Pulmonary Embolism Secondary to Chronic VTE Treated Mechanical Embolectomy

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November 19th-21st, 2021

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Disclosures

Drs. Elias Iliadis, Grace Ayafor, and Daniel Redle have no relevant relationships with commercial interests to disclose.

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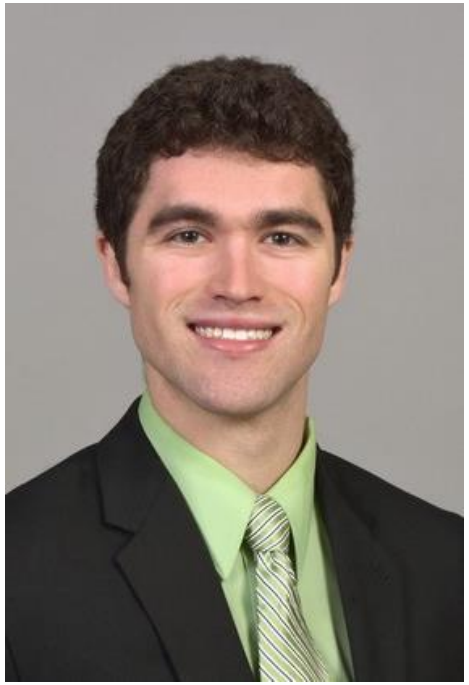

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Case – 64 yo Man

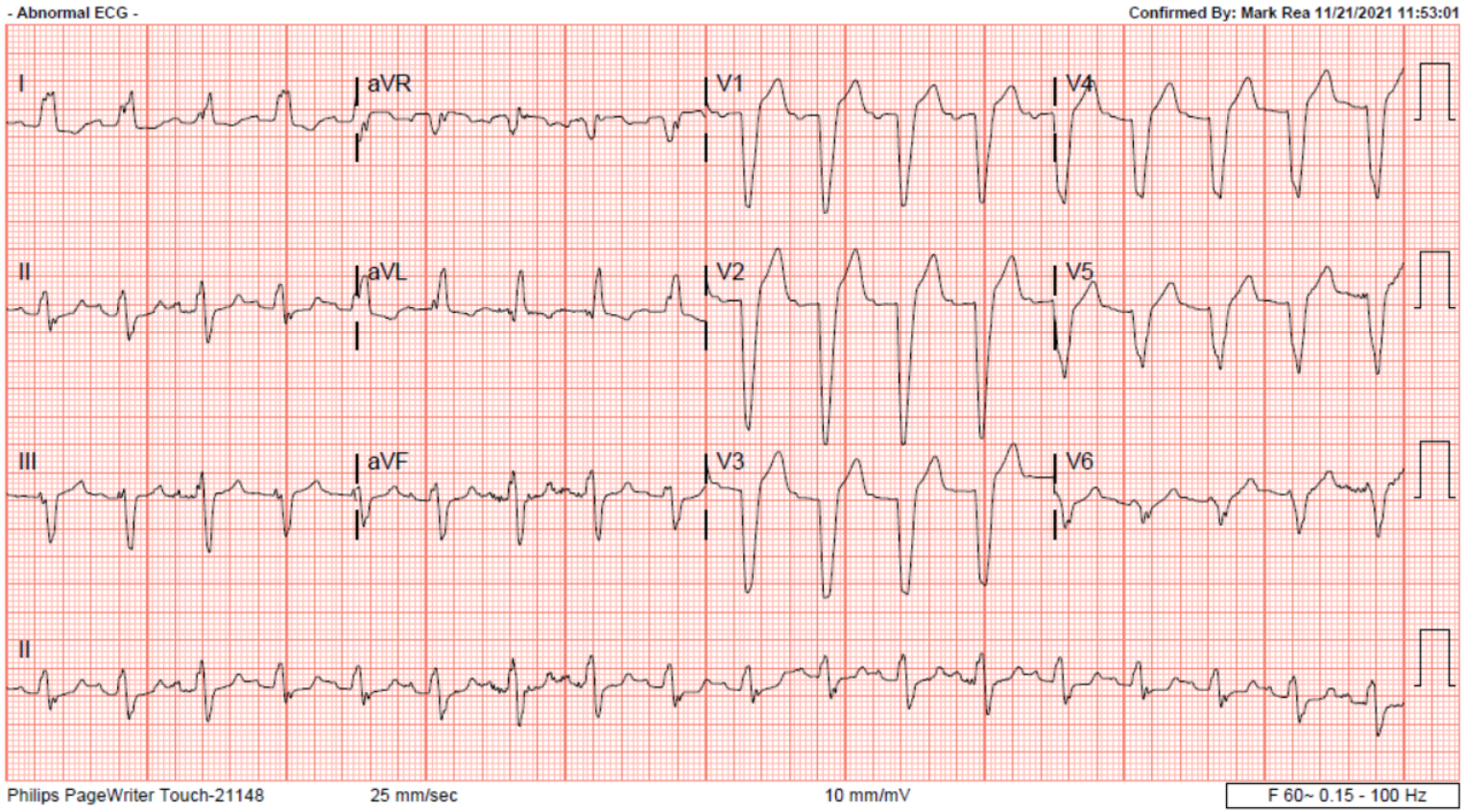
- Chief Complaint:
  - 2 weeks of worsening dyspnea with minimal exertion
- Past Medical History
  - NICM HFrEF 41%
  - chronic LBBB
  - HTN, HLP, DM2, BMI 33
  - Left femoral DVT and saddle PE 3 years ago attributed to prolonged car ride
    - Rivaroxaban x 1 year
    - hypercoagulable workup negative.
  - Ongoing Left LE post-thrombotic syndrome

