Qué hacer y cómo resolver
II - Sesión TEP

- HIGH RISK PE
- INTERMEDIATE-HIGH RISK PE ON
  HPTEC
- PEERLESS

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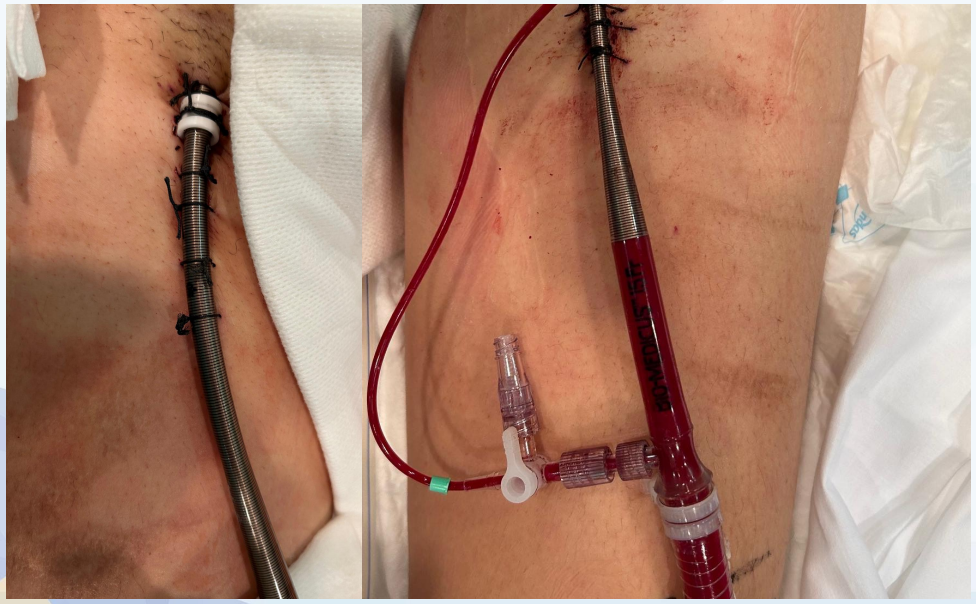
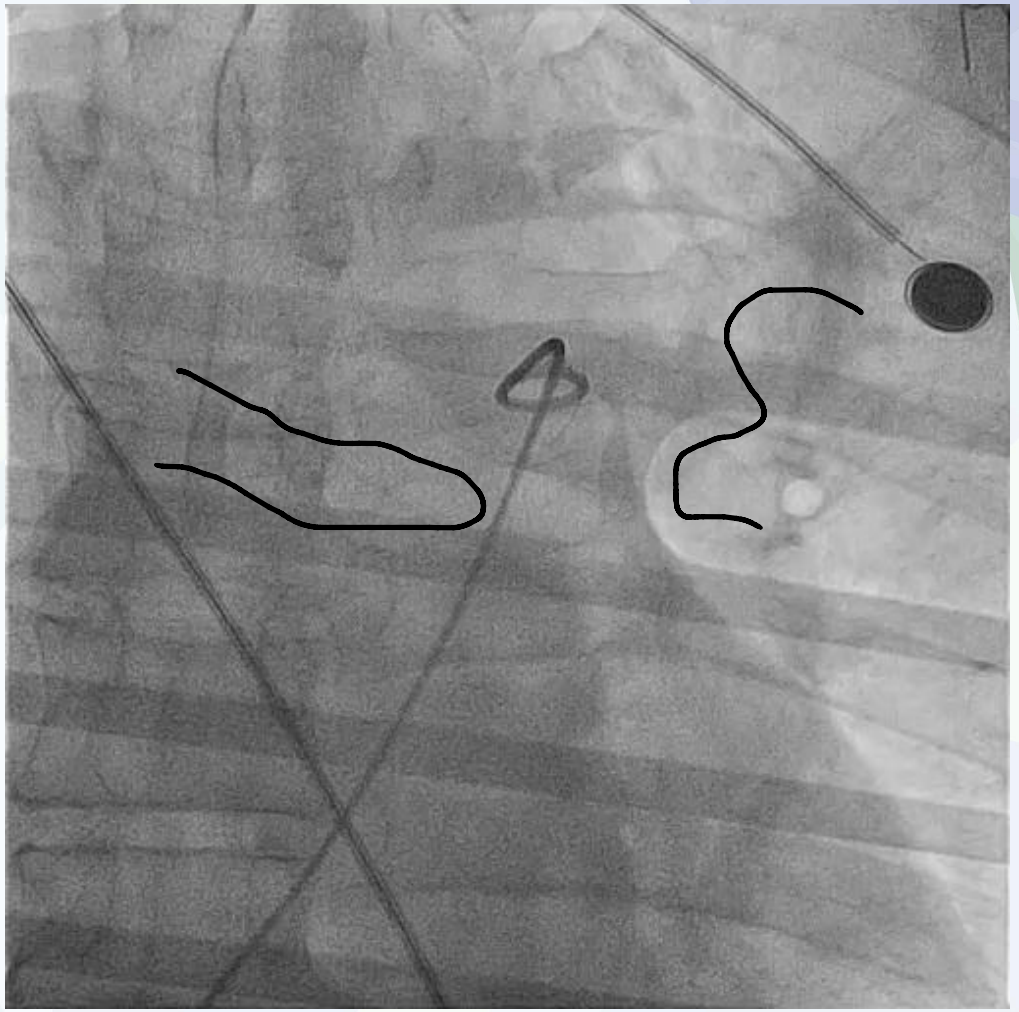
HIGH RISK PULMONARY EMBOLISM

- **43 yo male**
- **BMI 30.5**
- No previous medical history
- **Tibia and fibula fracture** 3 weeks ago (LWMH 40 mg/24h)
- Emergency department: abdominal pain and diarrhea
- **Cardiac arrest** at the emergency department
  - ✓ CPR maneuvers are started, adrenaline
  - ✓ Orotracheal intubation and mechanical ventilation
    - Pulse is recovered
    - Sinus rhythm+RBBB
    - BP 60 mm Hg

