ECMO and steroids for Severe COVID-19 Respiratory Failure

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Patient information

- 61 yo
- Female
- Hypertension, Type 2 Diabetes
- Obesity, BMI 35, below our average, some likely volume overload
- Relative baseline healthiness in line with our pre-established COVID ECMO criteria for age bracket
- All dates that follow are changed but relatively correspond

COVID-19 History of Present Illness

- Date symptoms began
- COVID-19 test: positive 8/9/20
- Presented to OSH 8/11/20 for worsening:
  - SOB
  - Cough
  - Fever
  - Headache
  - Flank pain and decreased urine output

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Clinical Hospital Course

- Presenting AKI resolved with fluid, but now volume overloaded
- 8/21/20 - Intubated at OSH after failure of Airvo & BiPAP with hypercarbia and hypoxia
- Progressively worsening hypoxia and hypercarbia despite lung protective ventilation, high peep, paralysis and proning
- Intubation day 3 - Saturations 80-85% despite FiO2 100%, PEEP +16
  - Unable to go higher due to inability to ventilate (PCO2 80-100)
  - Acidotic, but lactate was normal and kidneys perfusing
- Called by OSH for ECMO referral

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ECMO Candidacy

- Met our criteria:
  - For age 60-70, minor co-morbidities and no other organ damage
  - Rapidly progressive hypoxic and/or hypercarbic failure despite:
    - Vent optimization, paralysis, proning
  - Inability of facility to:
    - Use more advanced vent modalities
    - Additional therapy (in this case, inhaled epoprostenol or nitric oxide)
  - Inability to transfer safely to higher level of care
  - Less than 7 days of intubation + BiPAP + Airvo
    - Beyond this VILI/SILI already inducing fibrosis
  - Potentially reversible process (COVID pneumonia)

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ECMO Initiation

- 8/23/20 - Team sent to OSH for remote cannulation
- Saturations on arrival (supine) 75%-79% and tachycardic
- 25 Fr Right femoral multistage drainage cannula
- 22 Fr Right internal jugular EOPA reinfusion cannula
- Initial flows 4.0 LPM
- Initial sweep 4 LPM, titrated to 9 LPM to achieve PCO2 < 55
- SpO2 now 90's, tachycardia resolving
  - Pressors initiated 2/2 reduced sympathetic drive
- 3 days 1mg/kg/day x3 days then rapid taper over 4 days

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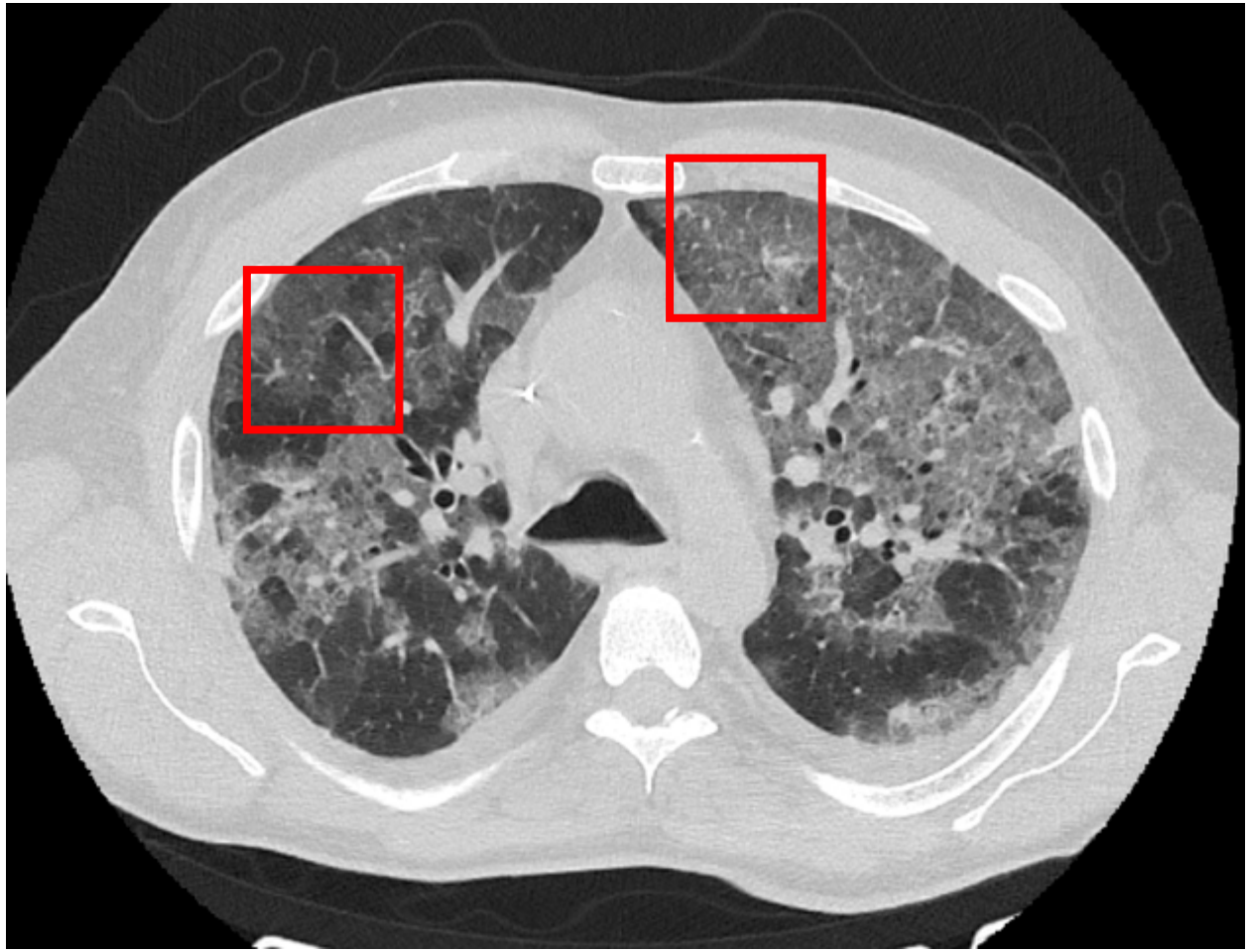
Radiology Lesson