Initial Evaluation

BP 129/94, HR 111, RR 25, O2 90% on 2L

- EKG: sinus tachycardia with LBBB
- Troponin I = 0.44 (nl 0 – 0.034)
- NT Pro-BNP = 1265 (nl < 125)
- BUN 24, Cr 1.24, Lactate 2.0
- CTA chest with extensive b/l PE
- Started on heparin infusion, admitted to ICU step down unit, Cardiology consulted

ECG



Sinus Tachycardia
LBBB

No typical findings for
Right Heart strain

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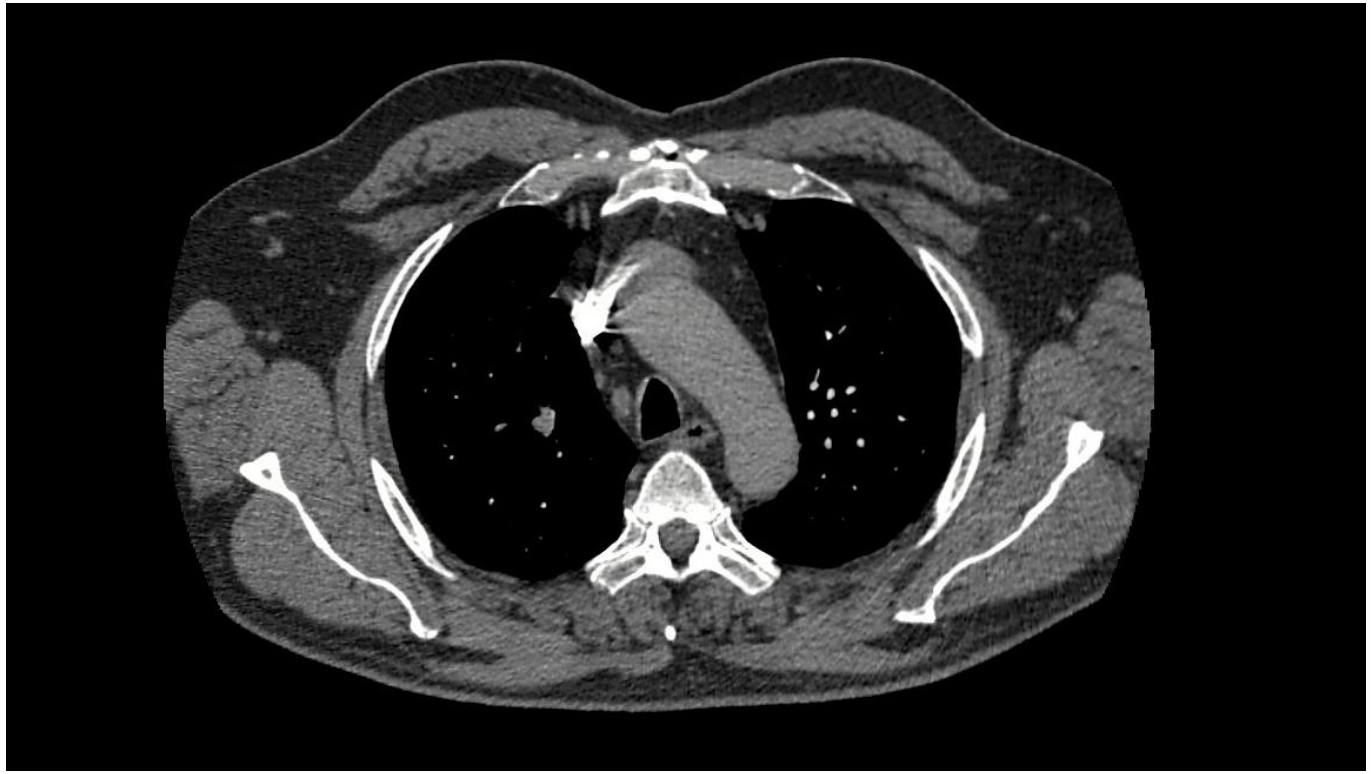
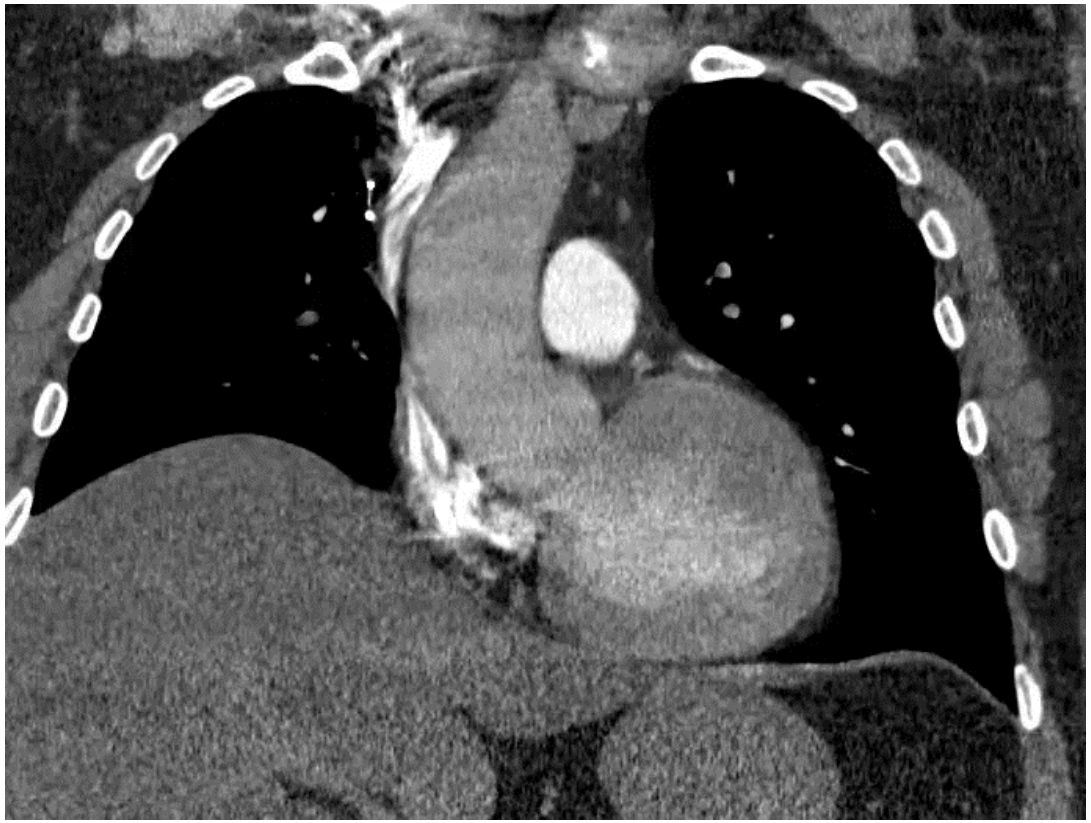
Chest CTA Axial View



