutting the left bronchus

Effusion in red



Quick aside, note the liver metastases



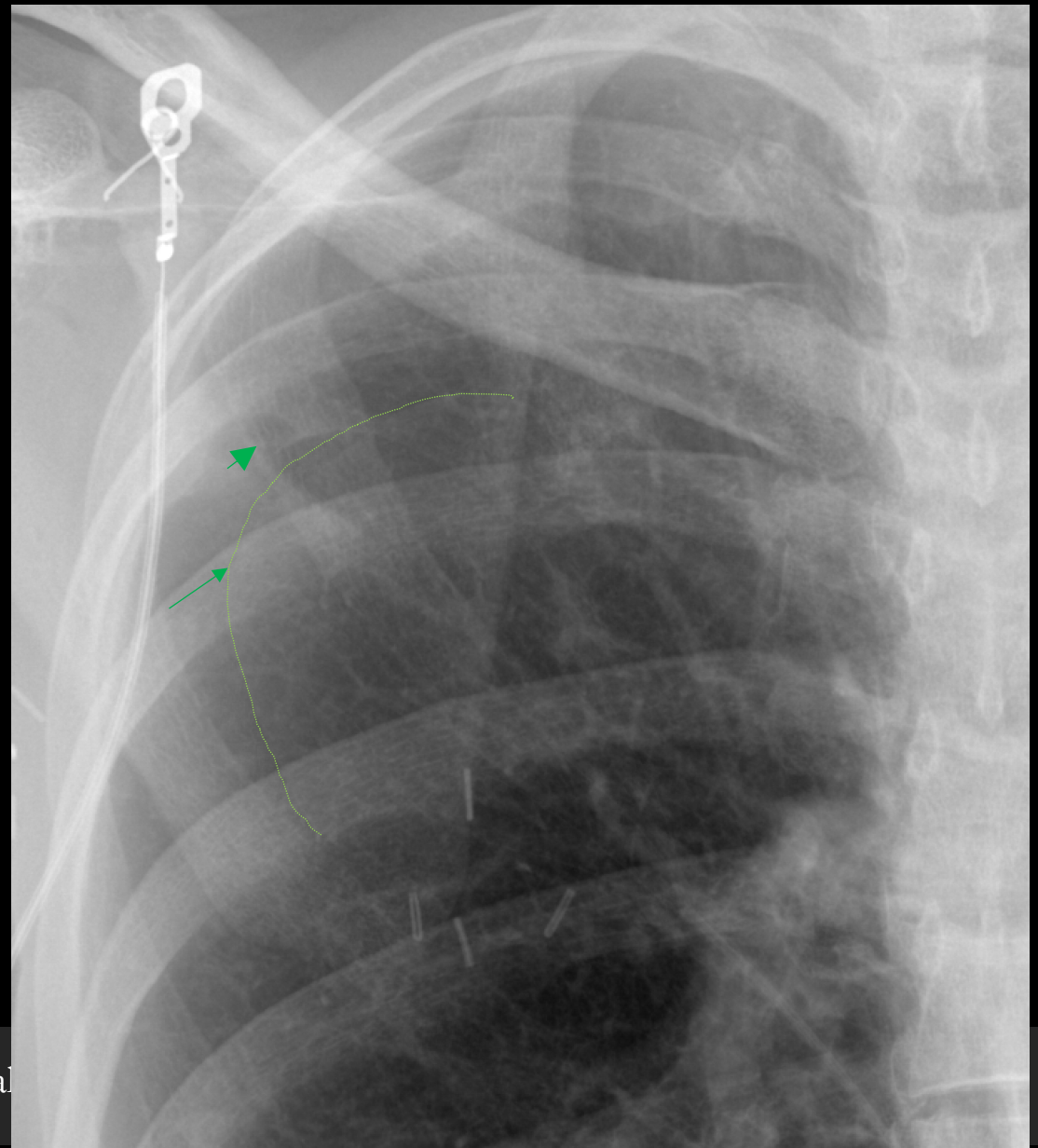
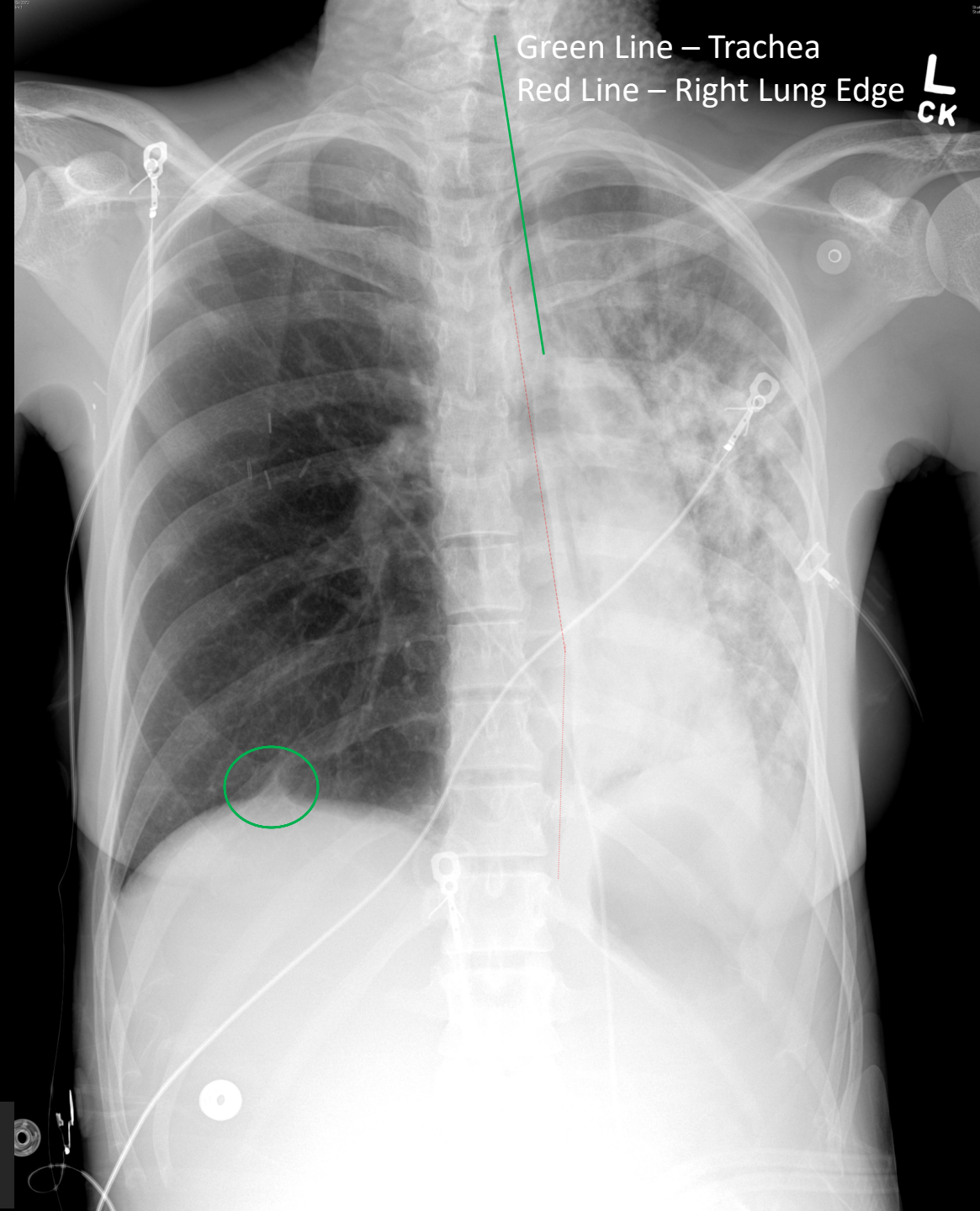