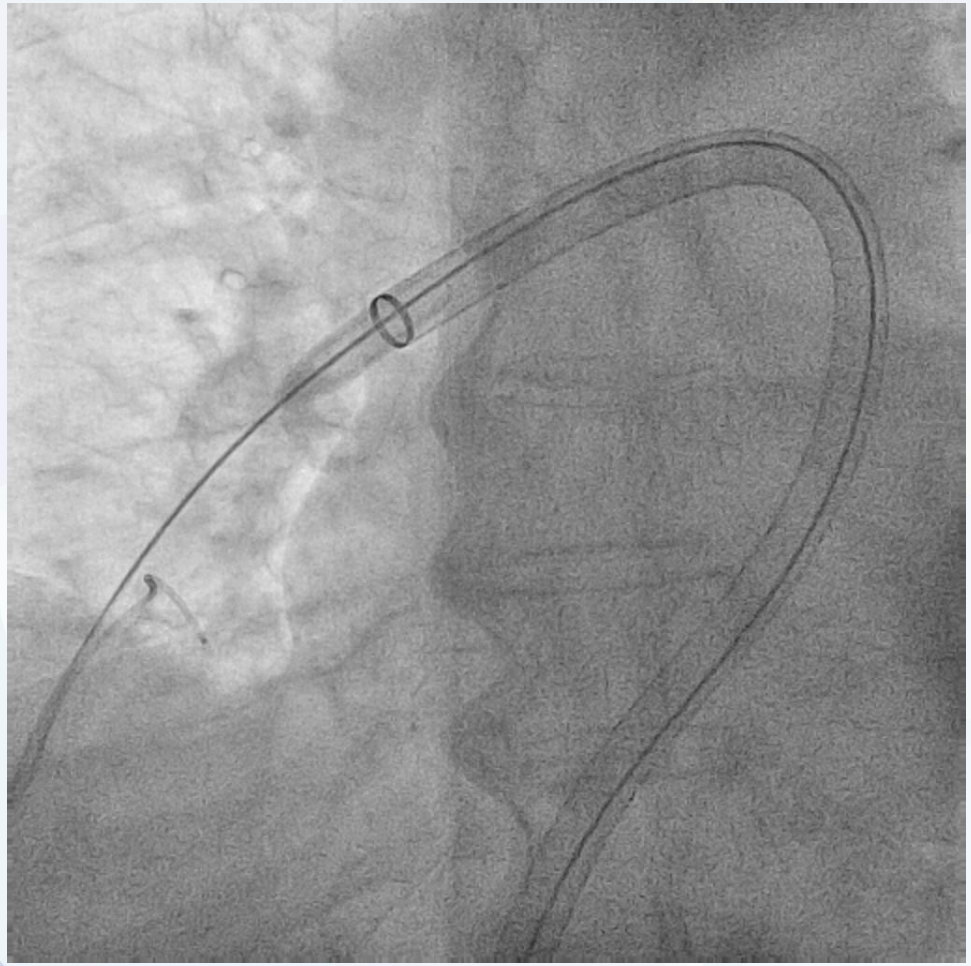
HIGH RISK PULMONARY EMBOLISM

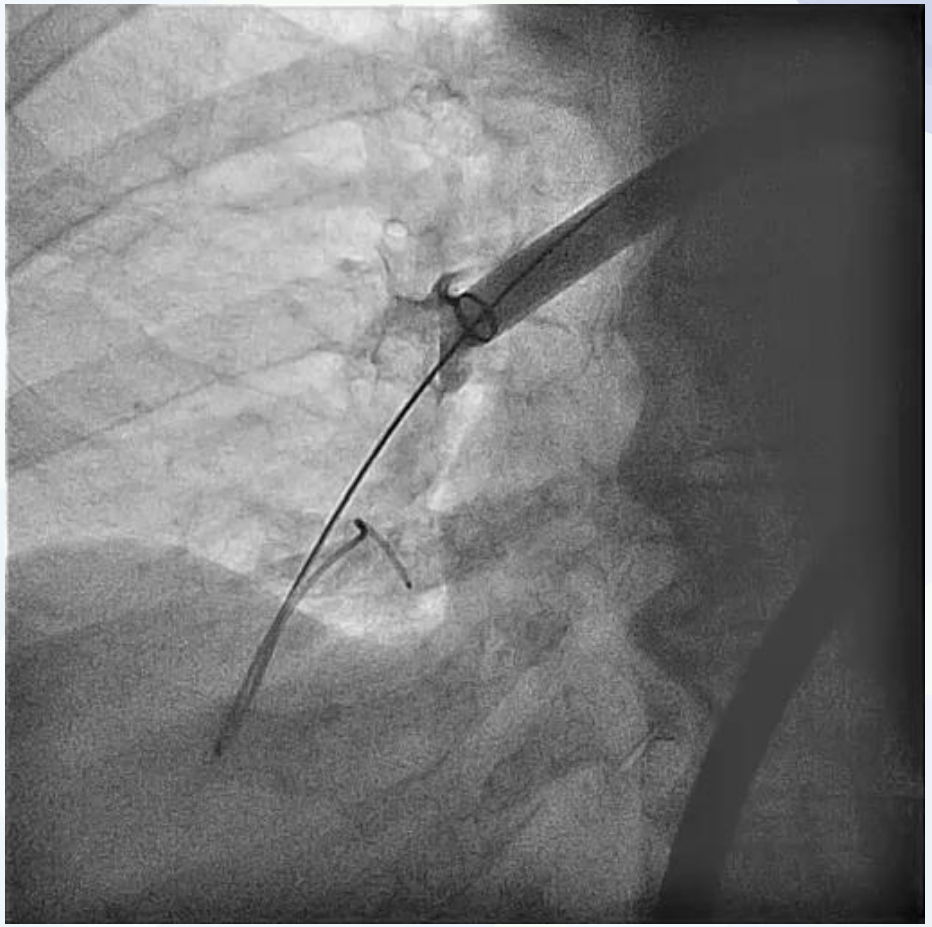
- Inmediate progressive **hemodynamic deterioration**
- Trasferred to the **cath-lab** while on cardiac massage with **external compressor**
- PH 7.2; Lactate 13
- Put on **VA-ECMO**