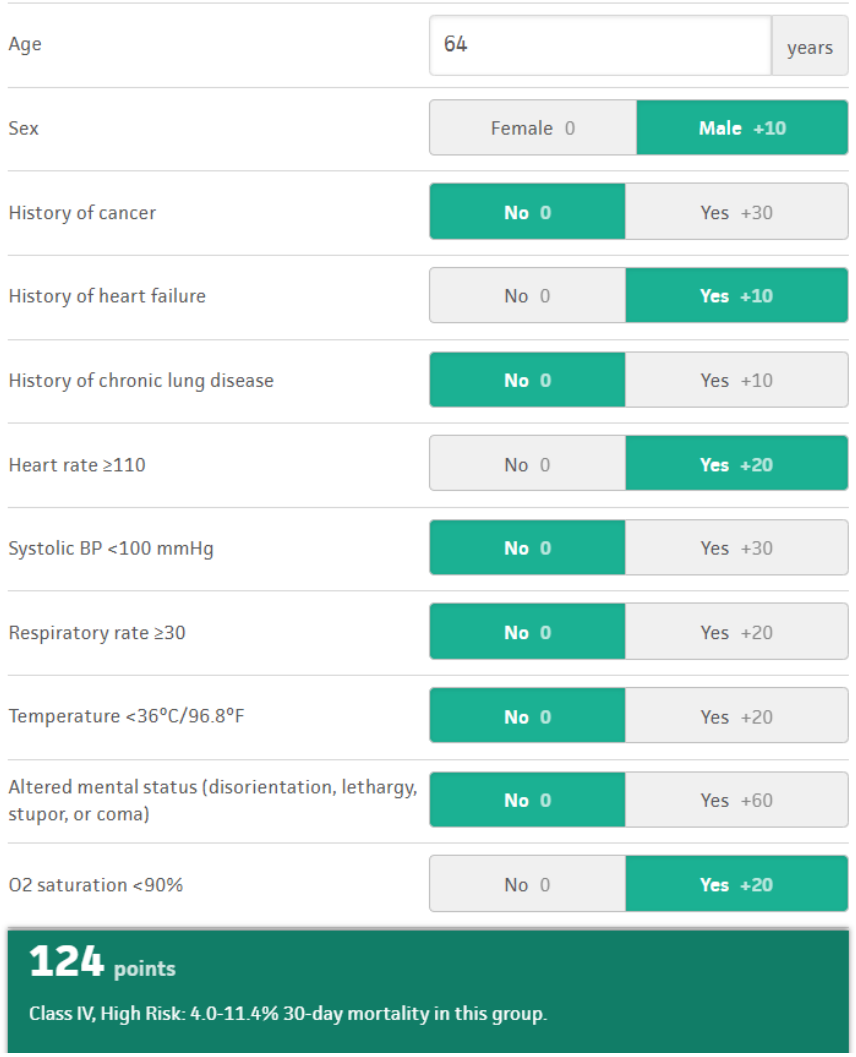
- Significant b/l clot burden, “vein cast emboli” described in the R main pulmonary artery
- RV/LV ratio: 1.5