Green Line – Trachea  
Red Line – Right Lung Edge

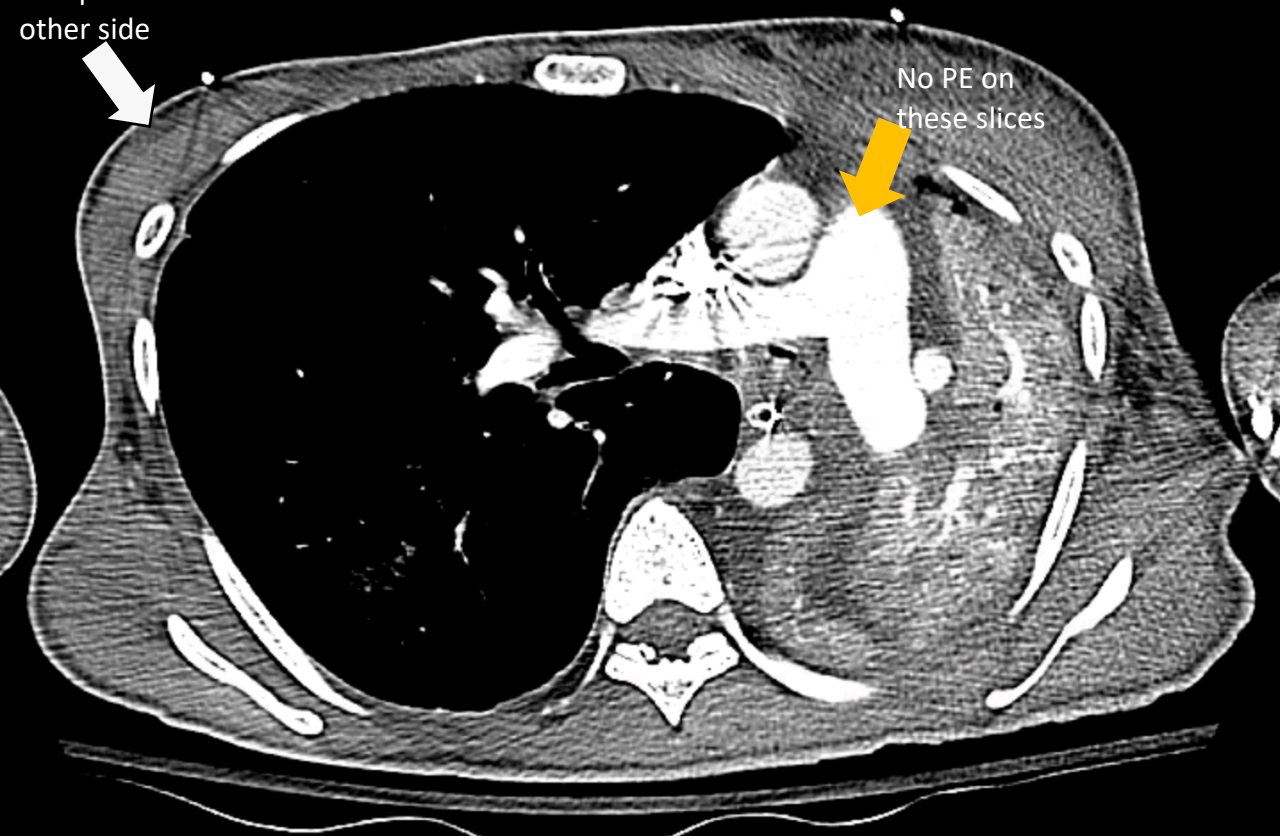
L  
CK

CXR during transfusion 6.3.19  
note the trachea (left image line), the lesion with tension on the right diaphragm (left image circle)  
also note the subtle linear edge (right image, arrow) with lung marking laterally (arrowhead) which makes pneumothorax unlikely