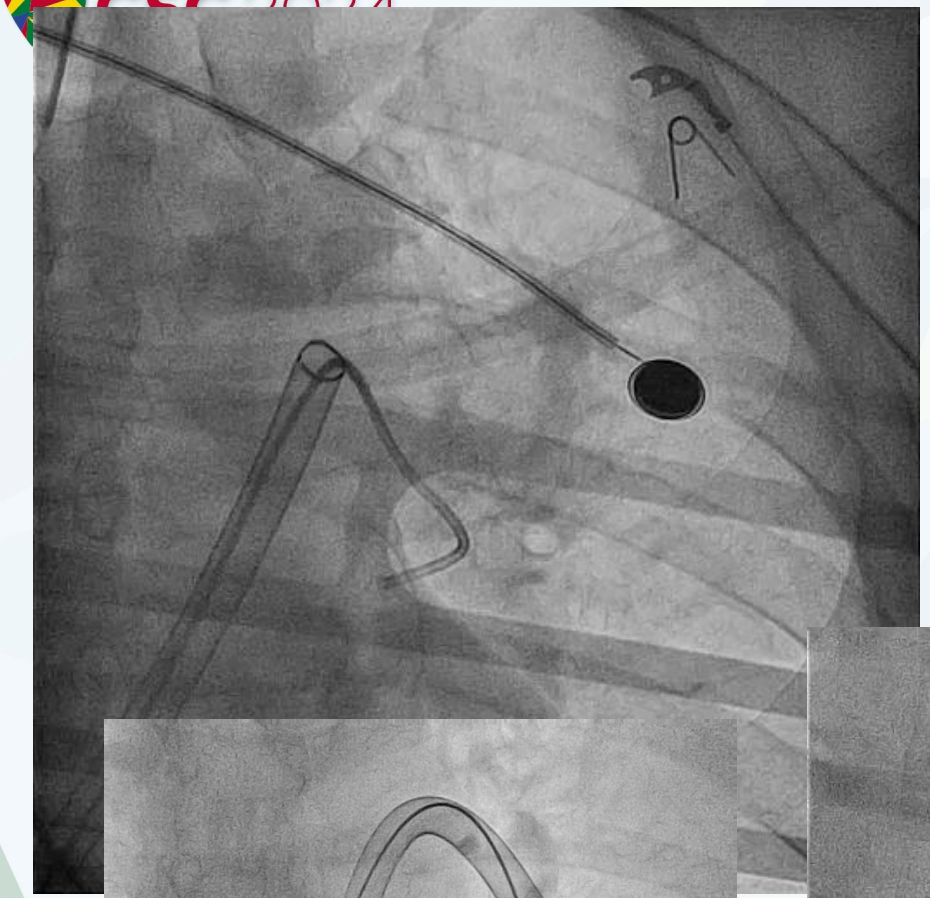


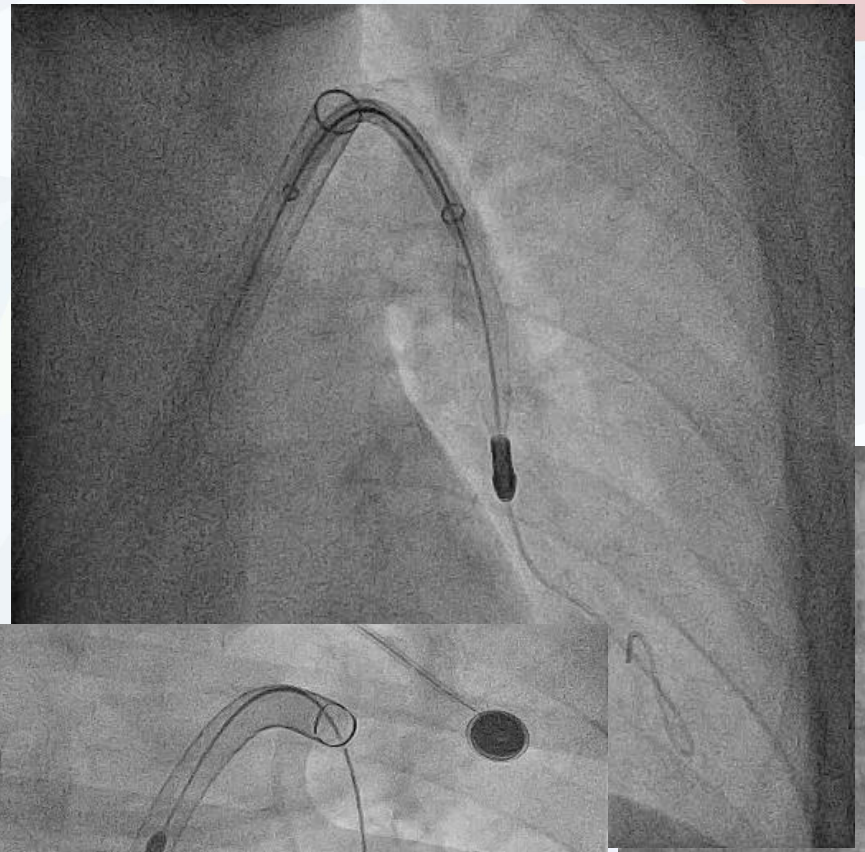
HIGH RISK PULMONARY EMBOLISM

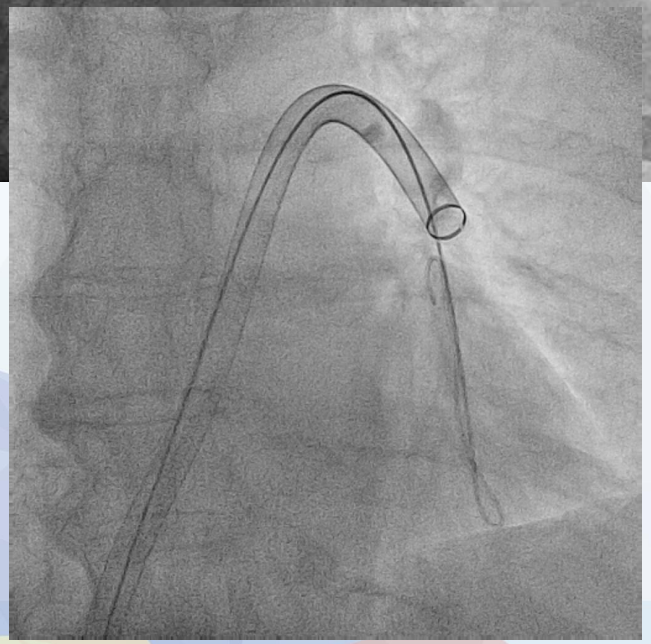


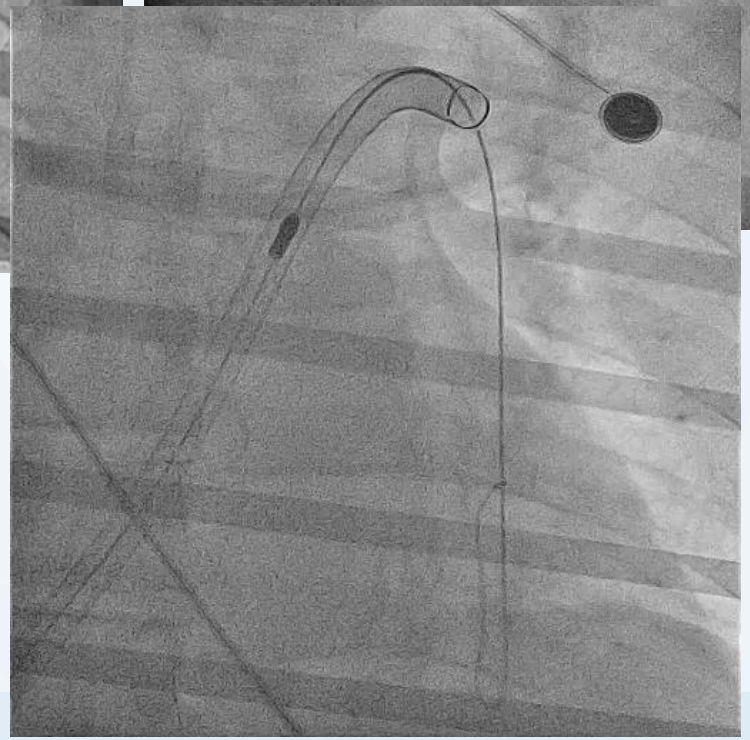


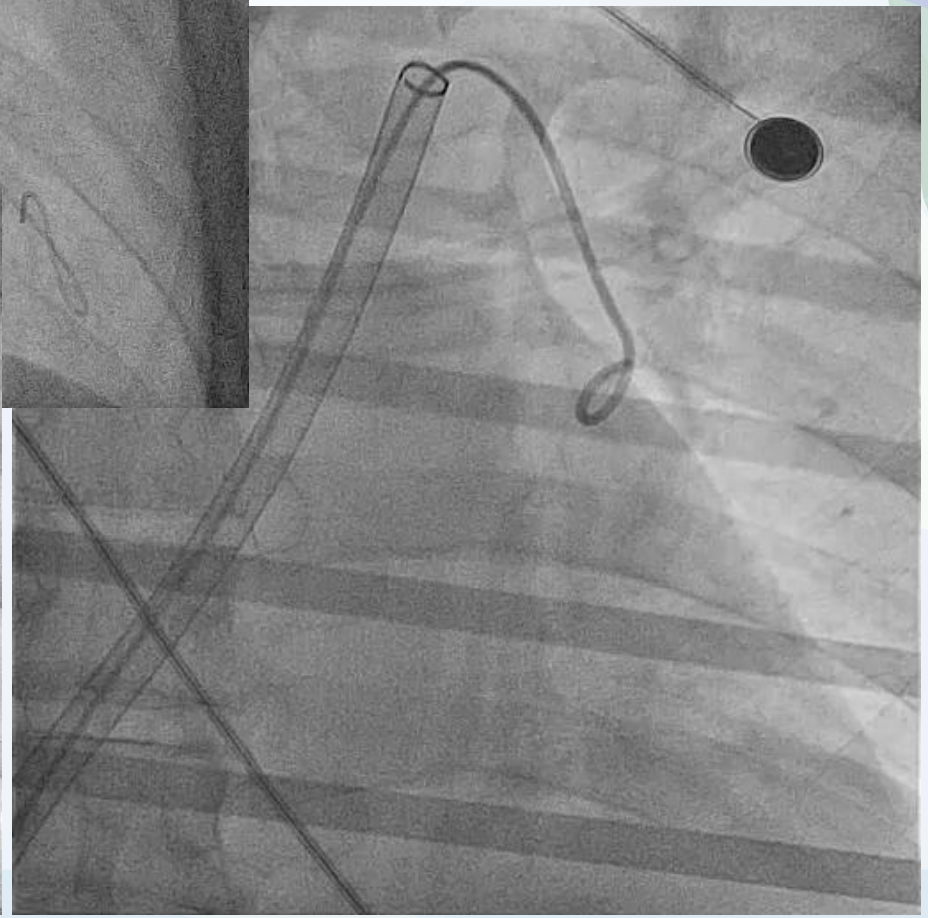
HIGH RISK PULMONARY EMBOLISM







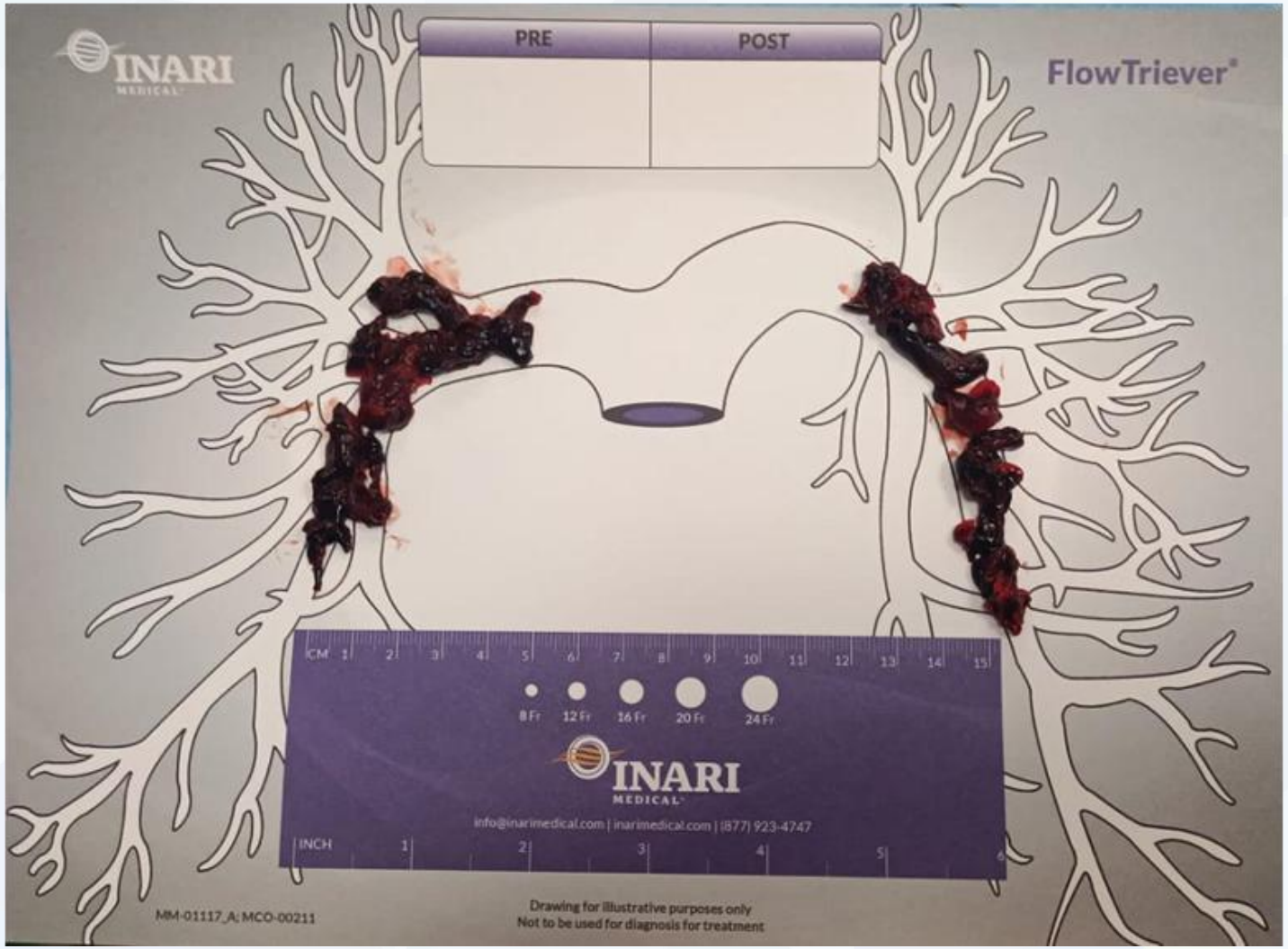




HIGH RISK PULMONARY EMBOLISM

BASAL

- PAP 69/35/46mmHg
- SAT AO 96%
- HR 110 bpm



POST-TROMBECTOMY

- PAP 41/21/29mmHg
- SAT AO 100%
- HR 104 bpm

HIGH RISK PULMONARY EMBOLISM

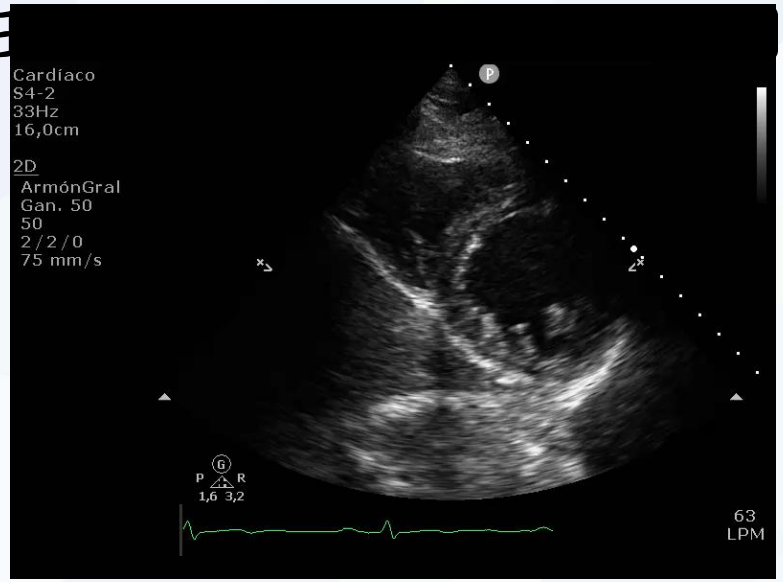
- Excellent evolution in the ICU
- Hemodynamically stable, DBT at minimal doses and ECMO around 2 L/min
- TTE: moderate to severe RV dilatation and dysfunction improved to mild