- Outrageously simplified

- Ground glass
  - Inflammation
  - Infiltrates
  - Edema
  - Partially collapsed alveoli
- Generally reversible



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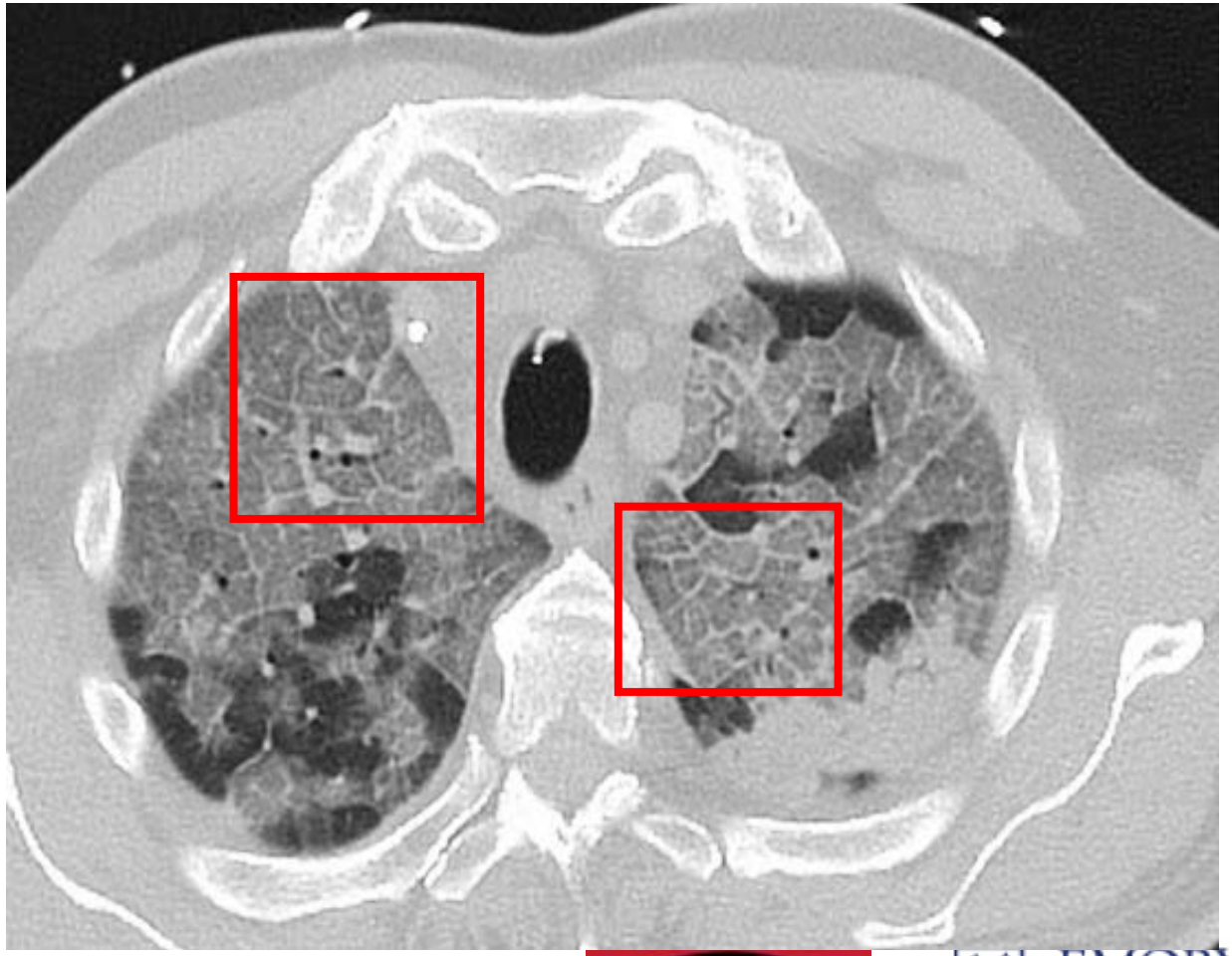
Radiology Lesson

