

A Case of Subcutaneous Emphysema with Pneumomediastinum in the Setting of Interstitial Lung Disease

Annika Medhus MS4

July 21, 2020

RAD 4001

Dr. Karthik Bande PGY3

Clinical History

- Ms. S is a 65 y/o F with RA, PE (on Apixaban), HTN, NIDDM, interstitial lung disease 2/2 RA (dx in 2018), and chronic respiratory failure (on 3L home O2 NC) who presented to the ED for worsening left eye, jaw, and facial swelling x 5 days.
 - Associated with diffuse itching and warmth in these areas and hoarseness of voice
 - No trauma, sick contacts, or recent travel
 - No family history of ILD, never smoker, works in Brownsville, TX with moderate dust exposure
 - Multiple recent admissions with acute dyspnea in March/May 2020

Physical Exam & Vital Signs

- T: 99.1 F (Oral), HR: 116, RR: 23, BP: 160/103, SpO2: 100%, BMI: 37
- General: alert and oriented
- Pulmonary: tachypnea, rales bilateral lungs with faint wheezing, no ronchi
- CV: tachycardia, regular rhythm, distant heart sounds
- Abdomen: soft, non-tender
- Skin: facial swelling and edema to left eye, bilateral jaw, upper neck. SQ crepitus appreciated to left eye, bilateral trapezius, upper back and upper anterior chest. No overlying erythema.

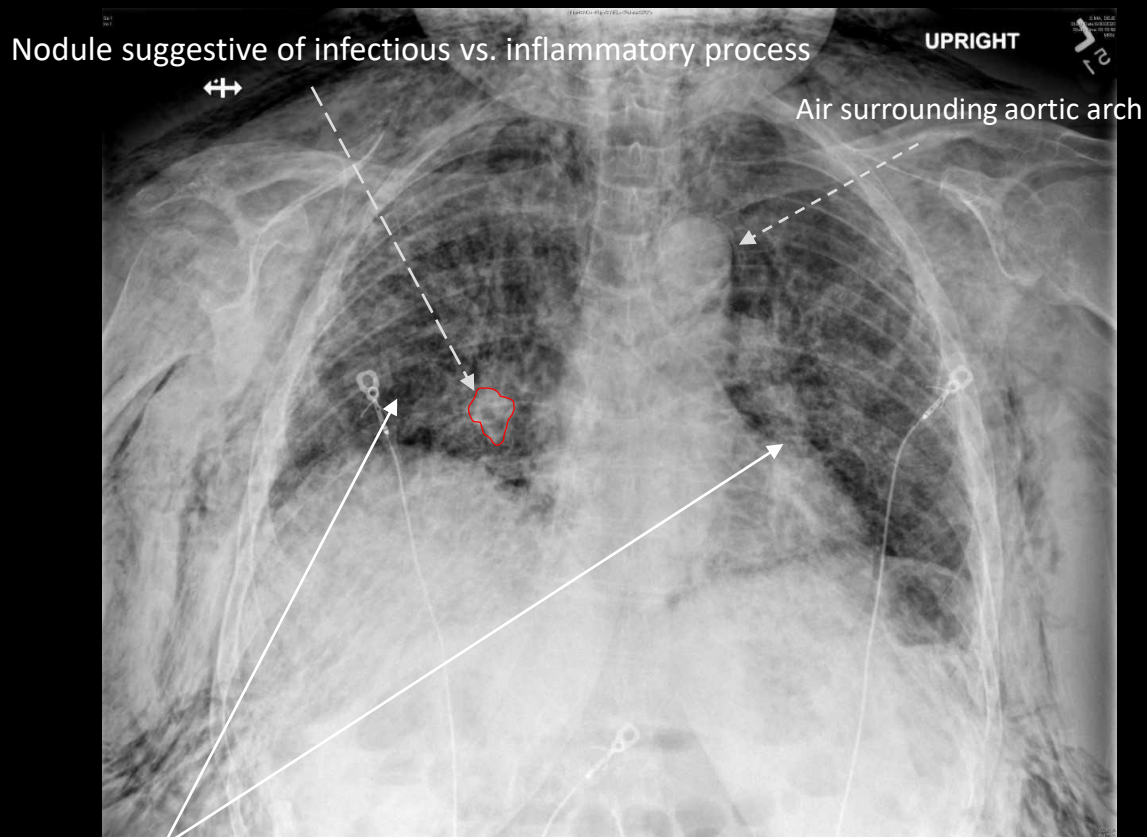
Initial Work-up

- COVID-19 testing → negative
- In the ED, CXR, CT abdomen/pelvis with contrast, and CTA chest ordered
- Pulmonology and CT surgery consulted
- Pain control and oxygen therapy given and admitted to IMU