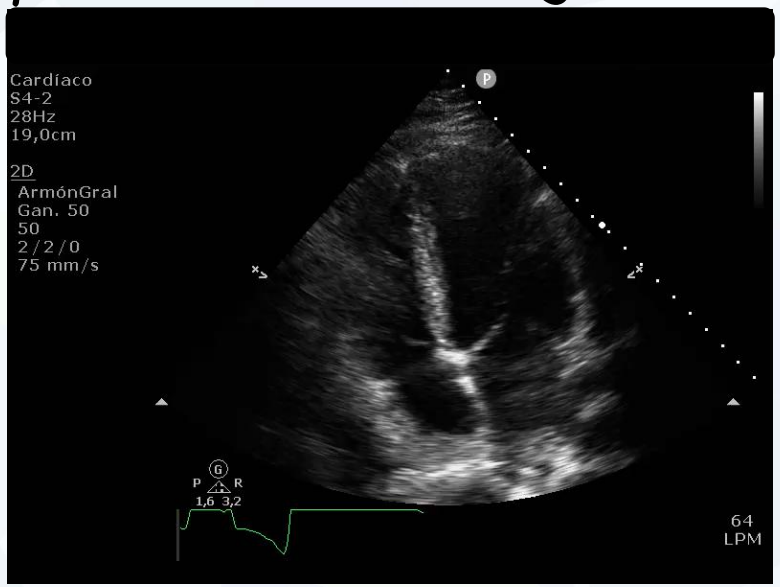
- Withdrawal of circulatory support 48 h later
  - ✓ Compression FV
  - ✓ Proglide in the FA

- Complications
  - ✓ anemia up to 8 g/dl (bleeding after venous decannulation)
  - ✓ fever up to 38.3º 2nd day of ECMO implantation (STAF coag neg), 4 days with prophylactic amoxi-clav in the context of urgent intubation

HIGH RISK PULMONARY EMBOLISM

- Pre-Discharge TTE: Non-dilated RV with preserved systolic function. No PH
- 6 months anticoagulation with apixaban. Discharge 10 days after PE





- 6 months follow-up

✓ Dyspnoea if walking fast. Working as a construction worker

✓ Unique perfusion defect in LII, not concordant in the ventilation

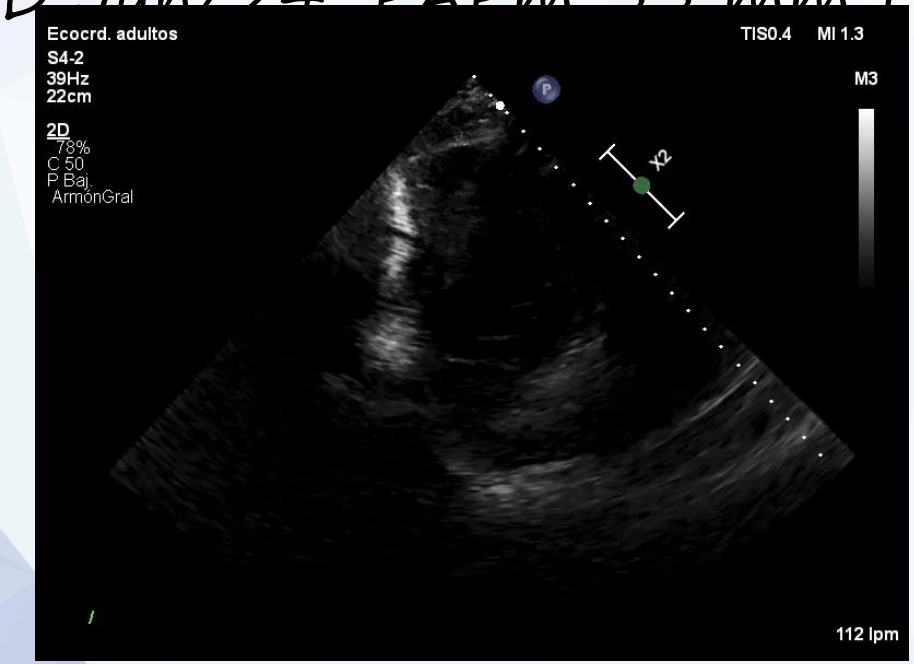
IMPORTANT ISSUES

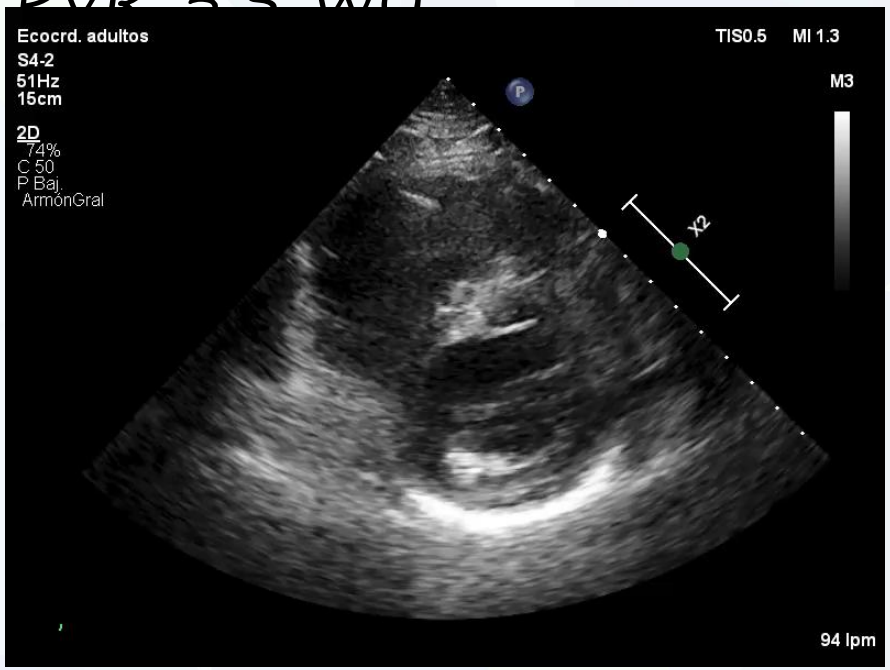
- NON-DEBATABLE
  - ✓ Mandatory reperfusion in HR-PE
    - ✓ If lysis contraindication or high bleeding risk ➡ TROMBECTOMY

- DEBATABLE
  - ✓ If cardiac arrest
    - iv inmediate sistemic lysis + ECMO?
    - ECMO + mechanical trombectomy?
    - ECMO + catheter directed local thrombolysis?

INTERMEDIATE-HIGH RISK ACUTE PE ON CTEPH

- 57 yo woman with systemic lupus + triple positive antiphospholipid syndrome + episodic hemolytic anemia
- DM-Insulin
- Precapillary PH mixed cause: CTEPH (PE Jan/2024) + group 1 (lupus)
- CCD Jun/24: PAPm 33 mm Hg, PVR 3.5 WU