- Crazy paving
  - Areas of ground glass surround by white borders, appearance of flagstone paving
  - Inflamed interlobular (groups of air sacs) septation membranes
  - Generally inflammatory process
  - Generally reversible



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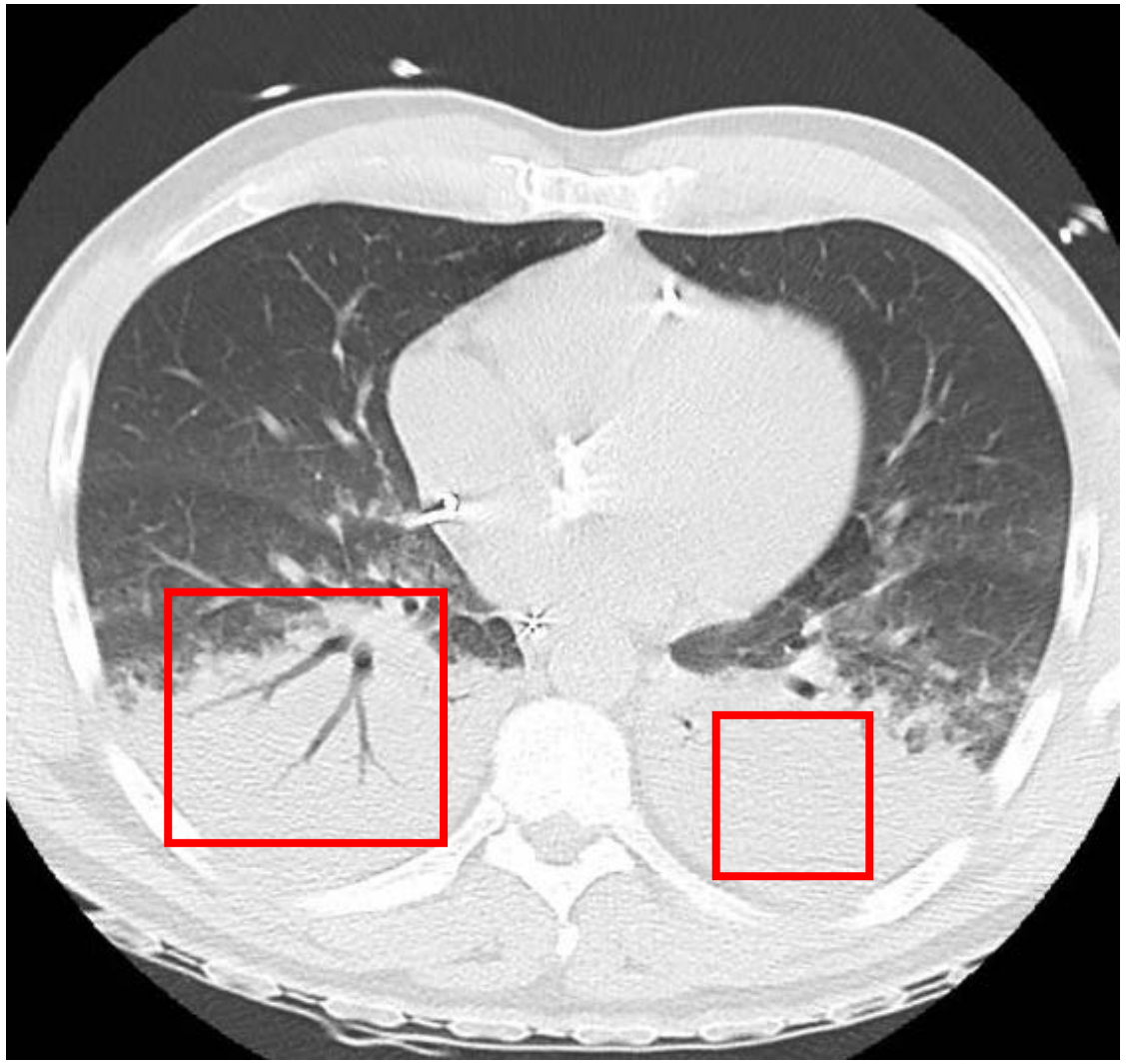
Radiology Lesson