CTA Chest Coronal View



PESI Score

Score 124, Class IV indicating high risk with a 4 -11.4% risk of 30-day mortality



Age	64 years	
Sex	Female 0	**Male +10**
History of cancer	**No 0**	Yes +30
History of heart failure	No 0	**Yes +10**
History of chronic lung disease	**No 0**	Yes +10
Heart rate ≥110	No 0	**Yes +20**
Systolic BP <100 mmHg	**No 0**	Yes +30
Respiratory rate ≥30	**No 0**	Yes +20
Temperature <36°C/96.8°F	**No 0**	Yes +20
Altered mental status (disorientation, lethargy, stupor, or coma)	**No 0**	Yes +60
O2 saturation <90%	No 0	**Yes +20**

124 points

Class IV, High Risk: 4.0-11.4% 30-day mortality in this group.

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Type of PE: Submassive / Intermediate-High Risk

Guidelines	Category	Hemodynamic Status	PE Severity Index (PESI) (or Simplified PESI)	Evidence of RV Dysfunction
American Heart Association (AHA, 2011)	Massive	Unstable	High	Typically Abnormal RV on Imaging, Elevated Troponin, OR Both
	Submassive	Stable	High	May Have Abnormal RV on Imaging OR Elevated Troponin OR Both
	Low Risk	Stable	Typically Low	None
European Society of Cardiology (ESC, 2019)	High Risk	Unstable	High	Typically Abnormal RV on Imaging, Elevated Troponin, OR Both
	Intermediate-High Risk	Stable	High	Abnormal RV on Imaging, AND Elevated Troponin
	Intermediate-Low Risk	Stable	High	May Have Abnormal RV on Imaging OR Elevated Troponin But Not Both
	Low Risk	Stable	Low	None

Treatment options for Sub-massive/Intermediate-High Risk PE

- Parenteral anticoagulation in all patients initially, then home going OAC
- Additional Treatments
  - **Full dose systemic tPA:** increased risk of ICH, mortality/morbidity benefit mostly in high-risk PE
  - **Half dose systemic tPA:** Studied in MOPETT Trial with promising results, not commented on in guidelines, some concerns that the dose has to be escalated to full in most patients
  - **Catheter guided tPA:** improved symptoms/RV function initially, no mortality/morbidity benefit proven yet, less bleeding risk than systemic tPA
  - **Catheter guided percutaneous embolectomy:** improved symptoms/RV function, no mortality/morbidity benefit yet proven, can be used when tPA is contraindicated
  - **Surgical embolectomy:** improved symptoms/RV function, no mortality/morbidity benefit yet proven, can be used when tPA is contraindicated

Catheter based therapies for Submassive/Intermediate Risk PE

Percutaneous Catheter-Directed Treatment			
Catheter interventions with thrombolysis		**Catheter interventions without thrombolysis**	
Technique	**Device examples**	**Technique**	**Device examples**
Catheter-directed thrombolysis	-UniFuse -Cragg-McNamara (4-5F infusion catheters)	Aspiration Thrombectomy	-Aspirex rotational thrombectomy -Angiovac suction cannula - Indigo Mechanical Thrombectomy System - Sheath with detachable hemostatic valve 8-9 F (Argon Medical Devices)
Ultrasound-assisted catheter-directed thrombolysis	EkoSonic 5.2, F12 cm treatment zone device	Mechanical Thrombectomy	**Flowtriever** 20F device with nitanol discs and aspiration
Rheolytic thrombectomy plus catheter directed thrombolysis	Angiojet 6 F PE thrombectomy with Power Pulse thrombolysis	Rheolytic Thrombectomy	Angiojet 6 F PE catheter
Combined techniques	Ex. Pigtail fragmentation plus Angiojet	Thrombus fragmentation	Pigtail Catheter (5-6 F) or peripheral balloon catheter (6-7F balloon diameter 5-10 mm)
		Combined Techniques	Pigtail plus thrombectomy with Aspirix