TRALI was thought to be less likely given the unilaterality



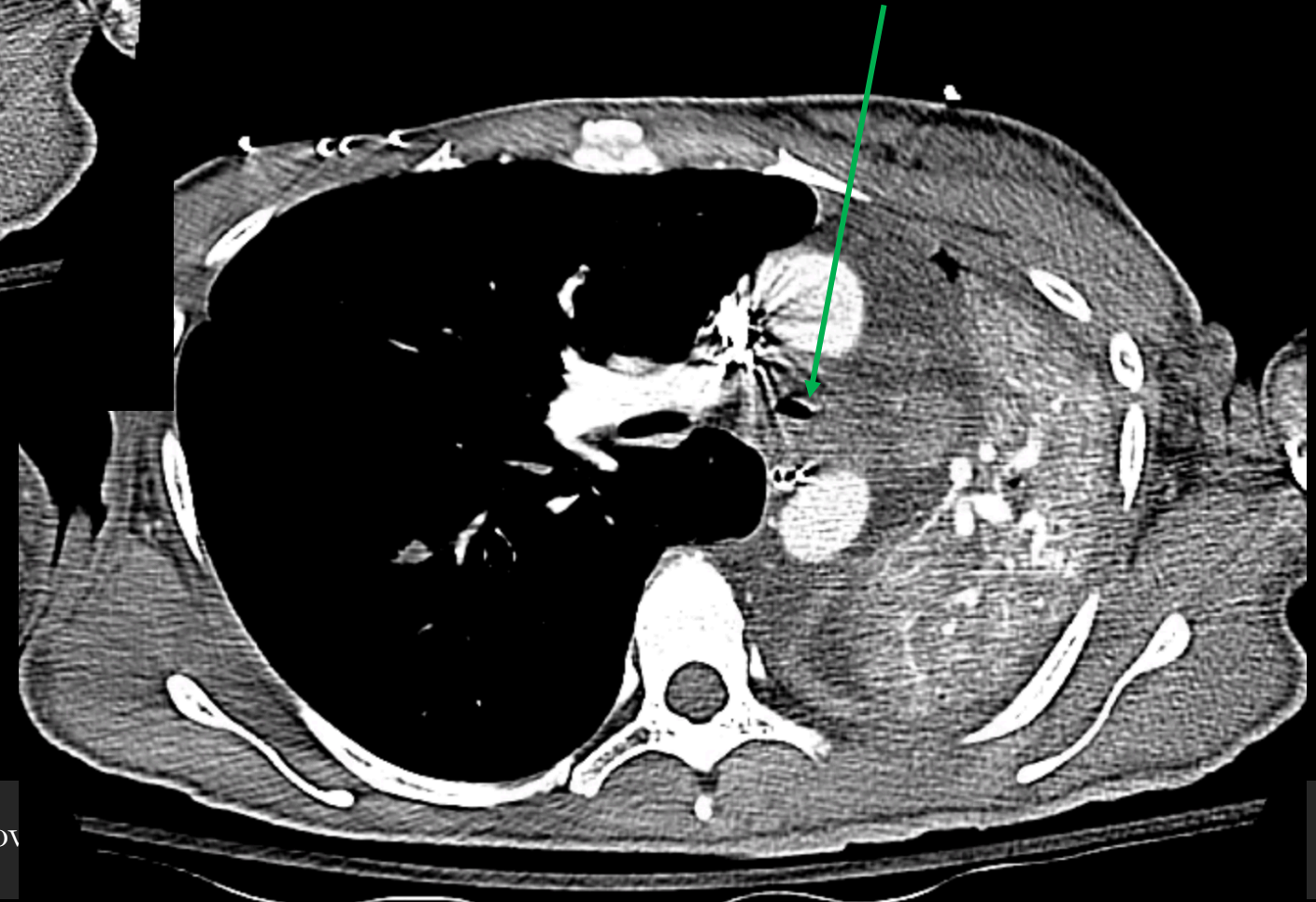
Compare to  
other side



No PE on  
these slices

CT PE was done and  
was negative for PE

Note the debris in the left mainstem



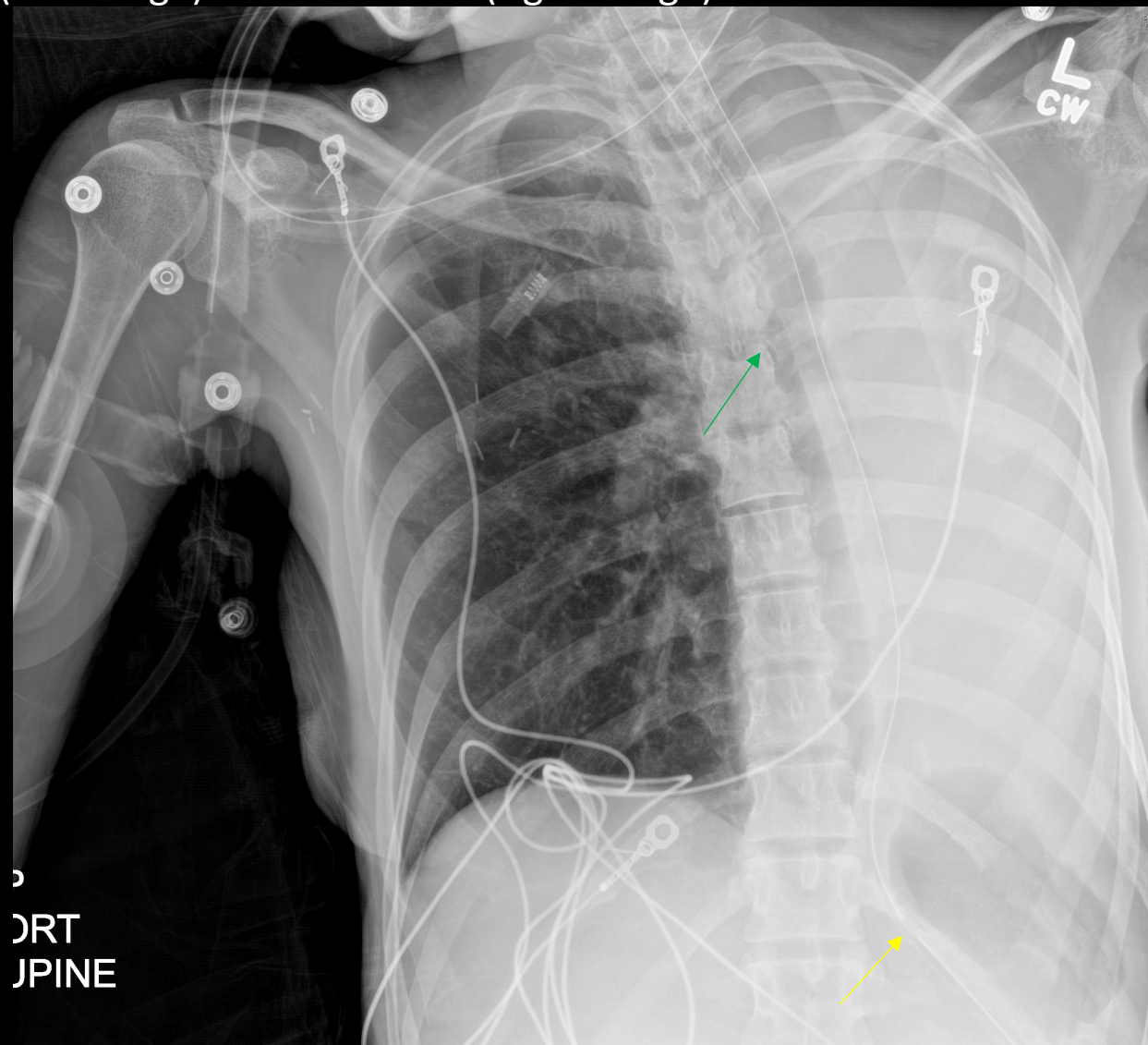
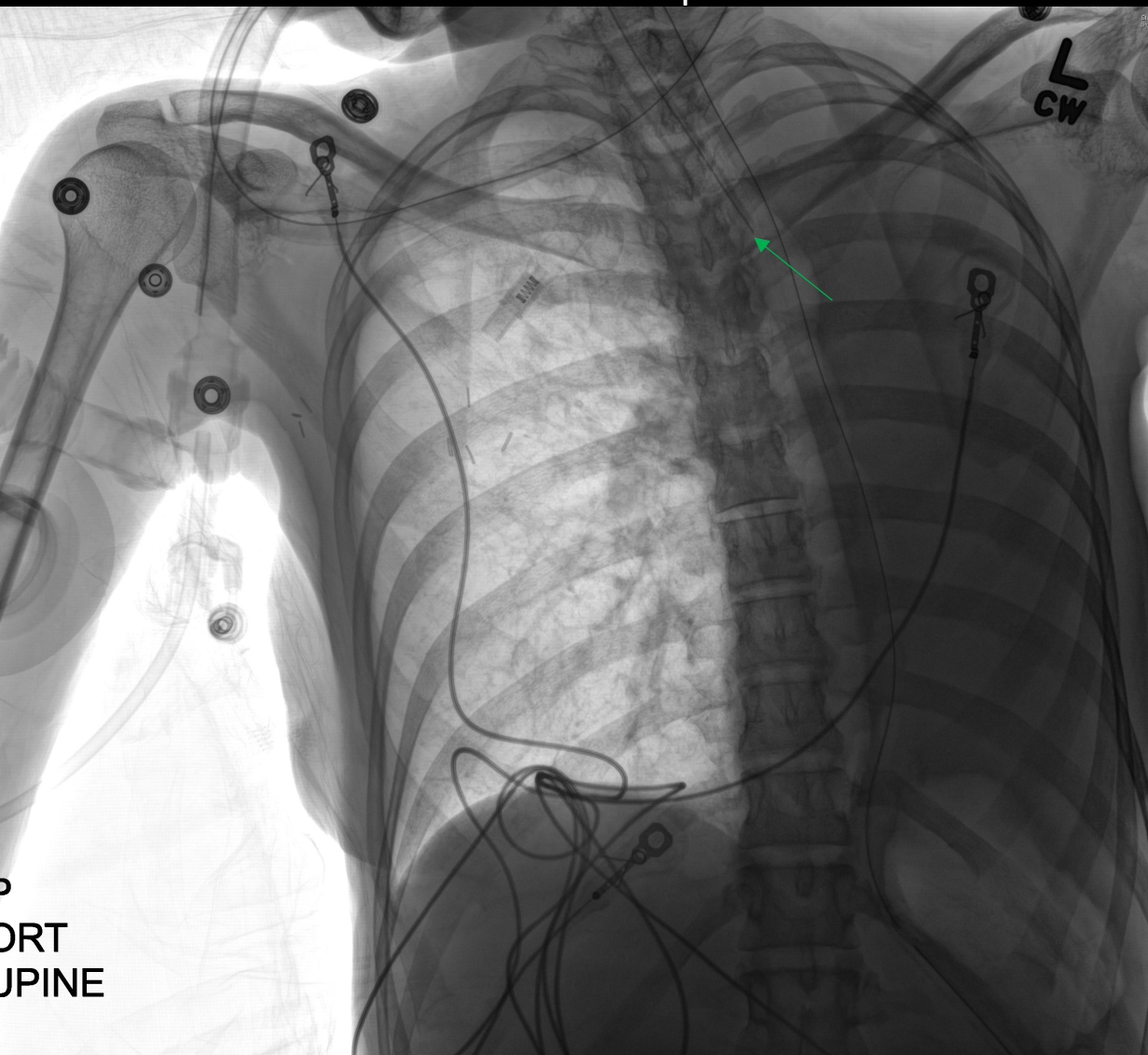


# Clinical History Continued

- 6.4.19 in early AM pt intubated due to desaturation to 83%
  - “dried blood noted in posterior oropharynx”

CXR 6.4.19

Note the tip of the endotracheal tube (left image) and the carina (right image)