- Consolidation
  - Completely collapsed alveoli
  - Due to:
    - Inflammation
    - Infiltration (debris, fluid, pus)
    - Compression
    - Airway obstruction (e.g. mucous)
    - Airway collapse
  - Generally reversible



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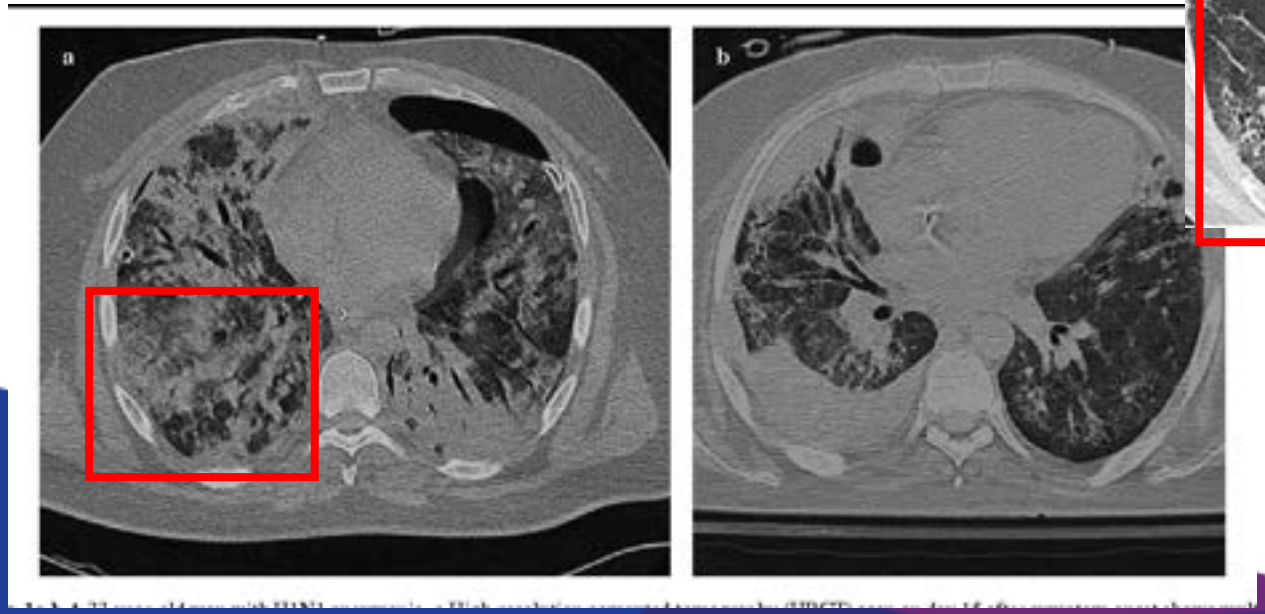
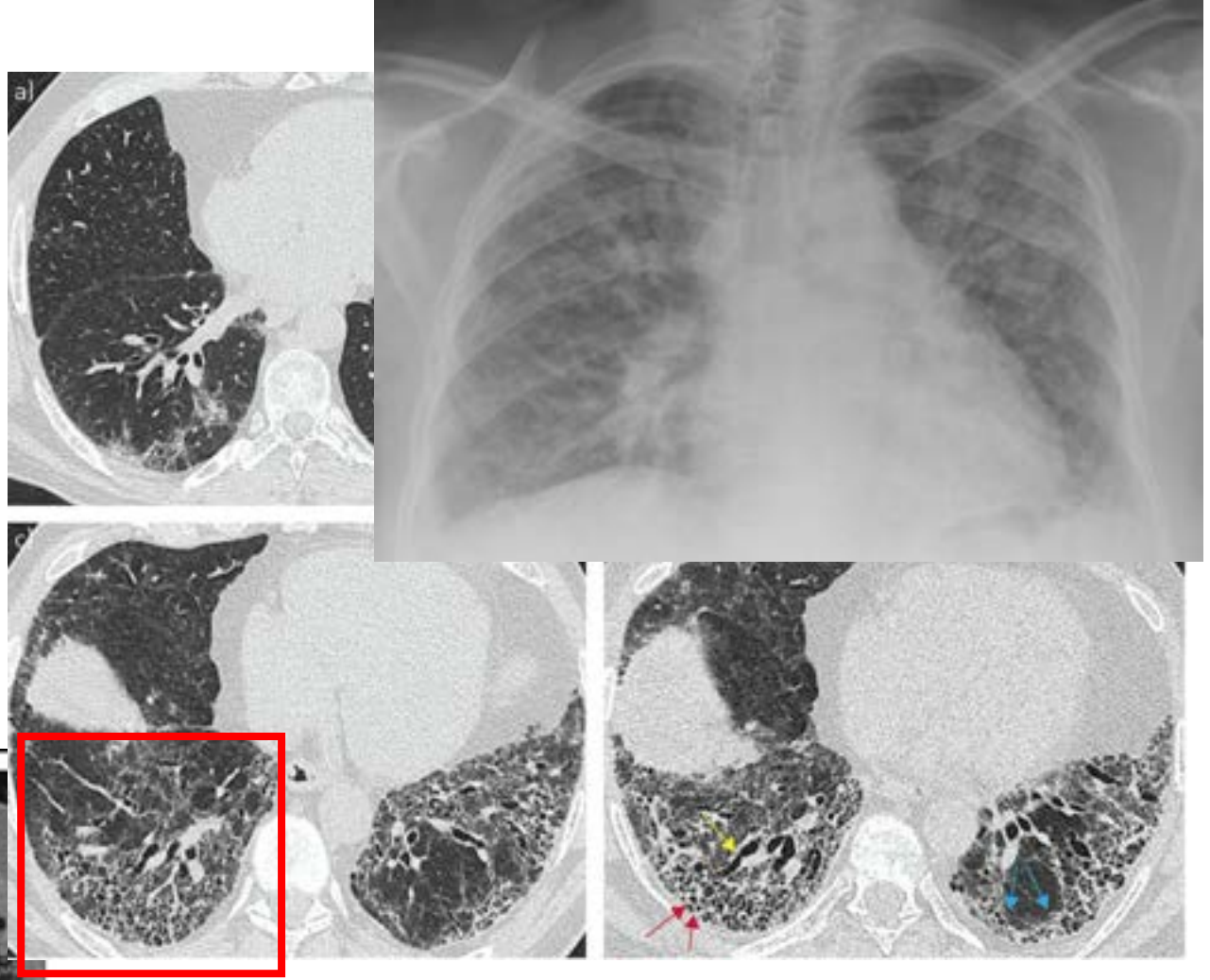
Radiology Lesson

- Fibrosis
  - Patent, enlarged airspaces surrounded by thick white scar
  - Traction bronchiectasis
  - Lung retraction
  - Generally not reversible





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ECMO Course

- Complications consistent with many COVID runs
  - Small PE
  - Bleeding
  - Flow insufficiency, high O2 demand
    - Failed attempt secondary drainage cannula
  - Encephalopathy, high sedation requirements
  - Volume management
    - Diuresed with drip but difficult to get significantly negative daily due to high obligate intakes
  - Nosocomial infections
    - Fungemia, candida
    - Pseudomonas pneumonia, cephalosporin resistant
  - Prolonged duration