Relevant imaging

- Chest X-ray
- CTA chest
- Neck soft tissue with contrast

Initial 2 view CXR (6/30)



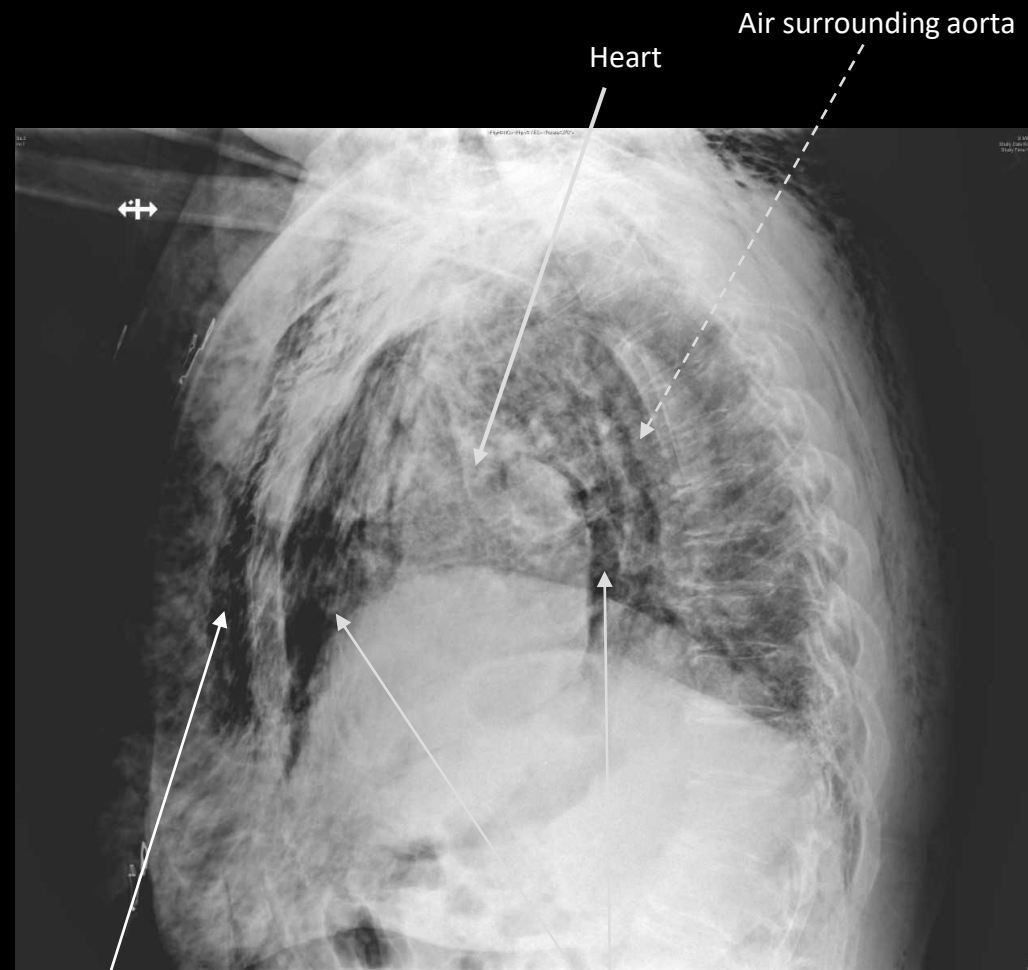
Nodule suggestive of infectious vs. inflammatory process

UPRIGHT

Air surrounding aortic arch

Decreased lung volumes

Extensive subcutaneous emphysema throughout the thorax obscuring view of lung fields.