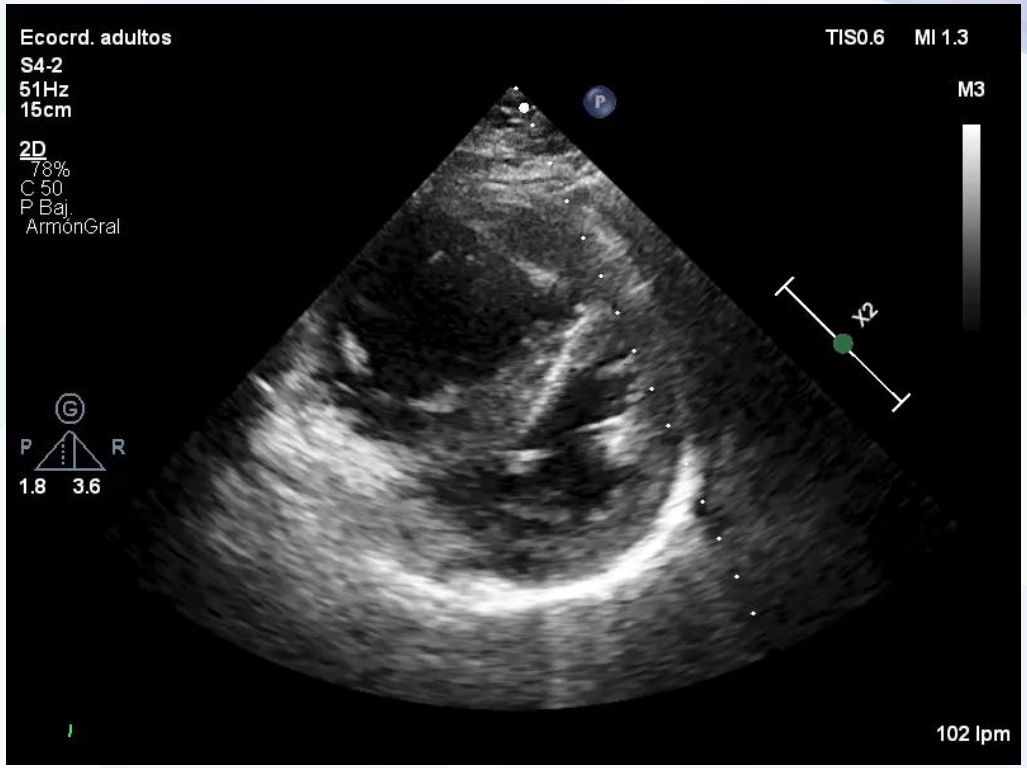


INTERMEDIATE-HIGH RISK ACUTE PE ON CTEPH

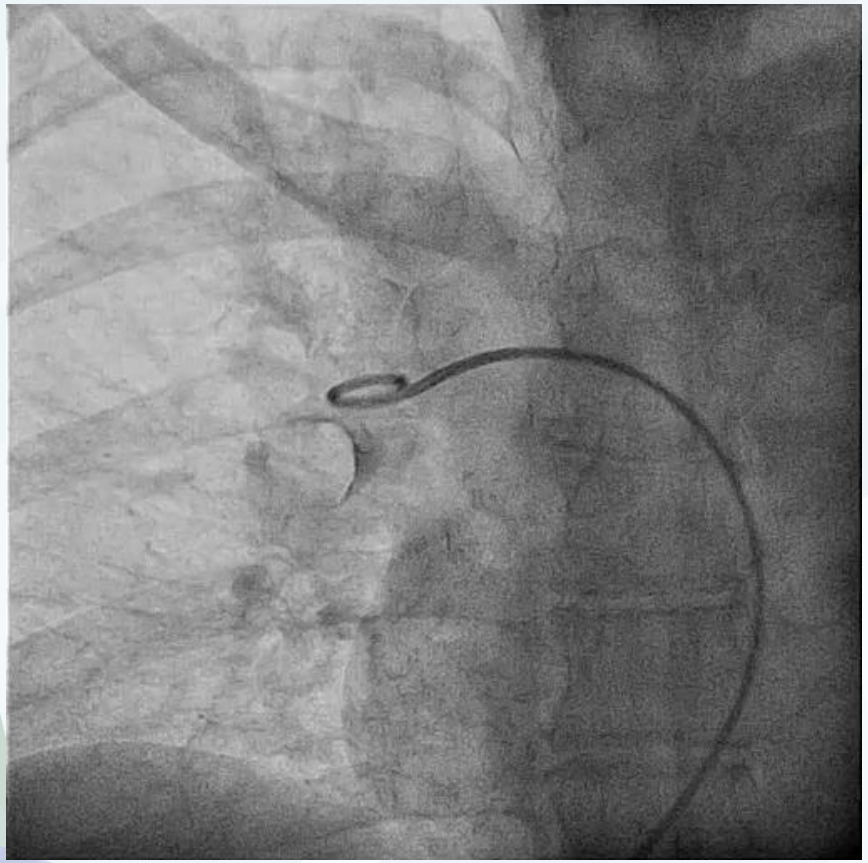
- 3/OCT/24 presented with haemoptysis, dyspnoea and tachypnoea

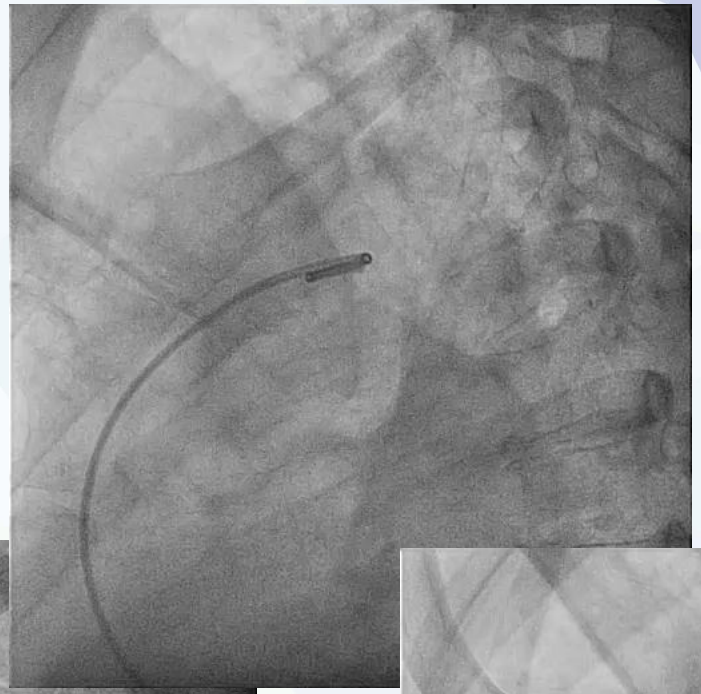
- Diagnosis of acute bilateral central PE
- Tachypnoeic (RR 40) , with respiratory insuficiency, needing high flow nasal cannula
- Normotensive but in sinus tachycardia (120 bpm)
- ProBNP 2900, lactate 1,9

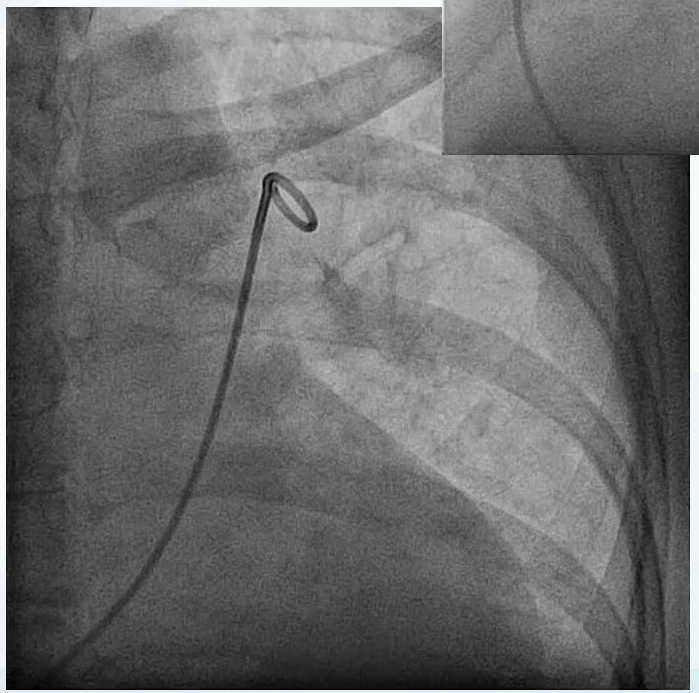
- Previous treatment: enoxaparin + inmunoglobulin + dexametasone + rituximab