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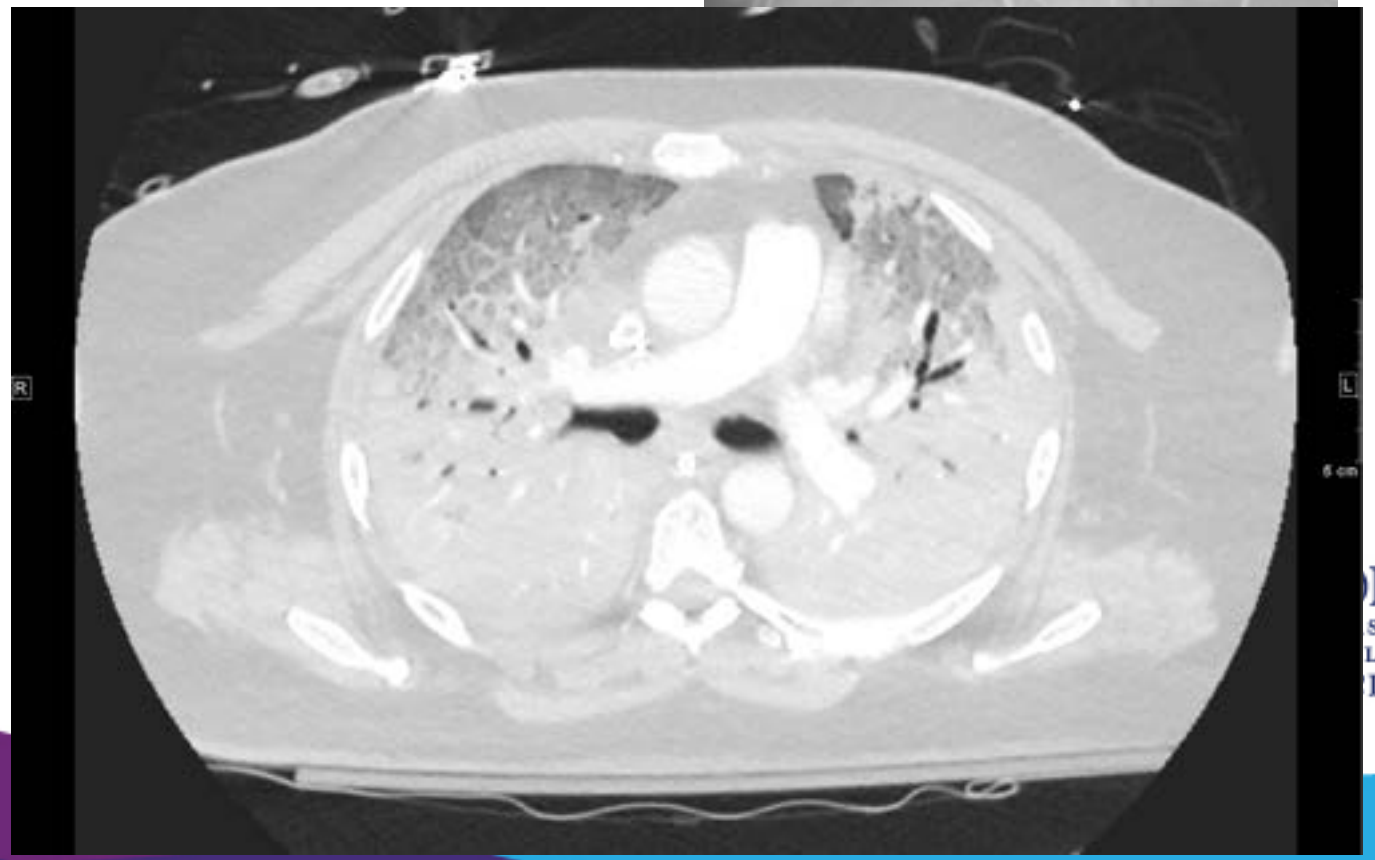