Heart

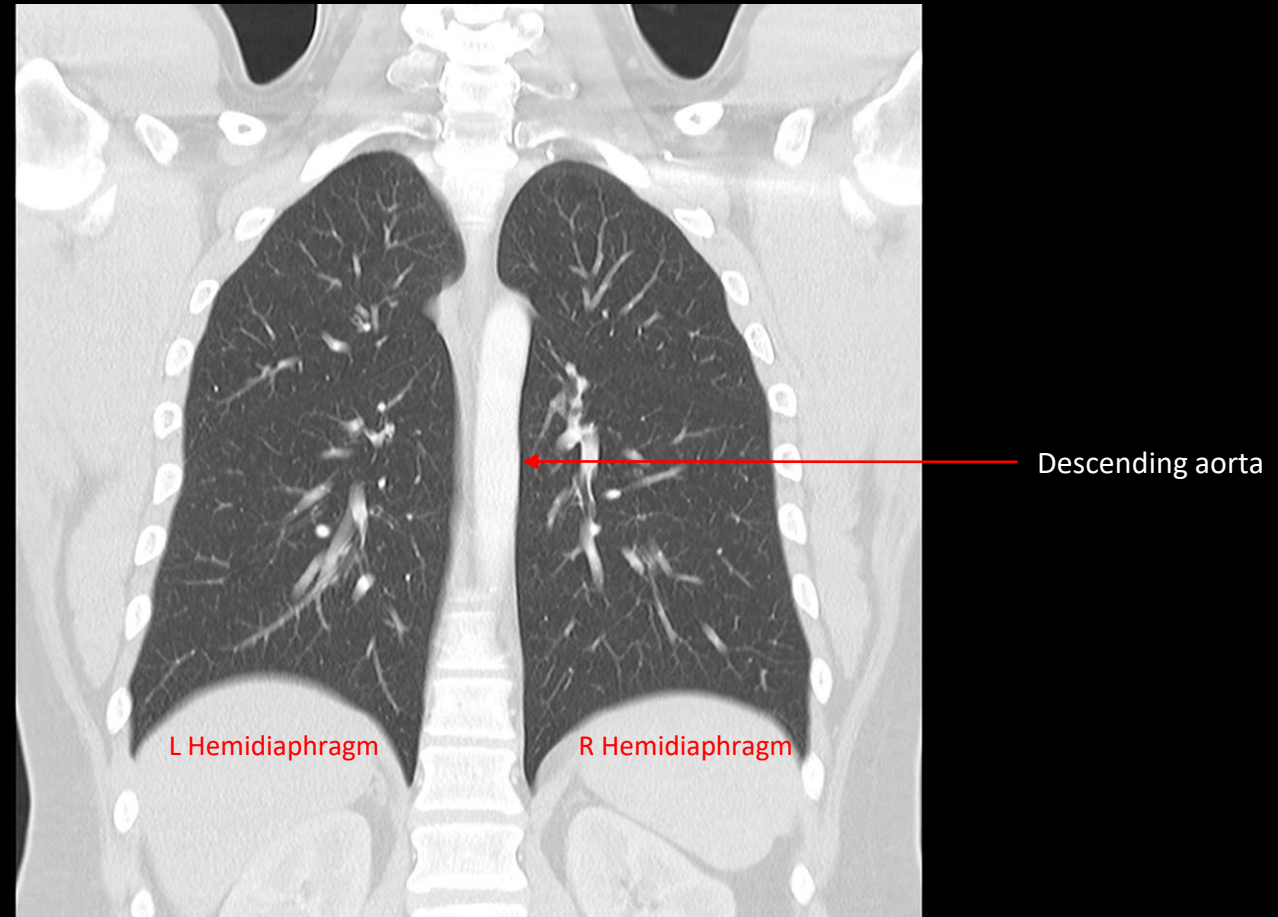
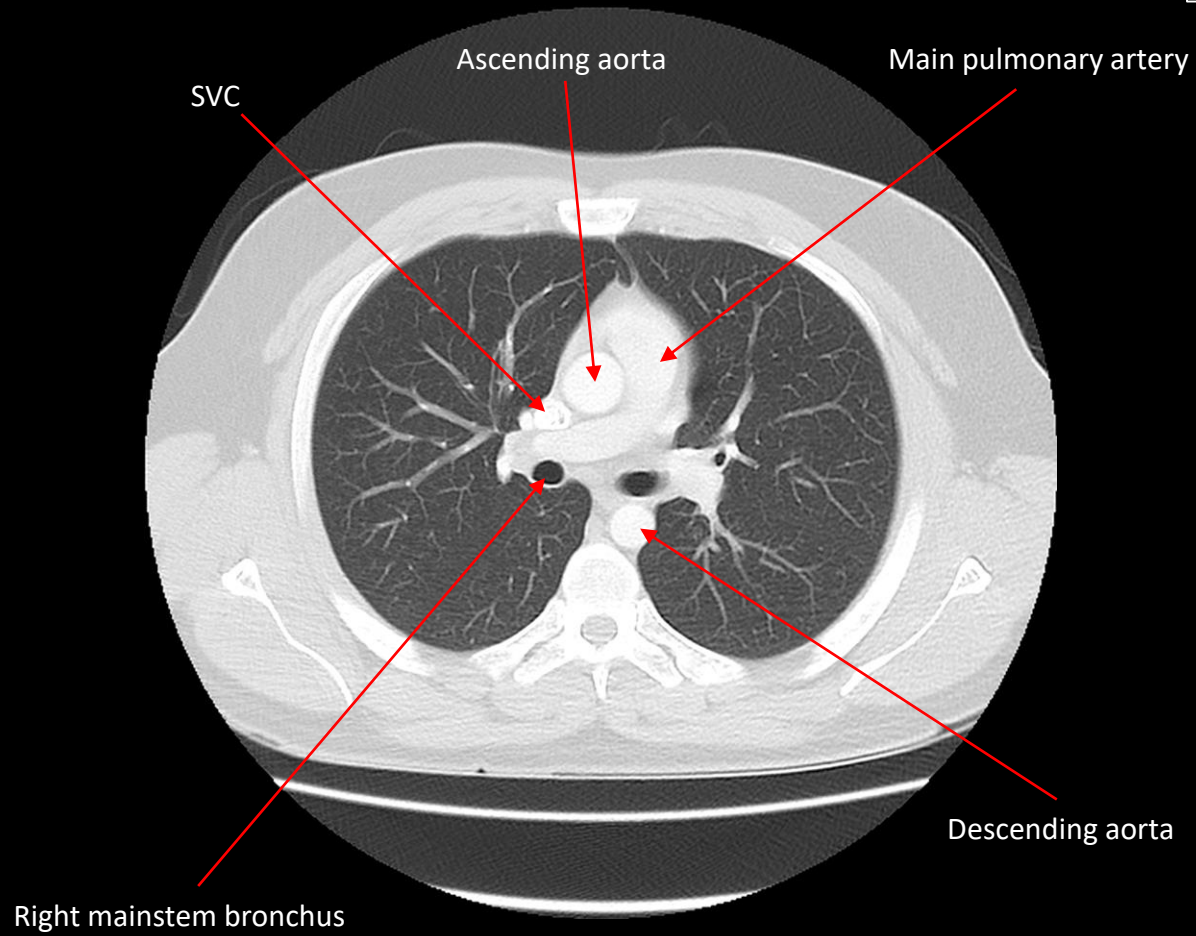
Air surrounding aorta