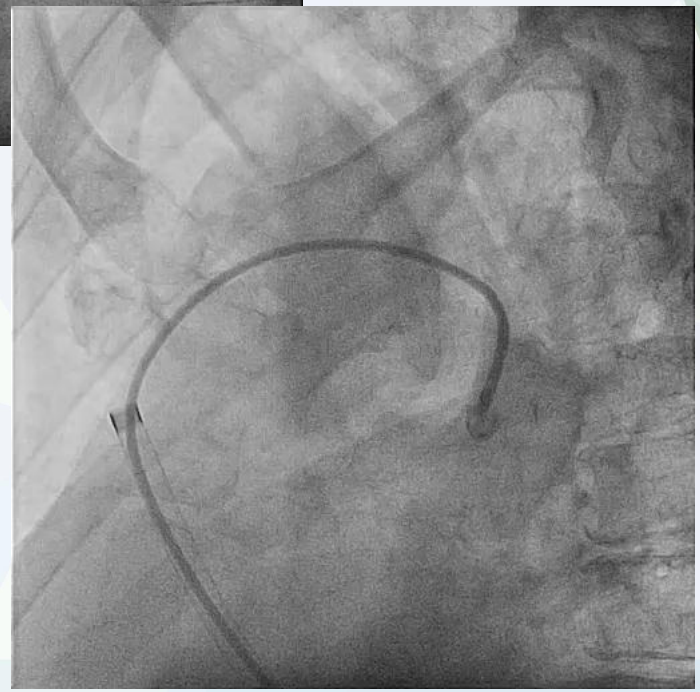


INTERMEDIATE-HIGH RISK ACUTE PE ON CTEPH

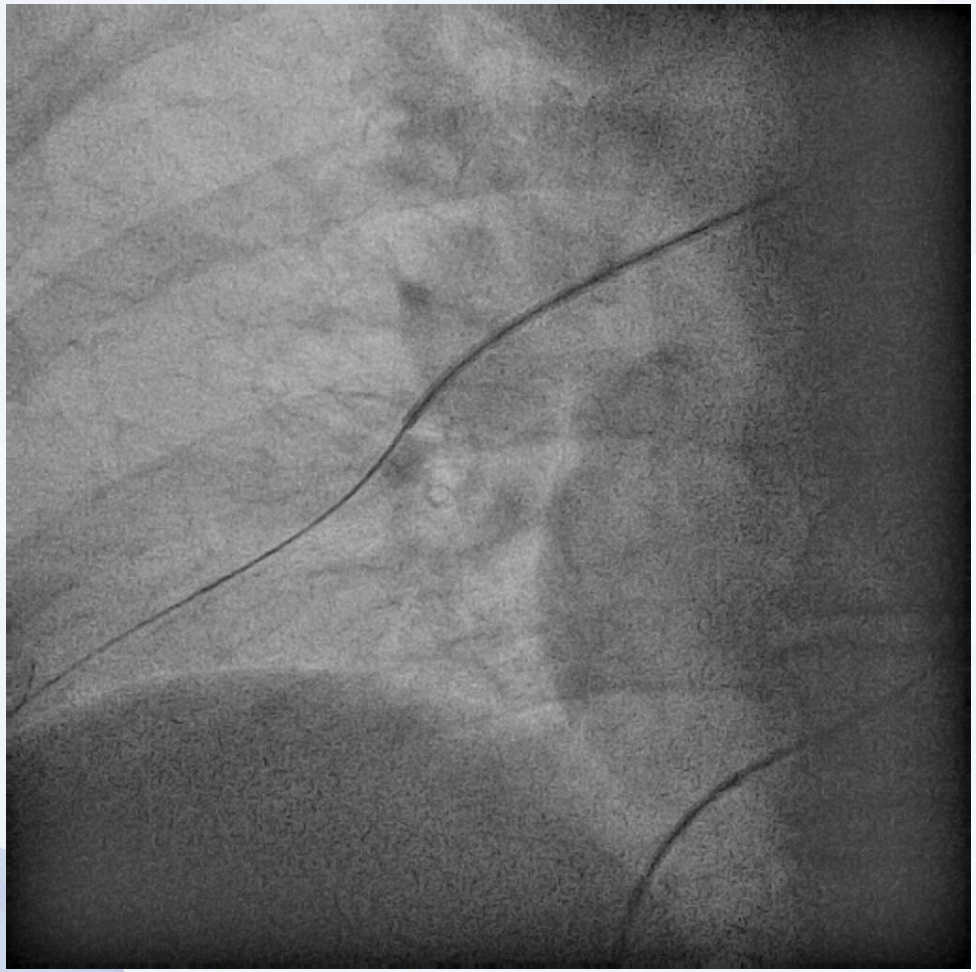


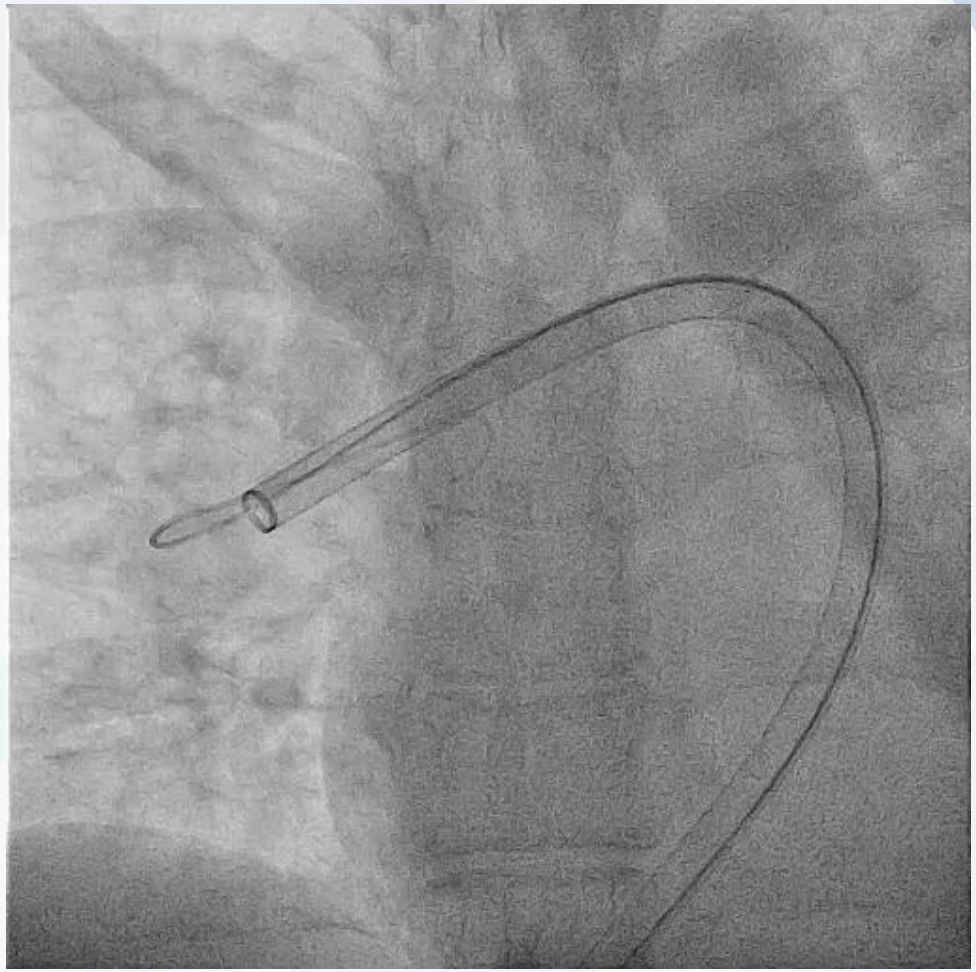






HIGH RISK PULMONARY EMBOLISM





INTERMEDIATE-HIGH RISK ACUTE PE

BASAL

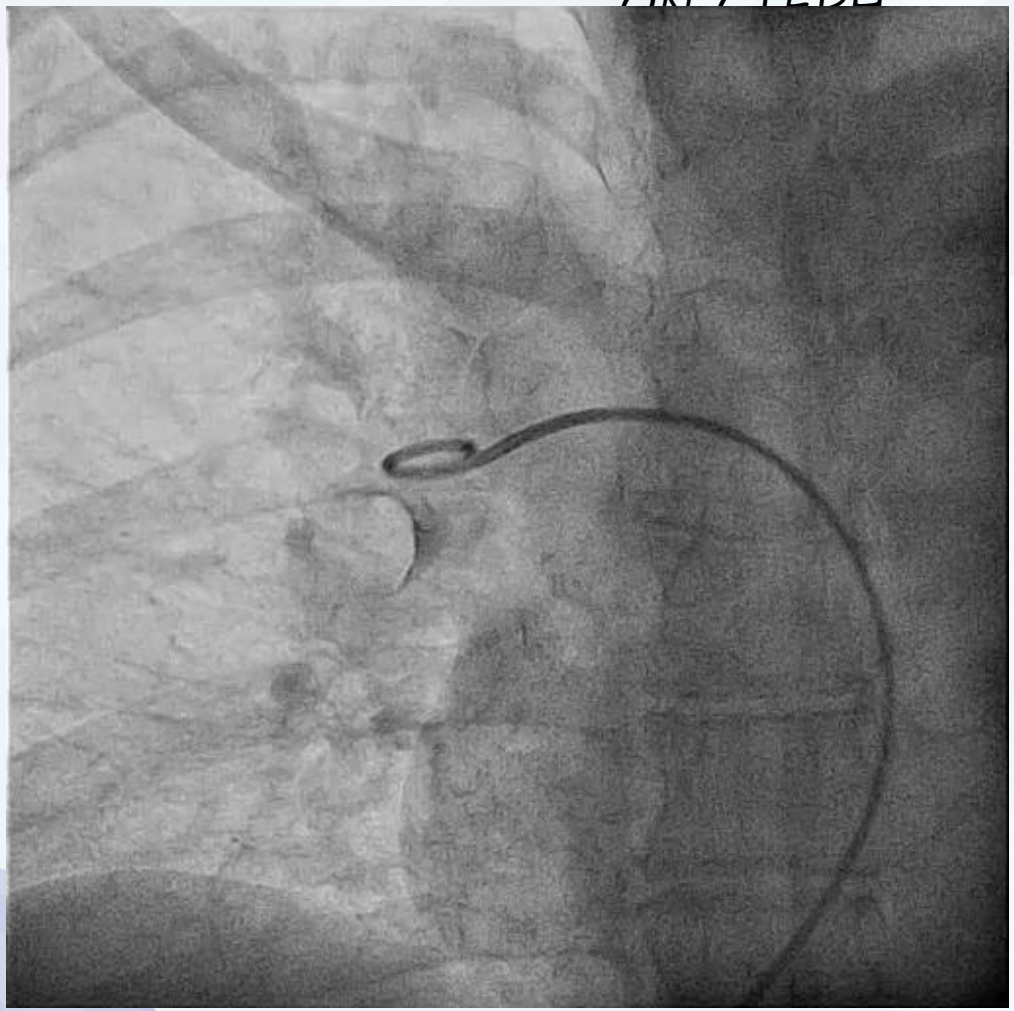
- PAP 89/23,50
- SAT AP 68.7%
- SAT AO 100%
- CI 4,7 l/MIN
- BP 135/80,95
- RR 33/min
- HR 114 bpm

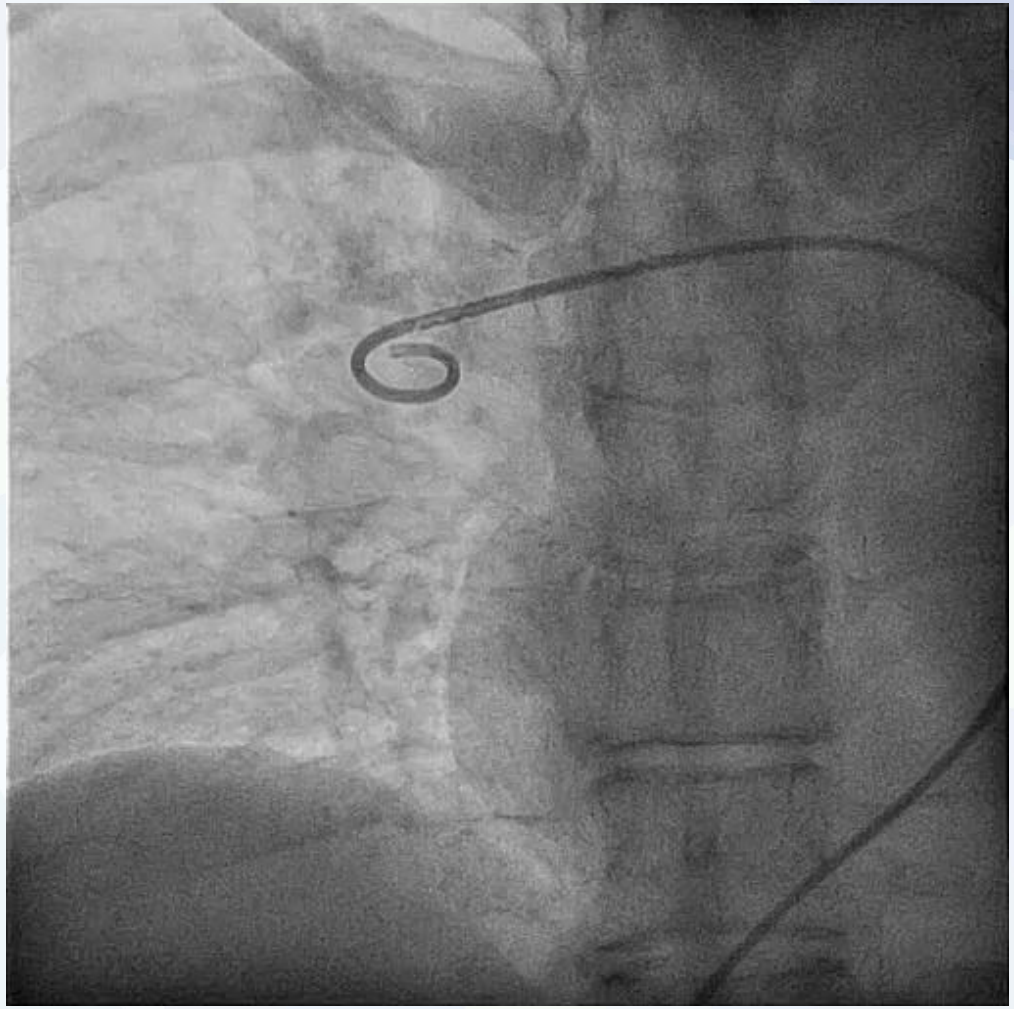
POST-TROMBECTOMY

- PAP 78/24,44
- SAT AP 62.8%
- SAT AO 100%
- CI 4,3 l/MIN
- BP 110/65,85,
- RR 27/min
- HR 103 bpm