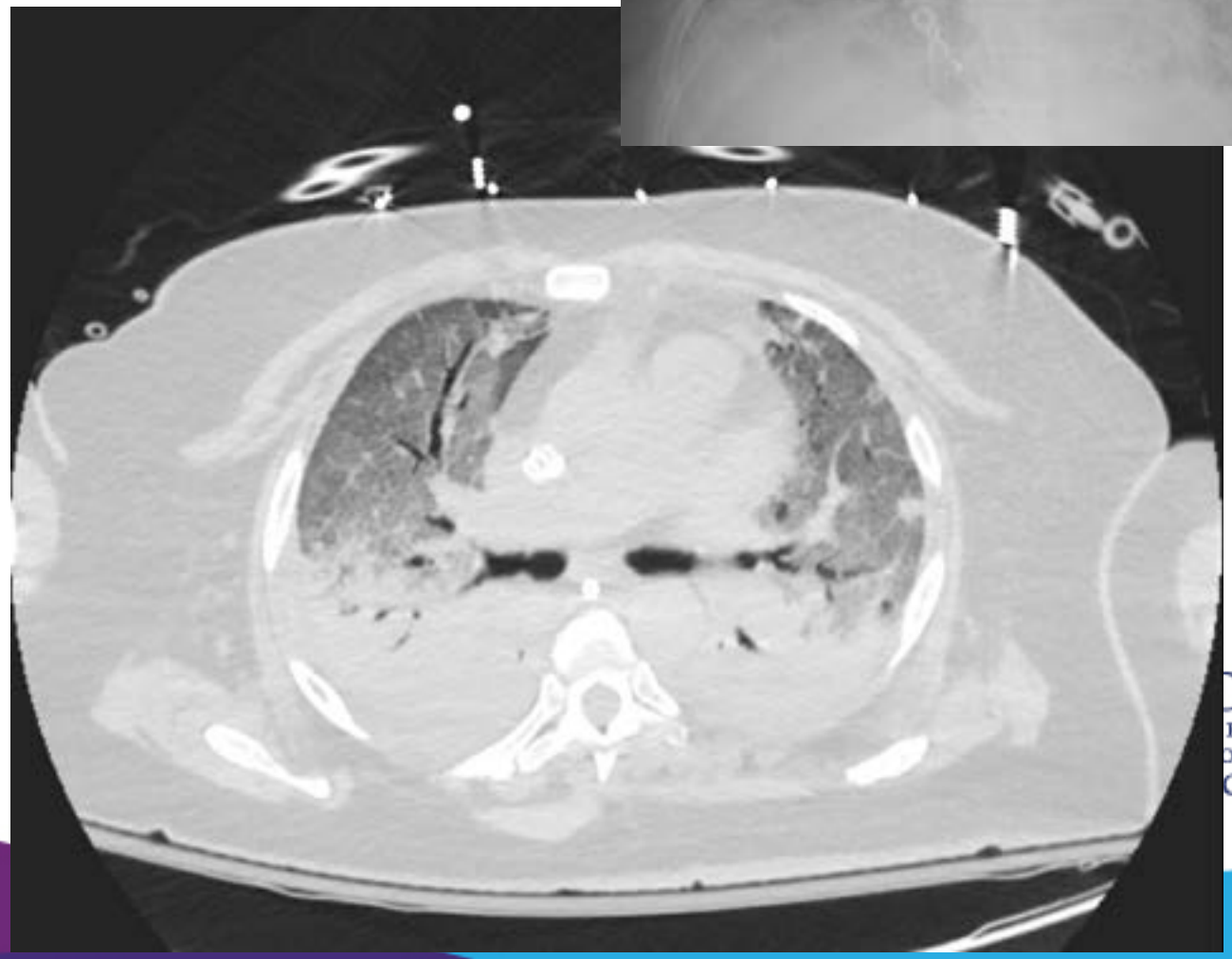
Results of treatment