Subcutaneous emphysema of chest wall

Air within mediastinum

Normal CT anatomy

Note no free air present within the soft tissue or mediastinum



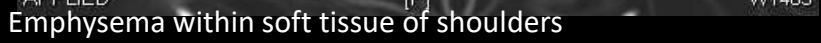
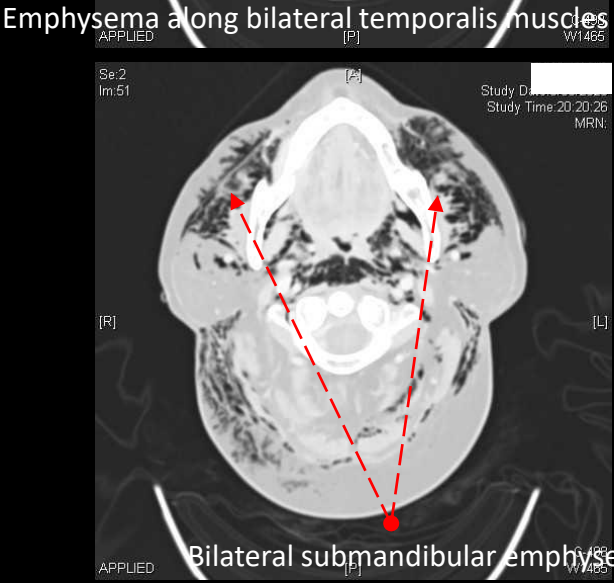
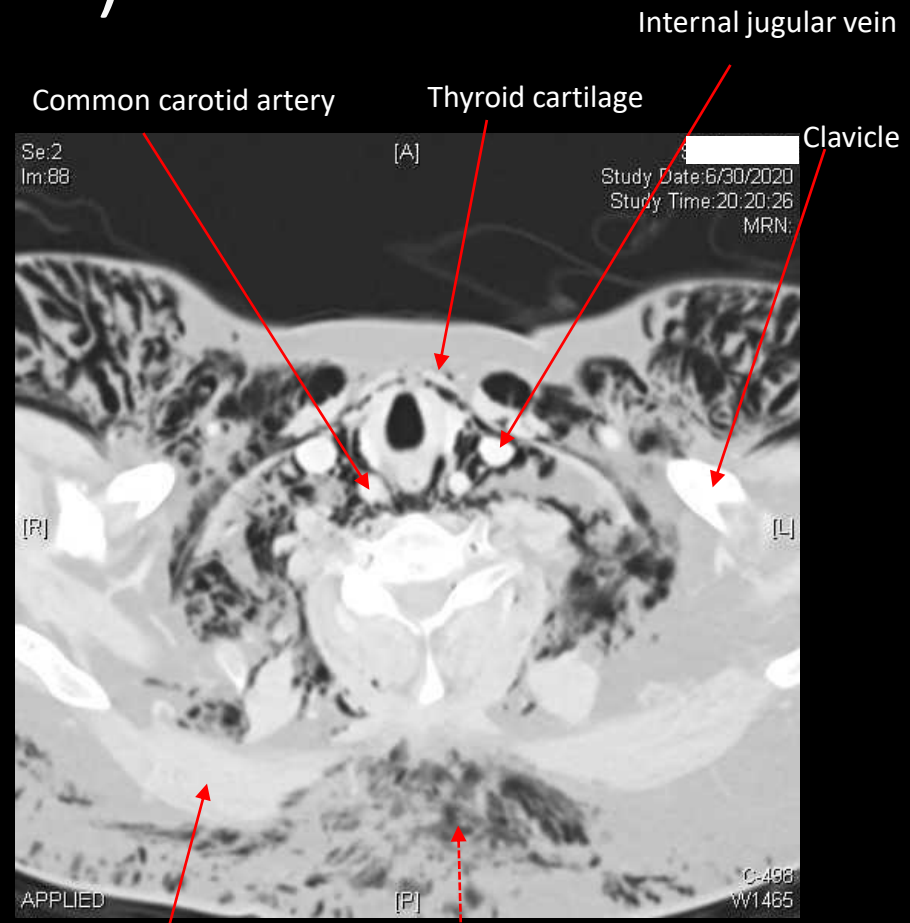
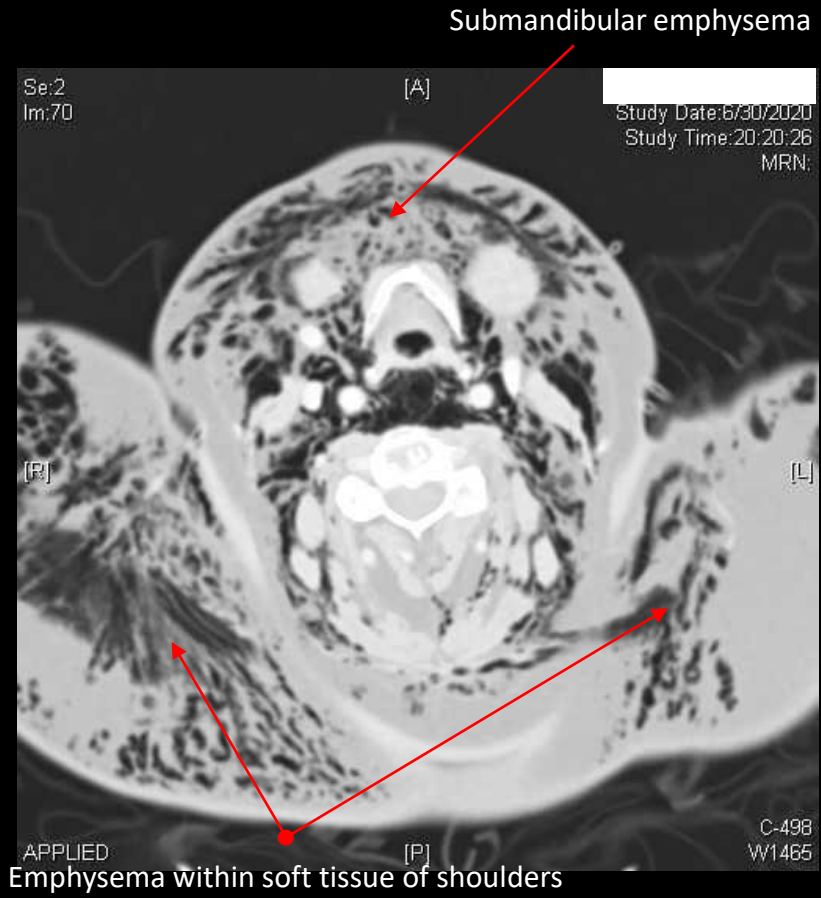
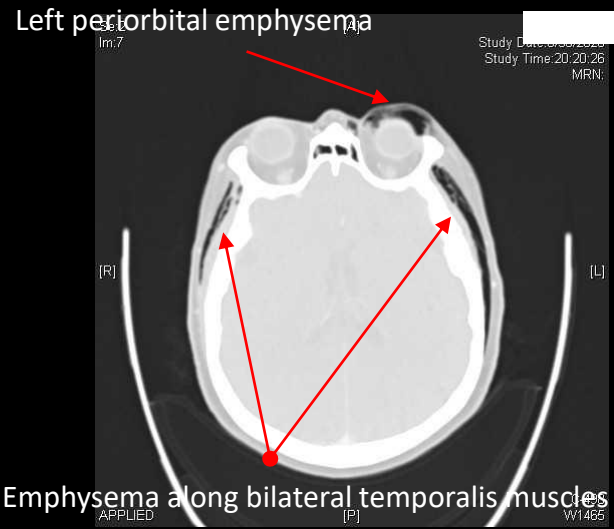
Case courtesy of Dr Andrew Dixon, Radiopaedia.org, rID: 36676