# Summary to date

- Patient is intubated and saturating in the 80s.
- Imaging demonstrates
  - Negative for PE
  - ETT in proper placement above carina
  - Debris in left mainstem bronchus
  - Complete opacification of left hemithorax
  - Metastatic lesions in lung and liver with a lesion that is abutting the left bronchus
  - Ascites

# Transfer to MDACC ICU

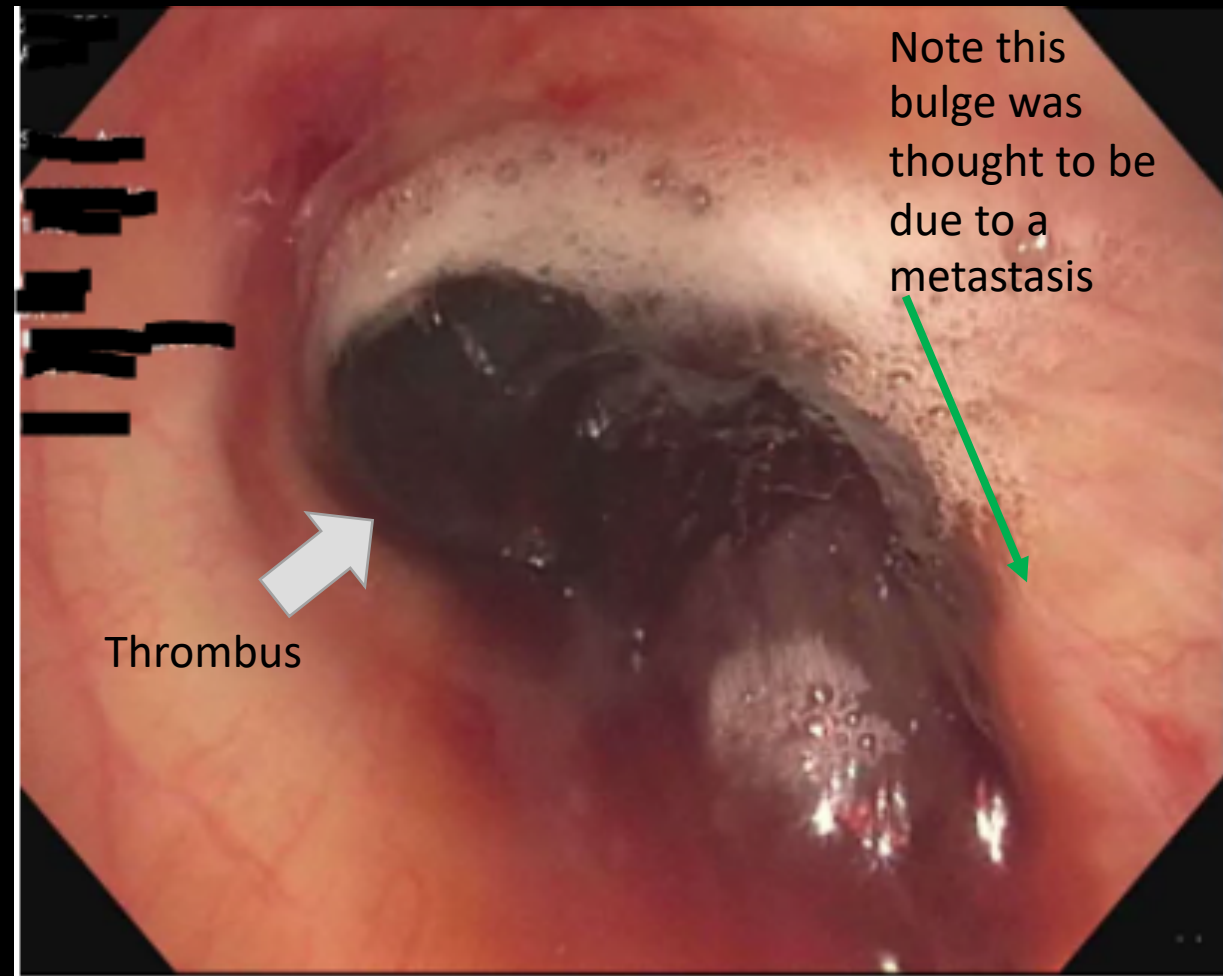
- Requested as patient was an MDACC patient and MDACC has interventional pulmonology capabilities.
- Current DDX is symptom based
  - Massive hemoptysis exacerbated by enoxaparin use
    - Due to erosive metastatic lesion vs. less likely pneumonitis vs. pneumonia
  - Concurrent pneumonia vs pneumonitis
  - Metastatic malignancy
  - Sepsis and septic shock vs. less likely cardiogenic shock

Remained intubated, transferred

Emergent cryotherapeutic bronch at bedside

Redeteriorated with complete reopacification of left hemithorax q2-3 days

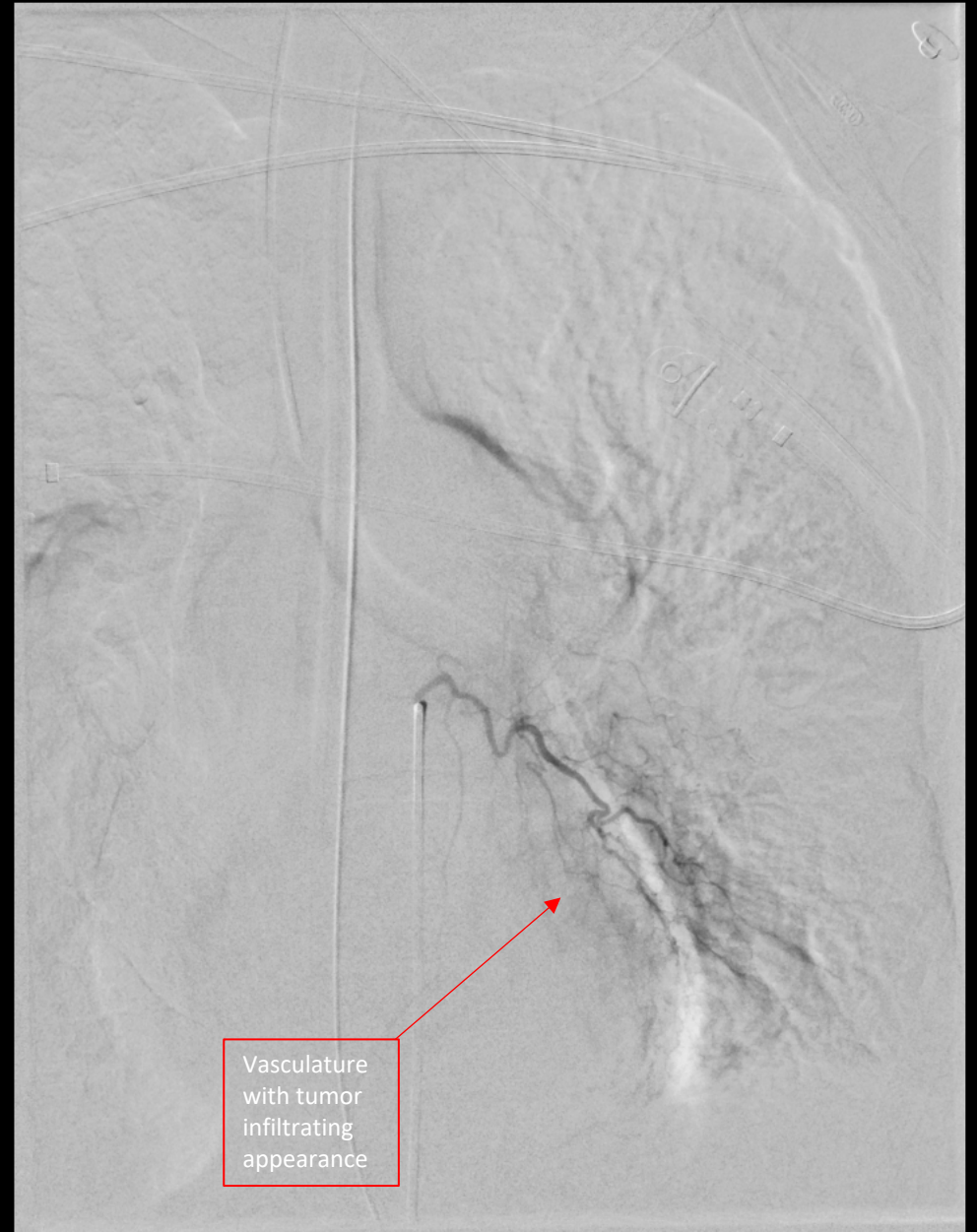
# Bedside APC / Cryotherapeutic Bronch and Bedside Bronch with Urological Stone Retrieval Basket