ESC 2019 PE Guidelines

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Indications for Catheter based therapies for Submassive/Intermediate Risk PE

- AHA Guidelines 2011: **COR IIb**, LOE C for patients with worsening prognosis (worsening hemodynamics or respiratory status)

- ESC Guidelines 2019: **COR IIa**, LOE C for patients with worsening hemodynamics

Back to our patient … Day 2

- Persistent dyspnea at rest, hypoxia requiring **4 L O2,** and persistent tachycardia
- Given large proximal PE, decided to proceed with catheter-based therapy - pulmonary artery embolectomy using Inari Medical FlowTriever device.

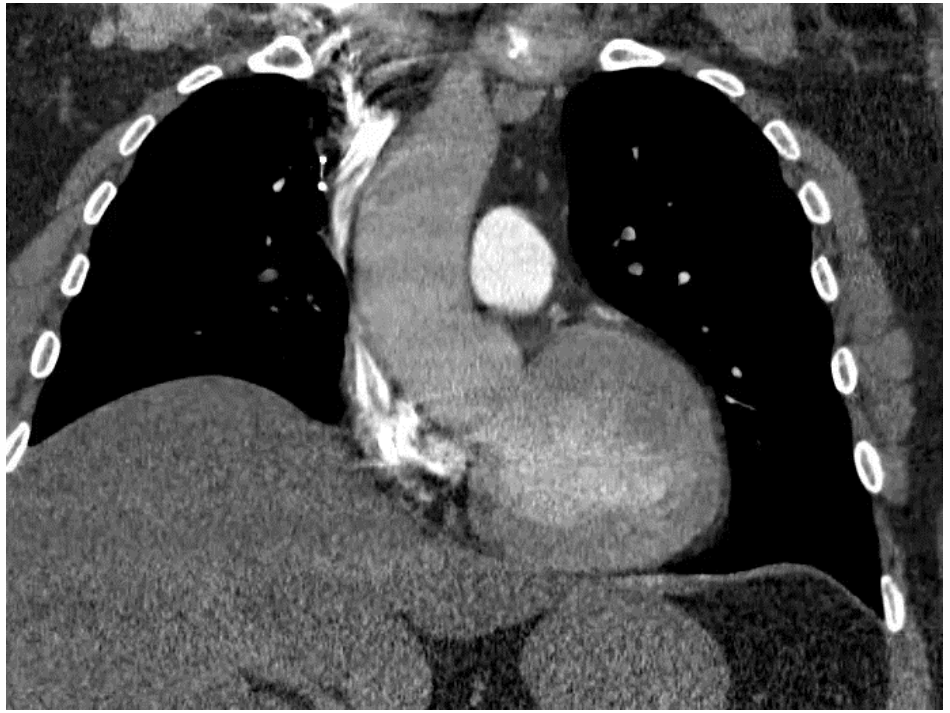
Right Lung pre-thrombectomy

Extensive filling defect in the main RPA, and R Interlobar pulmonary artery

Right Lung post-thrombectomy

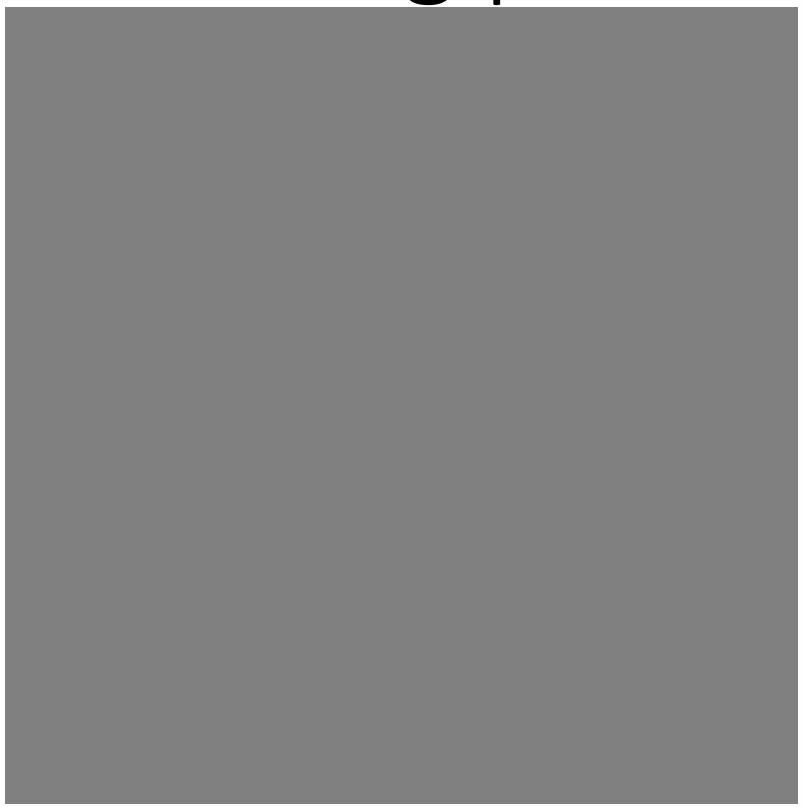
Significant improvement
after aspiration of emboli

Left Lung pre-thrombectomy



Extensive filling defect in the Left Interlobar artery, Anteromedial basal segment, Lateral basal segment, and Posterior basal segment but also some defect in the apico-posterior segment

Left Lung post thrombectomy



Curved catheter used to better engage L Interlobar artery

Successful thrombectomy

- PA pressures improved from 62/27 to 45/24
- Vitals leaving cath lab: BP 144/108, HR 81, RR 22, pulse ox 99% on 2Lpm
- Discharged home to following day on lifelong OAC

Question

- What are the indications for Catheter Guided Thrombectomy according to ESC guidelines?
  a. High Risk PE without contraindications to tPA as a first line option
  b. Intermediate Risk PE without hemodynamic compromise
  c. Intermediate Risk PE with worsening hemodynamics
  d. Low risk PE

Correct Answer

- **C** Intermediate Risk PE with worsening hemodynamics