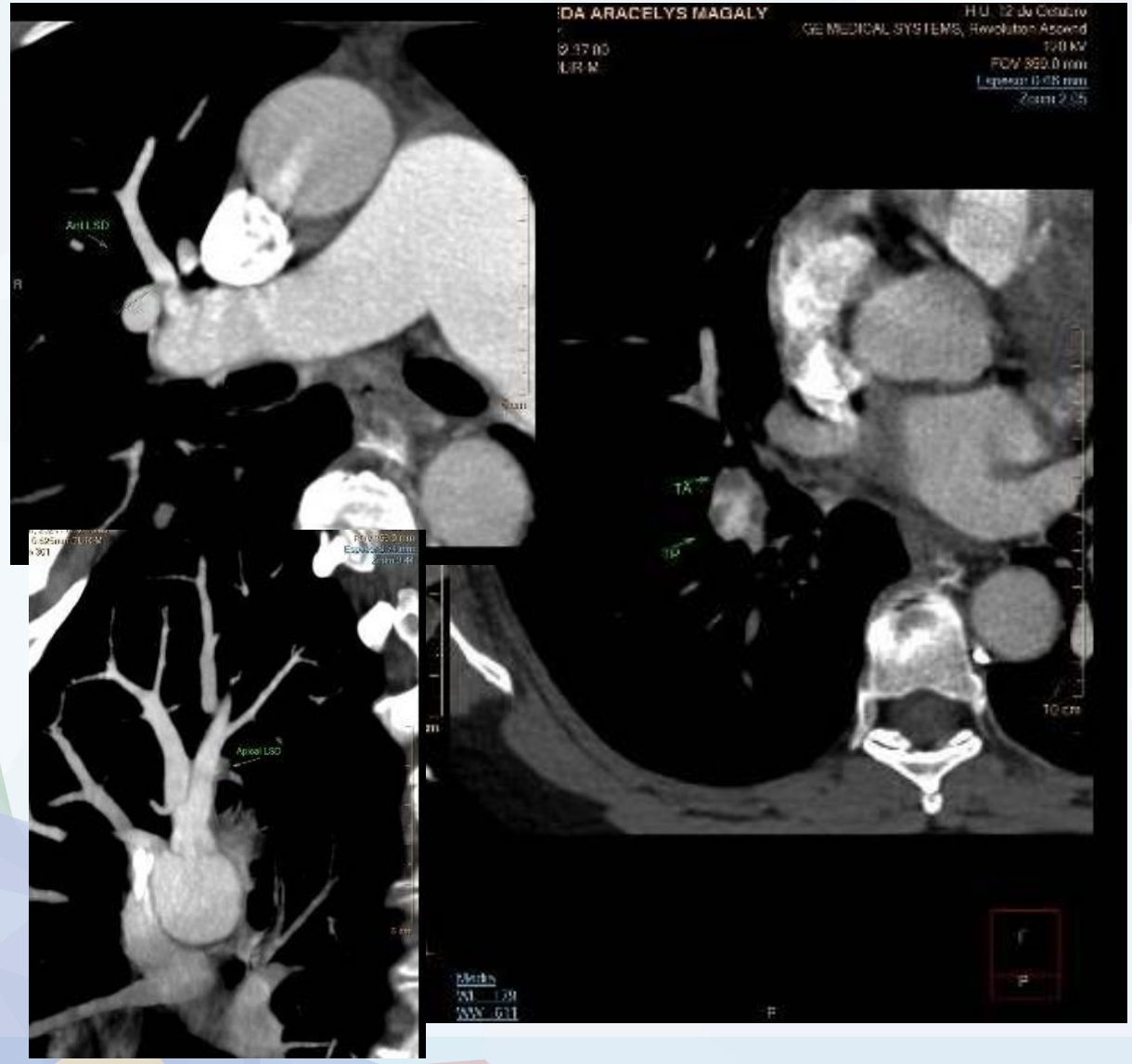
INTERMEDIATE-HIGH RISK ACUTE PE

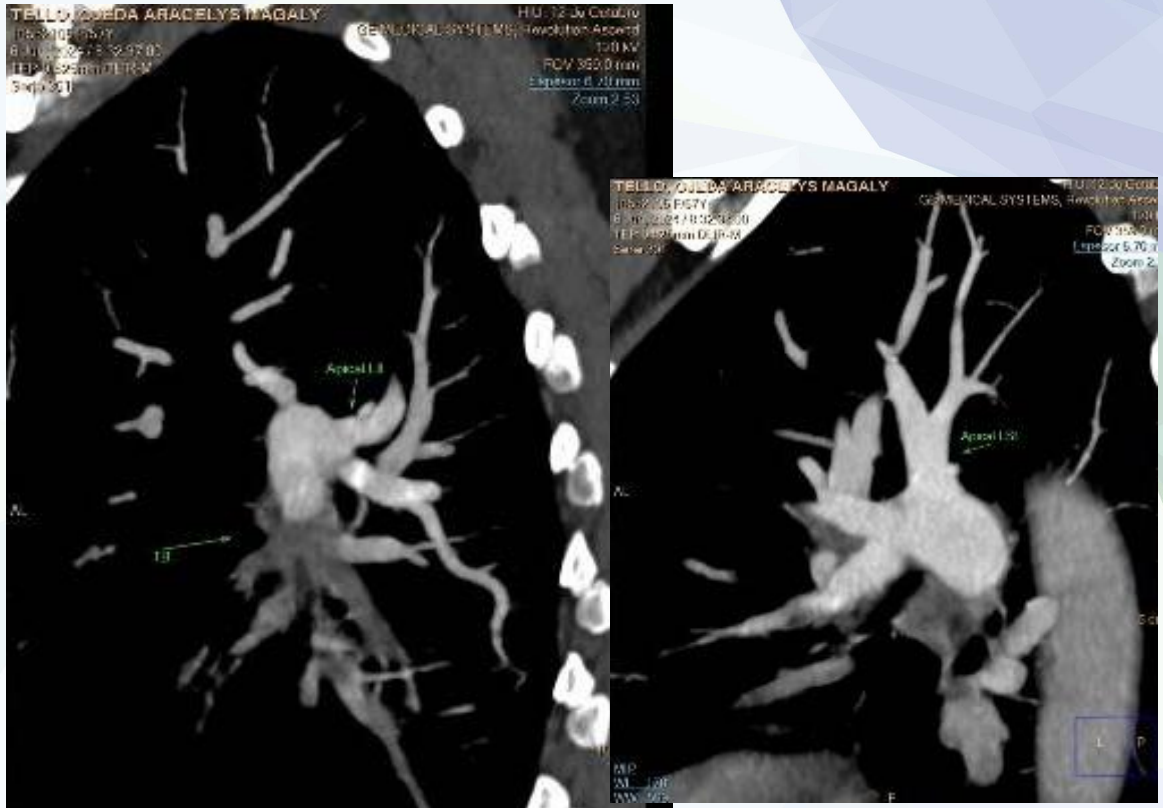
ON CTEPH





INTERMEDIATE-HIGH RISK ACUTE PE





INTERMEDIATE-HIGH RISK ACUTE PE ON CTEPH

- Enoxaparin + ASA 100mg + methylprednisolone pulses 250mg/24 (3 days) with subsequent switch to prednisone 10mg/day + immunoglobulins 5 days) + Daratumumab 1800mg/weekly

- Cardiorespiratory deterioration and progressive pancytopenia
- Currently on respiratory support with GNAF with episodic desaturation

- Multidisciplinary meeting:
  - ✓ to perform thromboendarterectomy
  - ✓ change treatment from Daratumumab to Eculizumab to control the Lupus disease in order to perform surgery next week