CTA chest (6/30)

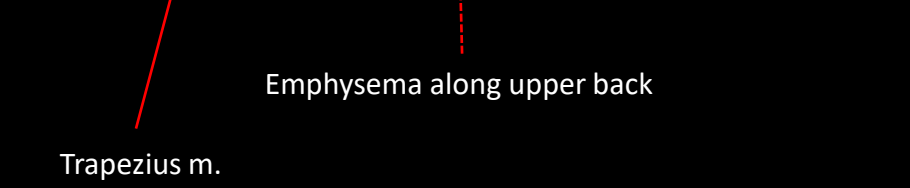
Extensive subcutaneous emphysema along chest wall and neck is noted with extra pleural air extending along lungs bilaterally. Peripheral fibrotic changes, including honeycombing, seen.



Neck soft tissue with contrast (6/30)



Extensive subcutaneous emphysema is seen dissecting through the spaces of the neck, face, and calvarium.



Recognizing Pneumomediastinum



“Ring around artery sign”: air around the pulmonary artery and main branches



“Tubular artery sign” : air outlining major aortic branches



“Continuous diaphragm sign”: air trapped posterior to pericardium

Differential Diagnoses & Etiologies

Subcutaneous emphysema

Differential Diagnoses:

- Angioedema/allergic reaction
- Hollow viscus rupture
 - Esophageal, bowel, trachea
- Necrotizing infections
- Artifact
 - Air trapped in skin folds/clothing
 - Fat density mistaken for gas

Etiologies:

- Penetrating trauma
- Pneumothorax
- Pneumomediastinum
- Perforated hollow viscus in the neck
 - Esophageal perforation
- Infection
 - Necrotizing fasciitis
- Iatrogenic
 - Post-surgical, injections, post-percutaneous interventions

Pneumomediastinum

Differential Diagnoses:

- Pneumopericardium
- Pneumoperitoneum
- Subcutaneous emphysema
- Pneumothorax

Etiologies:

- Trauma
 - Blunt or penetrating
- Esophageal perforation
 - Trauma, Boerhaave, iatrogenic
- Tracheobronchial perforation
 - Bronchoscopy, tracheostomy, laceration
- Barotrauma
 - Mechanical ventilation (PPV), diving
- ILD
- Infection
 - TB, mediastinitis, retropharyngeal
- Asthma/COPD
 - Alveolar bleb rupture
- Idiopathic

Discussion

- Subcutaneous emphysema with pneumomediastinum in patients with ILD occurs due to rupture of alveoli and dissection of air along the fascial planes of the tracheobronchial tree.
- Clinically, these patients present with dyspnea, chest pain, odynophagia, and hoarseness of voice.
- CT chest is the diagnostic modality of choice to examine the extent of pneumomediastinum.
- Given this patient has a known 2-year history of ILD 2/2 rheumatoid arthritis and similar presenting symptoms, subcutaneous emphysema with pneumomediastinum 2/2 ILD is the most likely diagnosis.

Continued discussion

- Although a rare complication of ILD, secondary pneumomediastinum is a self-limiting disease usually treated with supportive care, including high concentration O₂ and analgesics.
- Recent studies have shown that breathing 100% oxygen dissipates nitrogen from the blood, increasing the gas absorption gradient and resolution of pneumomediastinum.

Treatment

- In this case, the patient was treated with analgesics and oxygen therapy and was discharged a week later.
- Given her history of ILD with increasing dyspnea and new secondary pneumomediastinum, she was referred for lung transplantation.

CXR taken 7/5, just prior to discharge, reveals largely resolved pneumomediastinum and stable subcutaneous emphysema of neck and chest wall



ACR appropriateness Criteria

Variant 5: Chronic dyspnea. Suspected disease of the pleura or chest wall. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
Radiography chest	Usually Appropriate	☼
CT chest with IV contrast	Usually Appropriate	☼☼☼
CT chest without IV contrast	Usually Appropriate	☼☼☼
MRI chest without and with IV contrast	May Be Appropriate (Disagreement)	○
MRI chest without IV contrast	May Be Appropriate	○
US chest	May Be Appropriate (Disagreement)	○
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	☼☼☼☼
CT chest without and with IV contrast	Usually Not Appropriate	☼☼☼

Given the patient's acute on chronic dyspnea from ILD and presence of subcutaneous chest wall crepitus on exam, the initial CXR and CT chest with contrast were ***appropriate*** imaging modalities according to ACR.

<https://acsearch.acr.org/docs/69448/Narrative/>

Cost Calculation for Initial Work-Up

Imaging Modality	Average Self-Pay Patient Responsibility
Chest Xray Exam 2 Views	\$274
Ct Angio Chest W/O-W Con	\$1,622
Ct Neck Soft Tissue W/Con	\$1,602
Ct Pelvis/Abdomen W/Con	\$2,879
Total	\$6,377

<https://www.memorialhermann.org/patients-caregivers/pricing-estimates-and-information/>

Case Summary

- Patient with a history of ILD presented to the ED with worsening facial swelling.
- On exam she was found to have soft tissue crepitus on face, upper back, neck, and chest wall.
- CXR with subsequent CTA chest and soft tissue neck CT revealed extensive subcutaneous emphysema with associated pneumomediastinum.
- Patient was treated with oxygen therapy and discharged with resolution of pneumomediastinum.
- Referred for lung transplantation.

Teaching points

- Although a rare complication, massive subcutaneous emphysema with pneumomediastinum can occur 2/2 ILD.
- This occurs due to alveolar bleb rupture leading to dissection of air along the fascial planes of the tracheobronchial tree.
- This is a self-limiting disease that is treated with oxygen therapy, analgesics, and treatment of underlying lung disease.

References

- <https://www.memorialhermann.org/patients-caregivers/pricing-estimates-and-information/>
- <http://www.mamcjms.in/article.asp?issn=2394-7438;year=2017;volume=3;issue=2;spage=95;epage=97;aualast=Tayal>
- <https://radiopaedia.org/cases/normal-ct-chest?lang=us>
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- <https://radiopaedia.org/articles/pneumomediastinum?lang=us>



Questions?