- according to the ESC guidelines there must be evidence of worsening hemodynamics to justify the use percutaneous thrombectomy
- Note, the AHA guidelines include worsening respiratory status which fits with our patient
- **FLARE** study demonstrated that FlowTriever is safe with minimal incidence of major bleed (0.9%), MAE (3.8%) and improves RV/LV ratio significantly by -0.38

Discussion

- Emboli in right lung described as “vein cast emboli”, which raises the question if this was a chronic DVT/VTE. Patient had symptoms for 2 weeks
- Inadequate literature on incidence of chronic DVT causing PE
- FlowTriever may be more beneficial than EKOS in PEs with more hardened/chronic clot
- More research is needed to determine whether there is mortality and/or morbidity benefit to using the Catheter Interventions, prior studies underpowered

Future Research

- HI-PEITHO Study
  - Upcoming RCT across 65 sites across US and Europe comparing standard of care (high dose heparin UFH or LMWH) to EKOS +anticoagulation
  - Comparing acute intermediate-high risk PE patients
  - Endpoints include mortality and morbidity measures

- PEERLESS Study
  - Upcoming RCT across 60 sites across Europe and US comparing FlowTriever to Catheter Directed Thrombolysis
  - Comparing acute intermediate-high risk PE patients
  - Endpoints include mortality and morbidity measures

Conclusions and Learning Points

- FlowTriever is effective in reducing thromboembolism burden in the pulmonary arteries and improving blood flow with minimal complications
- Improves RV Function in the short term
- Effective in improving symptoms rapidly and likely reduces hospital stay length
- There are upcoming trials investigating Catheter Therapies impact on mortality and morbidity compared to standard of care