- 8/24/20 Baseline scans
  - Ground glass
  - Crazy paving
  - Dependent consolidation
- CXR gives poor impression



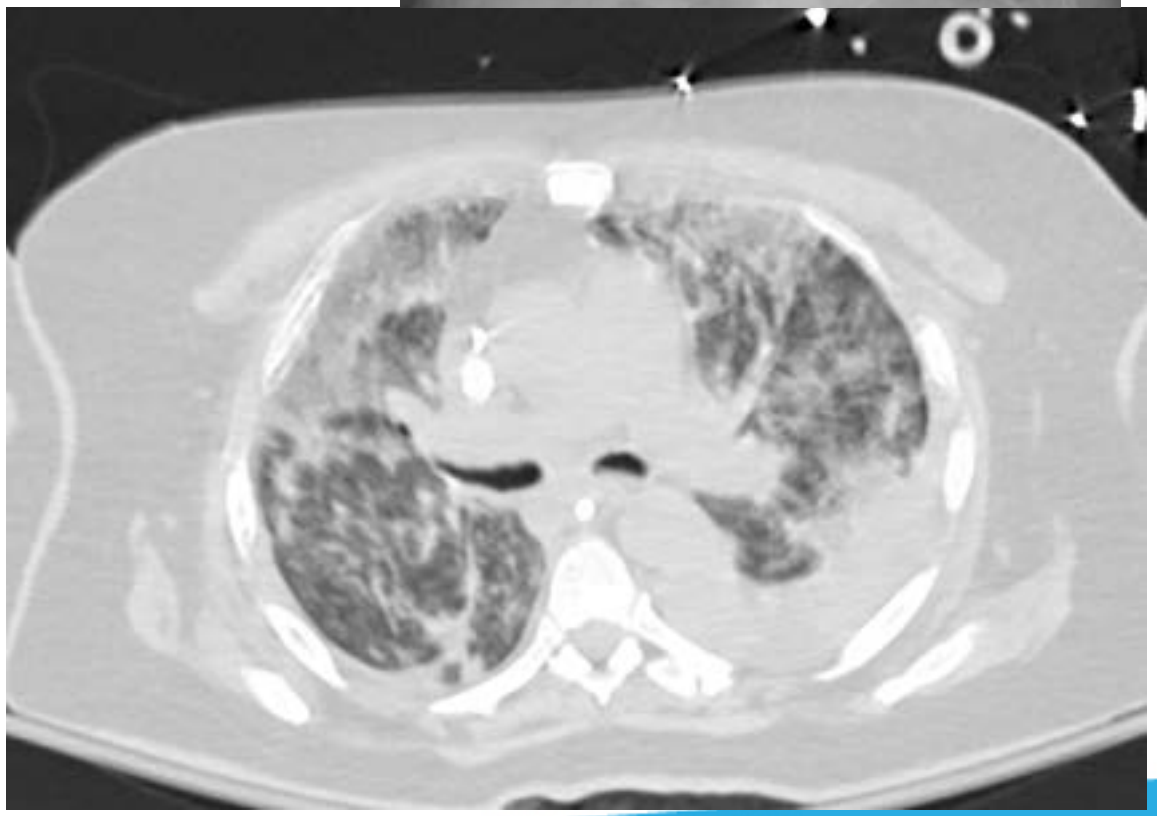
Results of treatment

- 9/15/20 (3 week) scans
  - No clinical improvement
  - Slight improvement of consolidation on CT
  - Same diffuse inflammation
  - No evidence of fibrosis
- Decision to pulse steroid
  - 2mg/kg per day x 3 days
  - Then 7 day taper



Results of treatment

- 9/22/20 (4 week) scans
  - Marked clinical improvement (flows and sweep down)
  - Markedly improved aeration (and corresponding vent volumes)
  - Improvement in ground glass inflammation
  - In retrospect, some areas of increased infiltrate (turned out to have developing bacterial pneumonia)
  - Again, CXR doesn't tell story well



Results of treatment

- Improvement stalled 2 weeks later
  - Improved again after treating resistant pseudomonas
- Septic shock also in same time-frame
  - Responded to micafungin, switched to fluconazole later
- Transitioned to Avalon cannula (dual-lumen cannula) and circuit changed (9/26/20)
- Weaned from sedation
  - Helped with spontaneous breathing and improved recruitment

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Results of treatment

- 9/30/21 - Decannulated
- 10/11/21 – Discharge to LTAC
  - 24 hours trach collar

Conclusions

- All prolonged respiratory failure is not necessarily fibrosis
  - CT can help guide therapy
  - CXR not sensitive enough, particularly to non-radiologists
- COVID is a steroid responsive disease
  - In this case, can't say for sure if was going to get better anyway
- ECMO in appropriate candidates can avoid further damage to lungs from VILI to allow treatment of underlying inflammation
  - Steroids, antimicrobials, * time *
  - Or bridge to transplant
- VV-ECMO for COVID challenging and atypical
  - 6-8 weeks not unusual (up to 2-3 months)

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