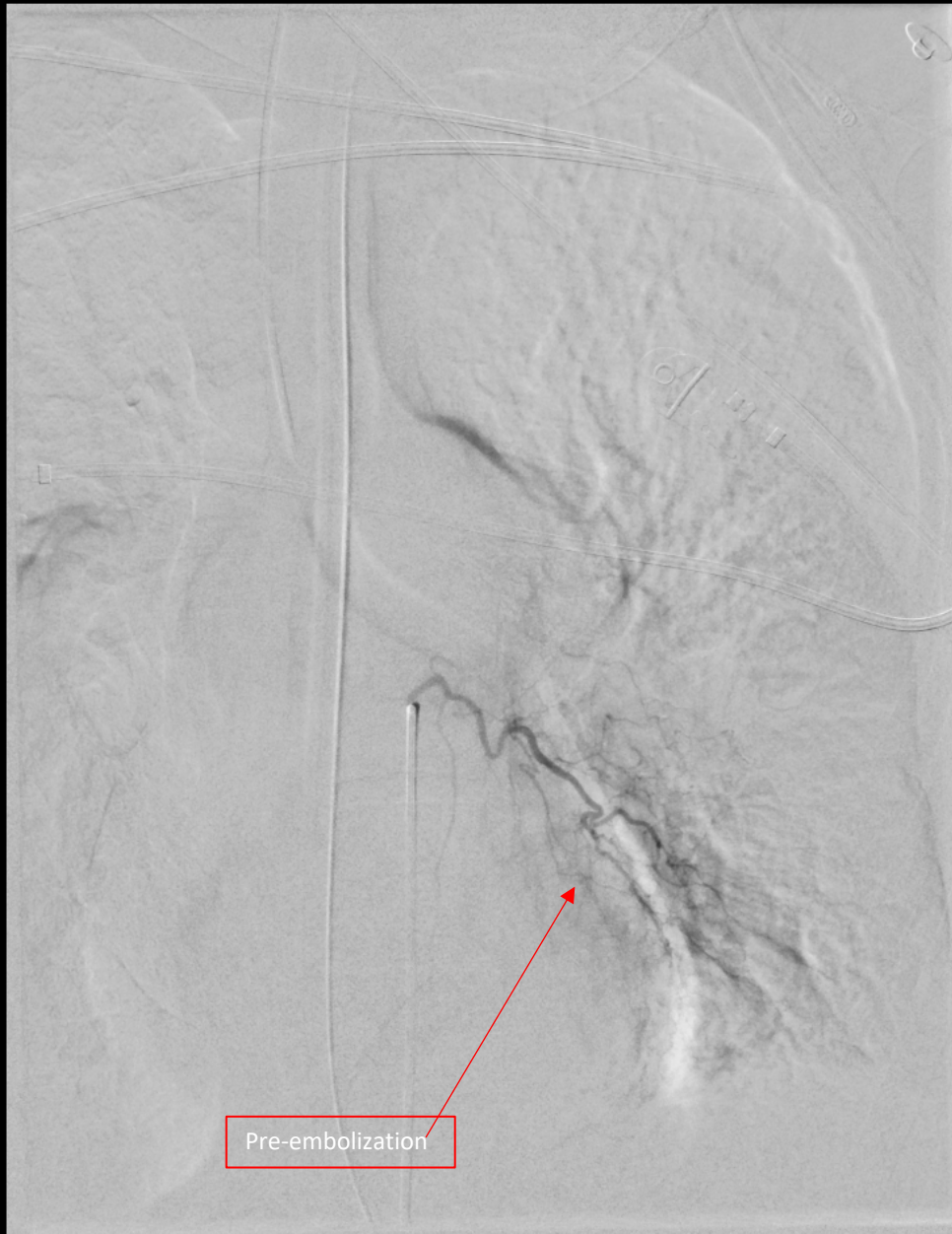
**5** Left mainstem bronchus

# Interventional Radiology Consult









# Embolization

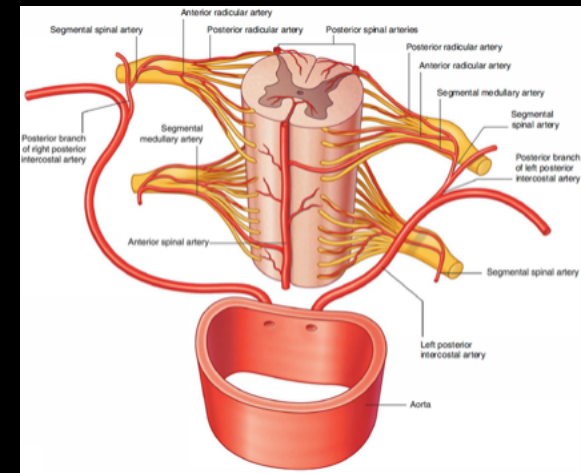
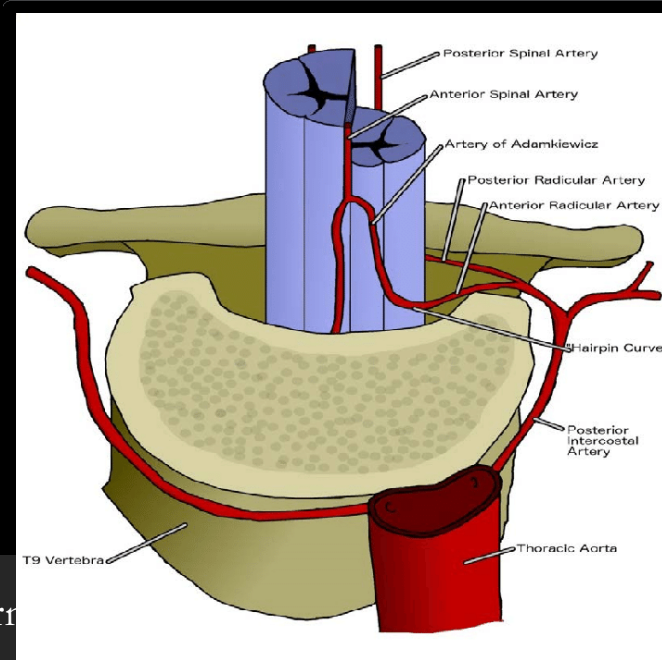
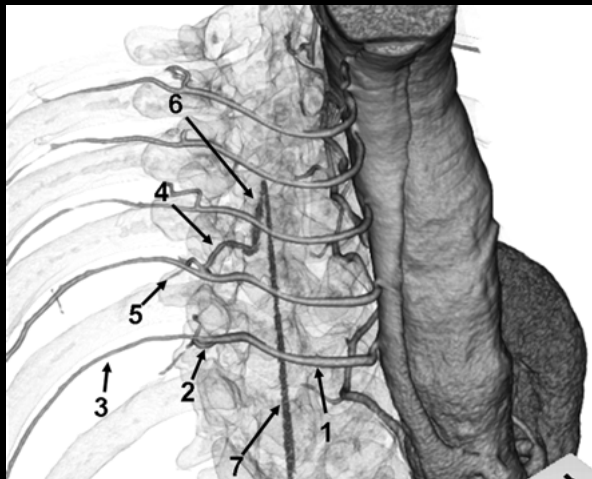
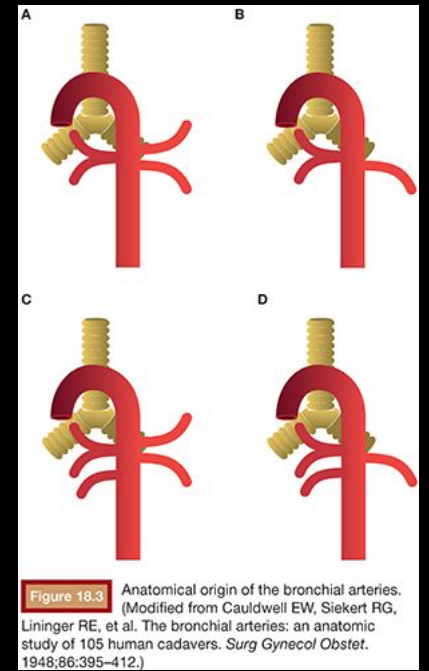
- Bronchial artery embolization is a primary treatment for massive hemoptysis; interventional radiology should be consulted in these cases
- This patient's chest x ray returned to baseline and she was weaned from all ventilatory support within 24 hours of the embolization.

# Learning Point - Embolization

- “Major complications are rare and immediate **clinical success** defined as cessation of hemorrhage ranges in most series from **85% to 100%**, although **recurrence of hemorrhage** ranges from **10% to 33%**.”
- “Surgical intervention carries a mortality of ~18% when performed electively, rising to 40% when performed emergently.”
- Observation and medical management has 50% mortality.
- Extravasation of contrast is rarely seen (~3.6 – 10%), so combination of CT, bronchoscopy and angiography with clinical findings should be used to guide embolization.

# Learning Point - Embolization

- Bronchial arteries normally originate directly from the descending thoracic aorta, most commonly between the levels of the T5 and T6 vertebrae.
- Be aware of spinal cord supplying anterior medullary artery (artery of adamkiewicz) which has a characteristic hairpin configuration.
  - Normally originates from left 9-12<sup>th</sup> posterior intercostal.
  - A variant origination from the intercostobronchial trunk at T5-T8 can occur. Contraindicates embolization due to risk of paraplegia and loss of spinothalamic sensation.

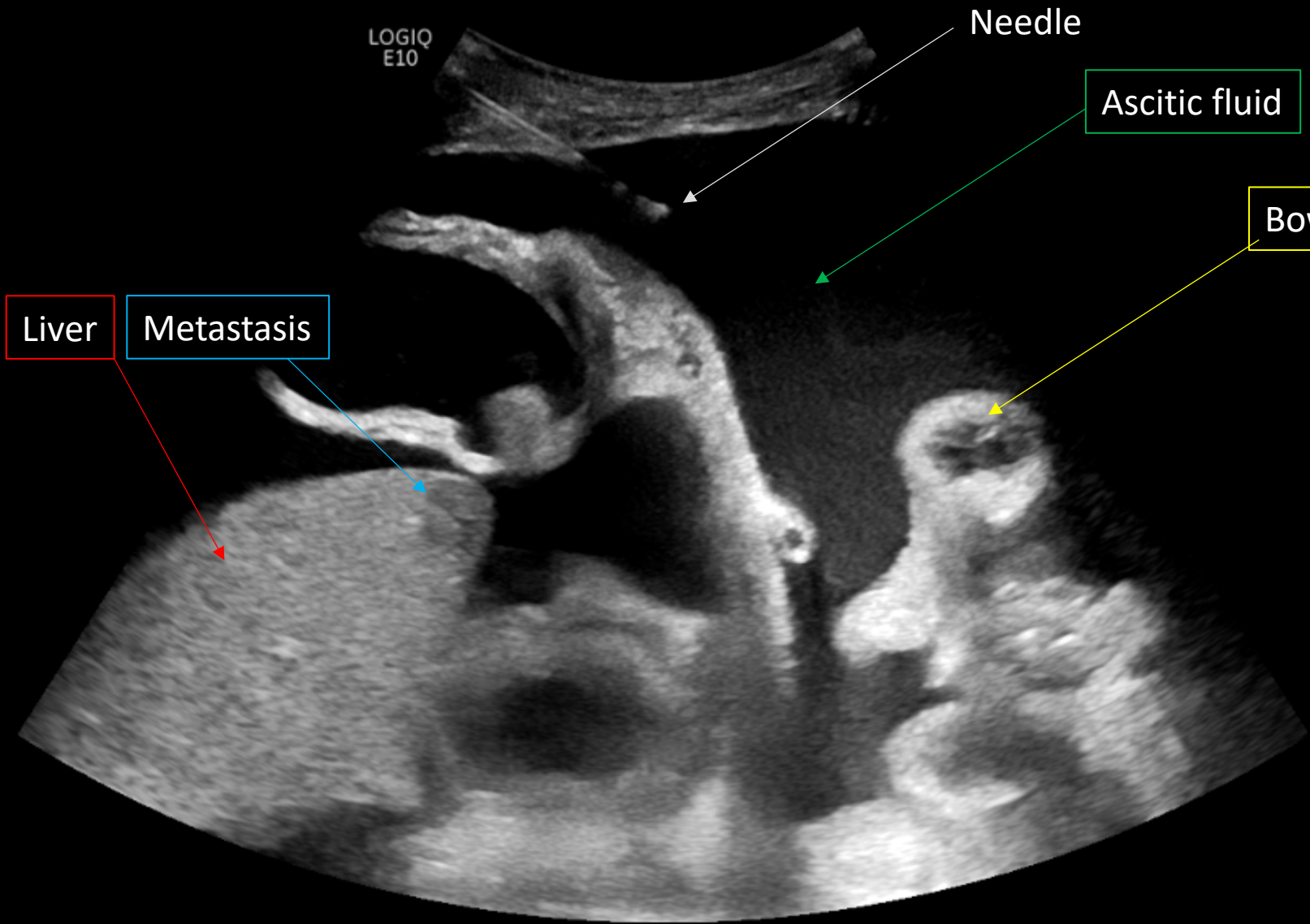


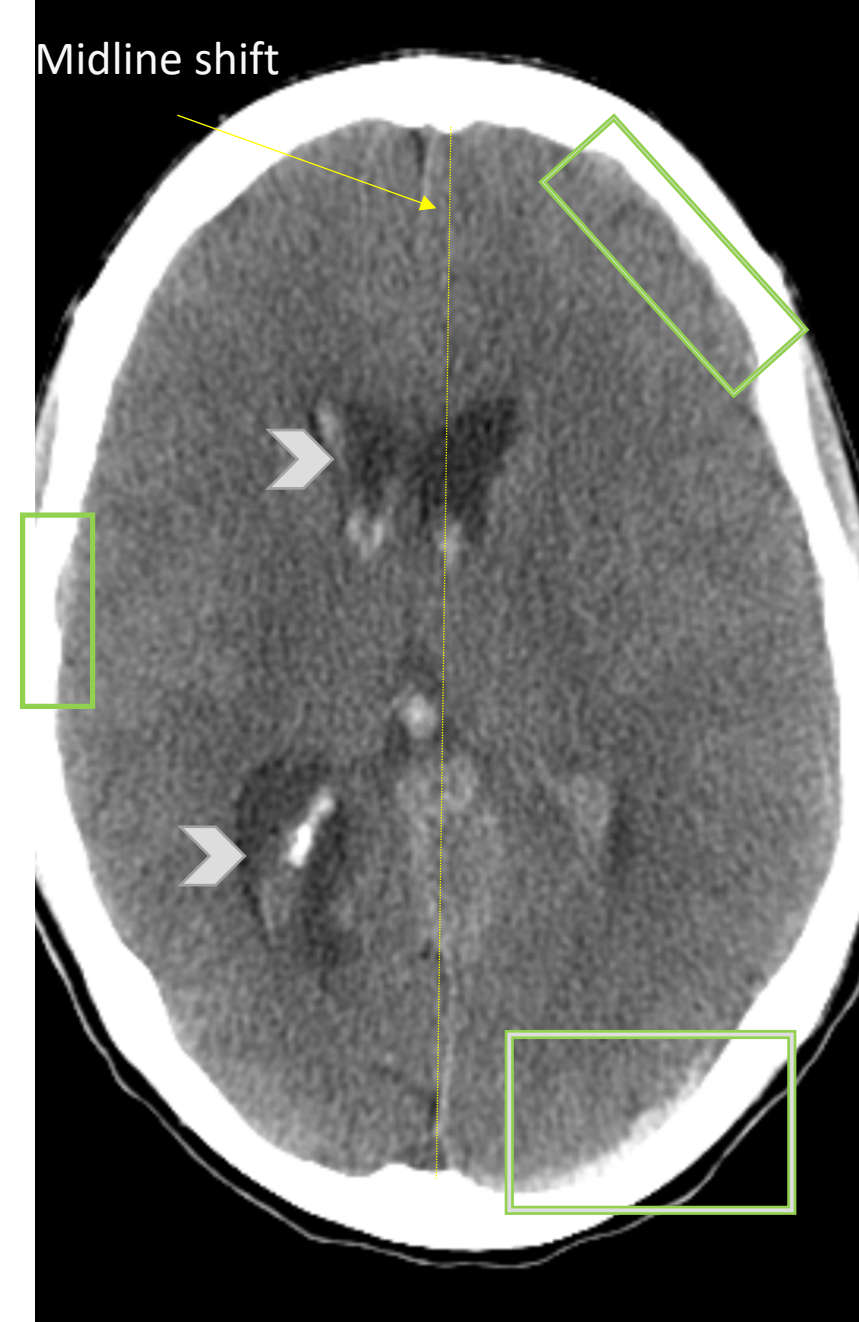
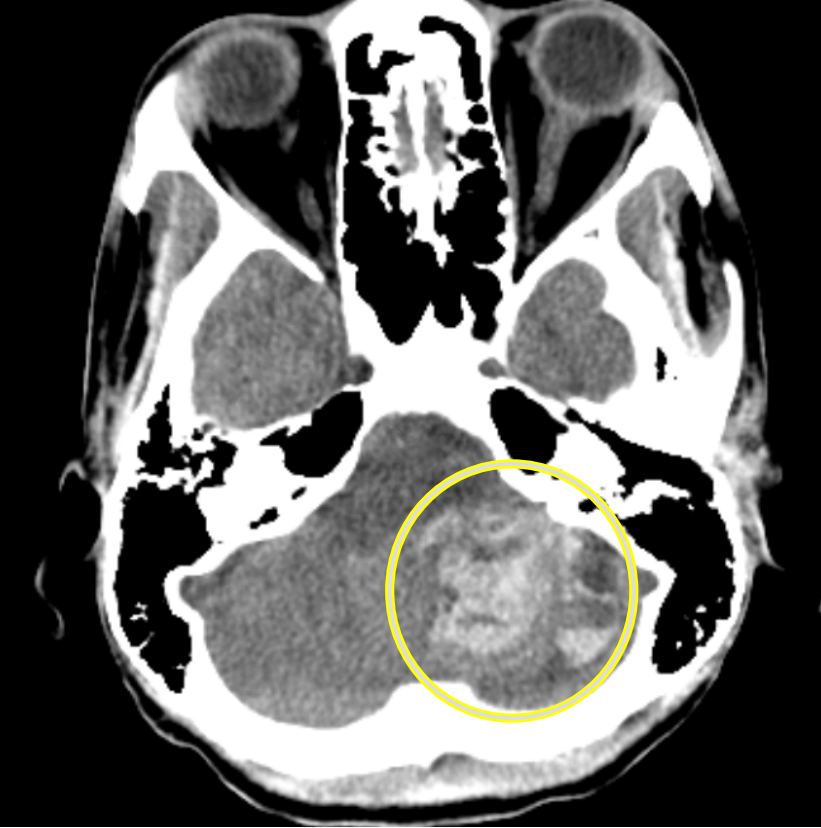
# After embolization

- Patient transferred to floor.
- Persistent abdominal pain; drain placed by radiology.
- Within 2 weeks patient began to become acutely altered. CT Head ordered.



# Ultrasound tube placement

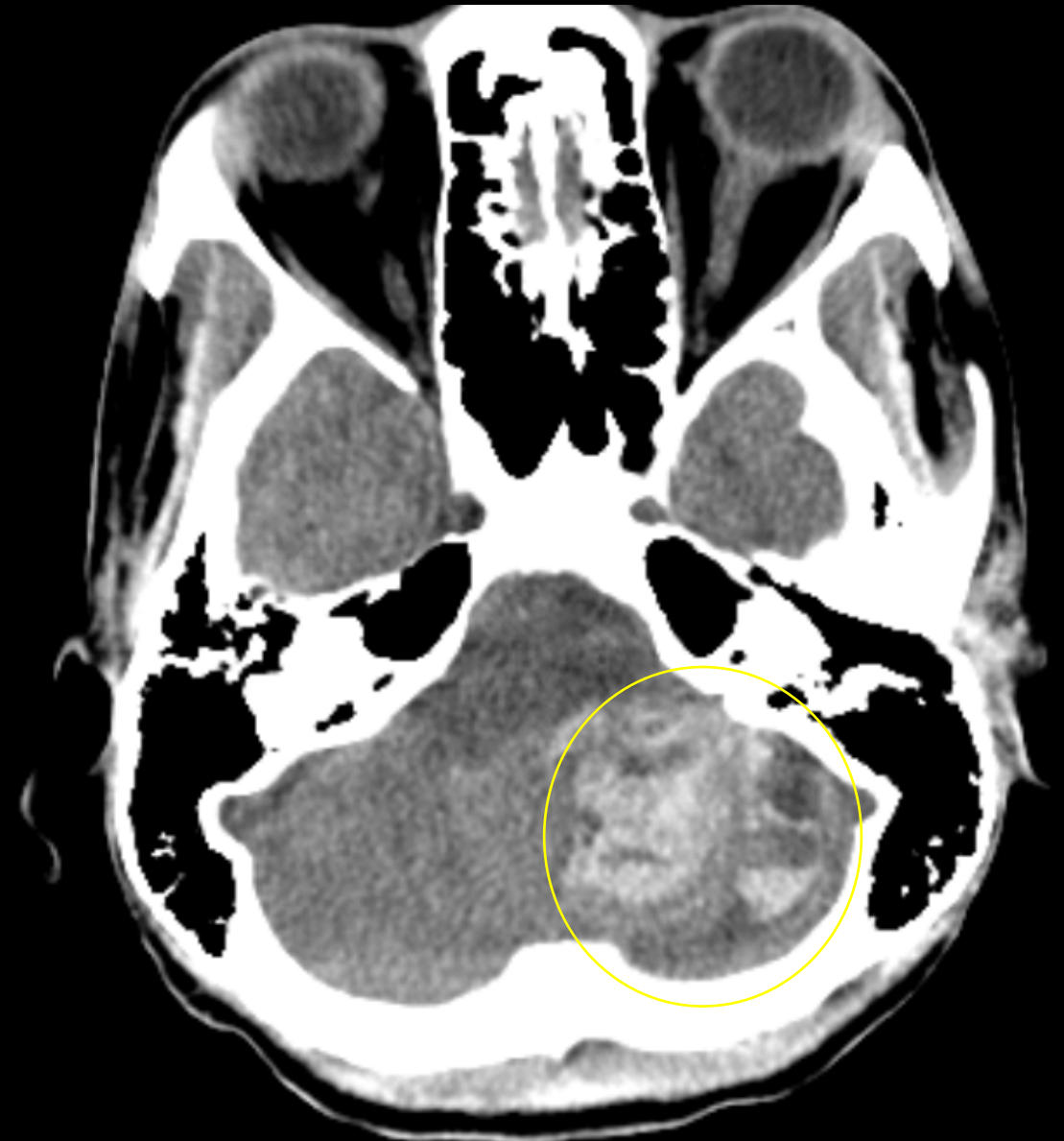




## CT Head w/o Contrast

- Interventricular Blood (arrowheads)
- Subarachnoid blood & sulcal effacement (arrow, middle img)
- Intraparenchymal hemorrhage with fluid levels (circle)
- Subdural hemorrhage (square)

- The fluid-fluid or blood-fluid levels are seen often in coagulopathy related bleeding
- Thought to be due to partially clotted blood





# Final course

- Due to the devastating neurological effects, patient's family decided to withdraw care

# Hemoptysis ACR Appropriateness Criteria

**Variant 1: Massive (life-threatening) hemoptysis. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
Arteriography bronchial with embolization	Usually Appropriate	⊕⊕⊕⊕
CTA chest with IV contrast	Usually Appropriate	⊕⊕⊕
Radiography chest	Usually Appropriate	⊕
CT chest with IV contrast	Usually Appropriate	⊕⊕⊕
CT chest without IV contrast	May Be Appropriate	⊕⊕⊕
CT chest without and with IV contrast	Usually Not Appropriate	⊕⊕⊕

**Variant 2: Nonmassive (non-life-threatening) hemoptysis. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
CT chest with IV contrast	Usually Appropriate	⊕⊕⊕
CTA chest with IV contrast	Usually Appropriate	⊕⊕⊕
Radiography chest	Usually Appropriate	⊕
Arteriography bronchial with embolization	May Be Appropriate	⊕⊕⊕⊕
CT chest without IV contrast	May Be Appropriate	⊕⊕⊕
CT chest without and with IV contrast	Usually Not Appropriate	⊕⊕⊕

**Variant 3: Recurrent hemoptysis. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
Radiography chest	Usually Appropriate	⊕
Arteriography bronchial with embolization	Usually Appropriate	⊕⊕⊕⊕
CTA chest with IV contrast	Usually Appropriate	⊕⊕⊕
CT chest with IV contrast	May Be Appropriate	⊕⊕⊕
CT chest without IV contrast	Usually Not Appropriate	⊕⊕⊕
CT chest without and with IV contrast	Usually Not Appropriate	⊕⊕⊕

# ICU Patient ACR Appropriateness Criteria

<b>Clinical Condition:</b> Intensive Care Unit Patients			
<b>Variant 1:</b> Admission or transfer to ICU.			
Radiologic Procedure	Rating	Comments	RRL*
X-ray chest portable	7		☼
<b>Rating Scale:</b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			<b>*Relative Radiation Level</b>
<b>Variant 2:</b> Stable patient. No change in clinical status.			
Radiologic Procedure	Rating	Comments	RRL*
X-ray chest portable	3		☼
<b>Rating Scale:</b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			<b>*Relative Radiation Level</b>
<b>Variant 3:</b> Patient with clinical worsening.			
Radiologic Procedure	Rating	Comments	RRL*
X-ray chest portable	9		☼
<b>Rating Scale:</b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			<b>*Relative Radiation Level</b>
<b>Variant 4:</b> Post-insertion of tube or catheter.			
Radiologic Procedure	Rating	Comments	RRL*
X-ray chest portable	9		☼
<b>Rating Scale:</b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			<b>*Relative Radiation Level</b>
<b>Variant 5:</b> Post-chest tube removal.			
Radiologic Procedure	Rating	Comments	RRL*
X-ray chest portable	5	Data are largely based on studies of patients following cardiothoracic surgery. This may not be generalizable to all indications for chest tube removal.	☼
<b>Rating Scale:</b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			<b>*Relative Radiation Level</b>

- Pt received daily CXR while in ICU.

# Suspected PE ACR Appropriateness Criteria

**Variant 1:** Suspected pulmonary embolism. Intermediate probability with a negative D-dimer or low pretest probability.

Radiologic Procedure	Rating	Comments	RRL*
X-ray chest	9		☼
CTA chest with IV contrast	5	This procedure should be optimized for pulmonary arterial enhancement. This procedure may be appropriate but there was disagreement among panel members on the appropriateness rating as defined by the panel's median rating.	☼☼☼
CT chest with IV contrast	3	This procedure should be optimized for pulmonary arterial enhancement.	☼☼☼
US duplex Doppler lower extremity	3	This procedure has a low yield in the absence of symptoms of DVT.	○
CT chest without IV contrast	2		☼☼☼
Tc-99m V/Q scan lung	2		☼☼☼
CTA chest with IV contrast with CT venography lower extremities	2		☼☼☼
MRA chest without and with IV contrast	2		○
US echocardiography transthoracic resting	2		○
CT chest without and with IV contrast	1		☼☼☼
Arteriography pulmonary with right heart catheterization	1		☼☼☼☼
MRA chest without IV contrast	1		○
US echocardiography transesophageal	1		○
<b>Rating Scale:</b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			<b>*Relative Radiation Level</b>

**Variant 2:** Suspected pulmonary embolism. Intermediate probability with a positive D-dimer or high pretest probability.

Radiologic Procedure	Rating	Comments	RRL*
X-ray chest	9		☼
CTA chest with IV contrast	9	This procedure should be optimized for pulmonary circulation.	☼☼☼
CT chest with IV contrast	9	This procedure should be optimized for pulmonary circulation. This procedure may be an alternative to CTA, but both should not be performed.	☼☼☼
Tc-99m V/Q scan lung	7	This procedure may be an alternative to CTA, but both should not be performed.	☼☼☼
US duplex Doppler lower extremity	7	This procedure may be an initial study prior to CTA.	○
MRA chest without and with IV contrast	6		○
CTA chest with IV contrast with CT venography lower extremities	5		☼☼☼
Arteriography pulmonary with right heart catheterization	3		☼☼☼☼
US echocardiography transthoracic resting	3		○
CT chest without IV contrast	2		☼☼☼
CT chest without and with IV contrast	2		☼☼☼
MRA chest without IV contrast	2	This procedure has limited sensitivity and may be indicated for rare situations or certain contraindications for a specific patient.	○
US echocardiography transesophageal	2		○
<b>Rating Scale:</b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			<b>*Relative Radiation Level</b>

# Estimated Imaging Only Costs Assuming Care Continued at MHH, Utilizing Charge Master Costs

CT CHEST W/CON	3936.25	1	3936.25
CT CHEST W/O CON	3788.25	4	15153
CHEST XRAY EXAM 1 VIEWS	683	60	40980
ABDOMEN X-RAY 1 VIEW	670.00	10	6700
US ABDOMEN LIMITED	1493.00	4	5972
CT HEAD OR BRAIN W/O CON	3157.00	2	6314
CT ABDOMEN W/O CON	3921.00	3	11763

**TOTAL:**  
**\$ 90,845.25**  
**Excluding cost of fluoro**

# Take Home Points

- Consult IR for massive hemoptysis; bronchial artery embolization is a primary treatment.
  - Efficacious with rare complications.
- CT head without contrast for brain bleed suspicion.
- Daily CXR are not required in stable ICU patients. The cost is not insignificant.

# References

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- The Artery of Adamkiewicz: Vascular Anatomy, Clinical Significance and Surgical Considerations - Scientific Figure on ResearchGate. Available from: [https://www.researchgate.net/figure/An-Anatomical-Depiction-of-the-Artery-of-Adamkiewicz\\_fig3\\_311975365](https://www.researchgate.net/figure/An-Anatomical-Depiction-of-the-Artery-of-Adamkiewicz_fig3_311975365) [accessed 30 Jan, 2020]
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