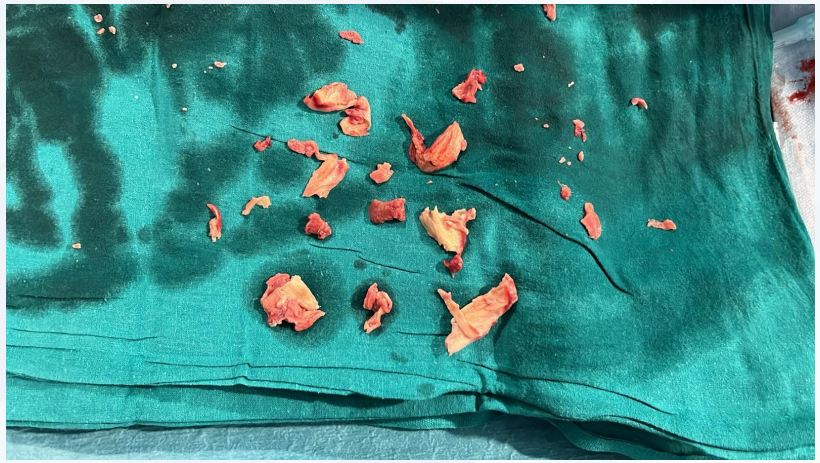
INTERMEDIATE-HIGH RISK ACUTE PE

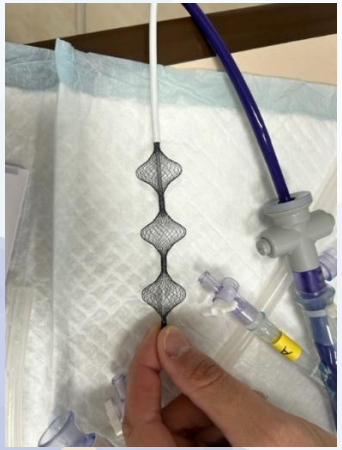
IMPORTANT ISSUES ON CTEPH

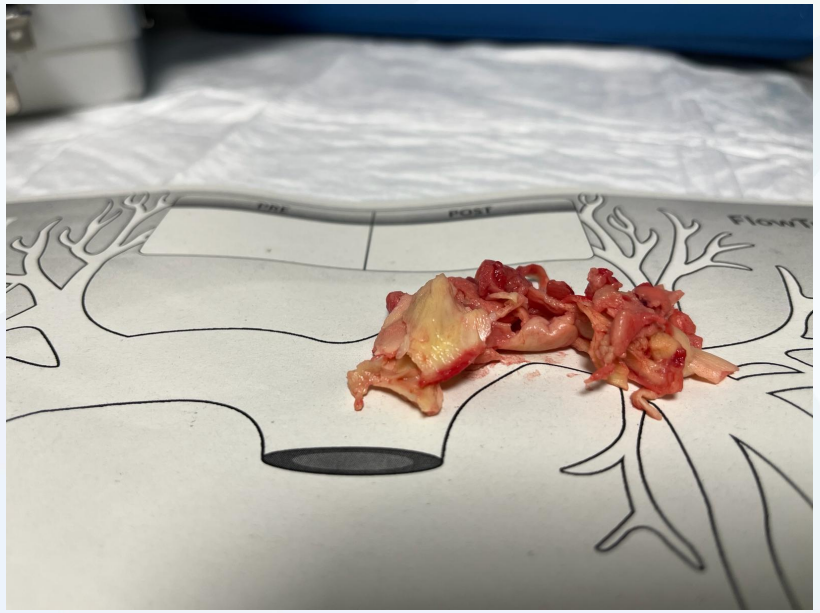
- 2-3% PE will develop CTEPH as a sequela
  - ✓ CTEPH should be suspected if severe PH in the acute event
  - ✓ Correlation with persistence of RV dysfunction during follow-up
- According to 354 PEAs at the University of California in 2021-2022 up to 44% patients with CDT had had CTEPH when the technique was performed
  - ✓ Importance of proper patient selection, as CDT is less effective when CTEPH is already present
  - ✓ Importance of recognizing this entity as CDT in this scenario may have a higher complication rate
  - ✓ Complicates the determination of the true rate of PES after CDT

Yang JZ. Outcomes associated with catheter directed therapies in chronic thromboembolic pulmonary hypertension. CHEST Pulmonary. 2023;1:100009. doi: 10.1016/j.chpulm.2023.100009.

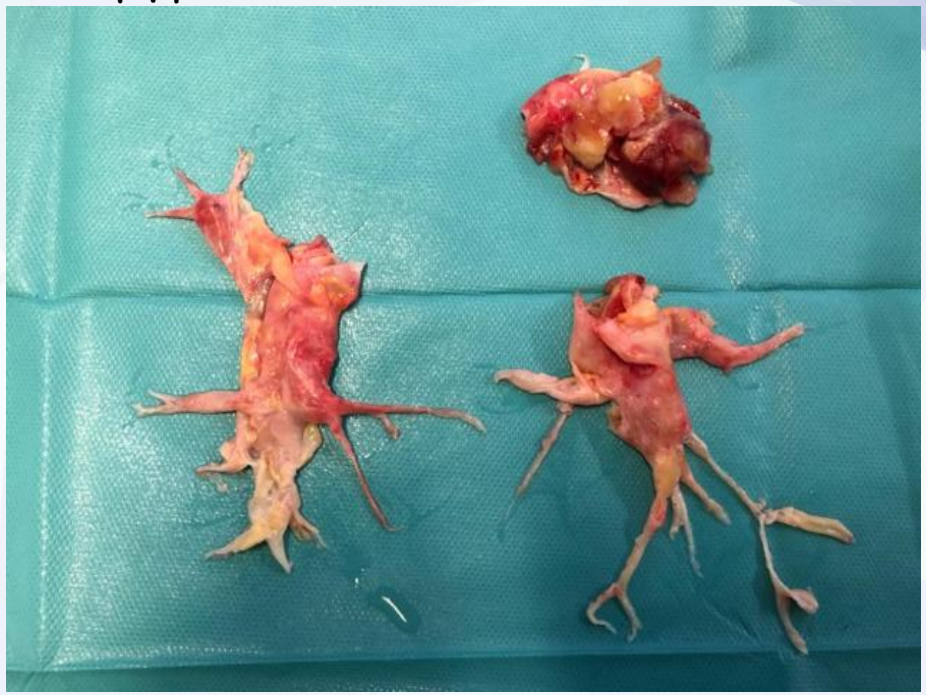
INTERMEDIATE-HIGH RISK ACUTE PE







THROMBOENDARTERECTOMY



PEERLESS

PEERLESS trial rationale and aim

Background and rationale	• In 2014, the PEITHO trial[1] demonstrated that intervention with tenecteplase plus heparin for intermediate-risk pulmonary embolism (PE) reduced risk of death or decompensation but at the expense of increased major bleeding. • Since PEITHO, catheter-based interventions for PE, including **catheter-directed thrombolysis (CDT)** and **large-bore mechanical thrombectomy (LBMT),** have been adopted to avoid the bleeding risks of systemic thrombolysis. • Observational studies of CDT and LBMT have separately reported positive outcomes,[2-3] but there are no prior randomized controlled trials (RCTs) directly comparing these interventional strategies.
Significance	• **The PEERLESS trial is the first RCT to evaluate LBMT and the first to compare acute clinical outcomes from patients randomized to catheter-based interventions with different mechanisms of action.[4]**
Aim	• To determine whether LBMT reduces the incidence of in-hospital adverse clinical outcomes compared with CDT by providing more rapid removal of emboli and relief of RV dysfunction.
Registration	• ClinicalTrials.gov NCT05111613

1. G Meyer et al. N Engl J Med. 2014.
2. G Piazza et al. JACC Cardiovasc Interv. 2015.
3. C Toma et al. EuroIntervention. 2023.
4. CF Gonsalves et al. Am Heart J. 2023.

CIRCULATION. 2024;[published online ahead of print] DOI: 10.1161/CIRCULATIONAHA.124.072364

Trial design

Eligibility criteria

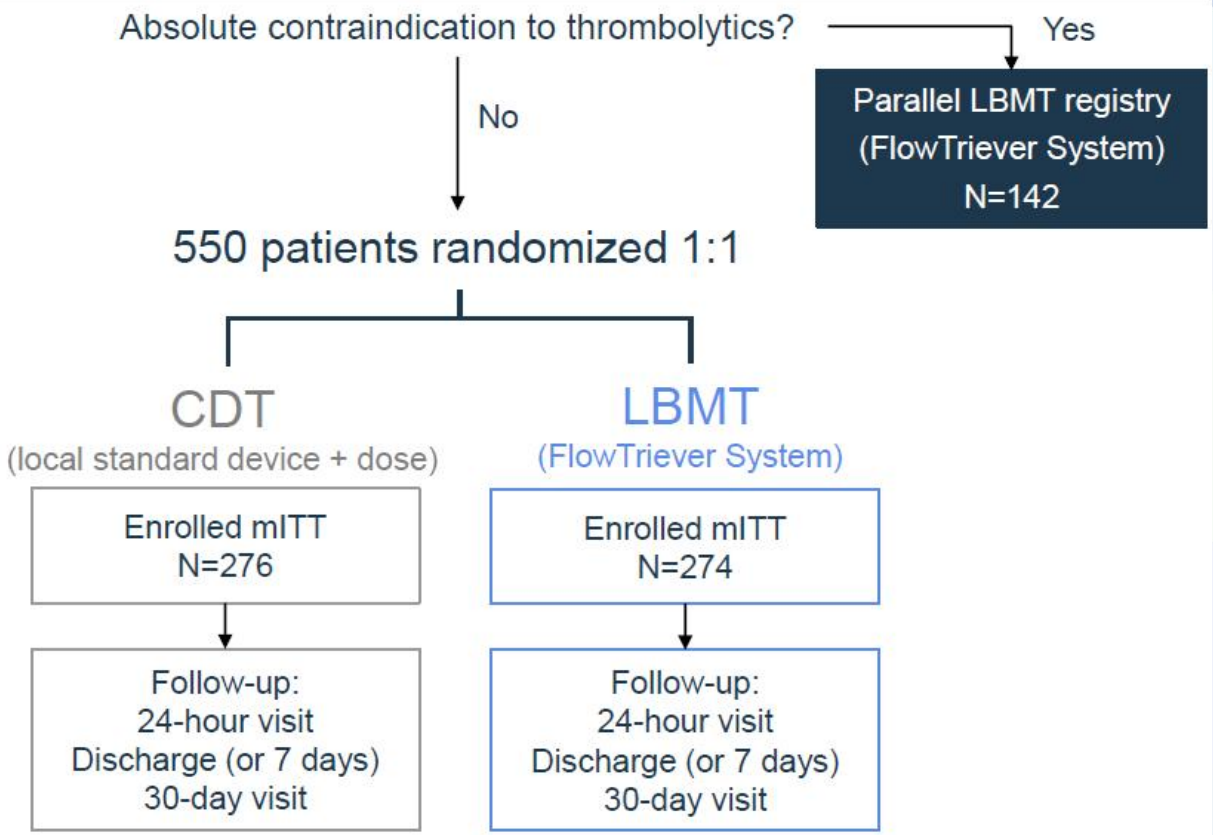
Inclusion

- SBP > 90 mmHg + central clot + RV dysfunction
- Symptom onset within 14 days
- Intervention planned within 72 hours
- + ≥ 1 additional clinical risk factor
  - Elevated cardiac troponin
  - History of heart failure
  - History of chronic lung disease
  - Heart rate ≥ 110 bpm
  - SBP < 100 mmHg
  - RR ≥ 30 breaths per min
  - Oxygen saturation < 90%
  - Syncope related to PE
  - Elevated lactate

Exclusion

- Unable to receive AC
- Right heart clot in transit
- Life expectancy < 30 days
- CTEPH/CTED
- sPAP ≥ 70 mmHg on invasive hemodynamics

Treatment and follow-up



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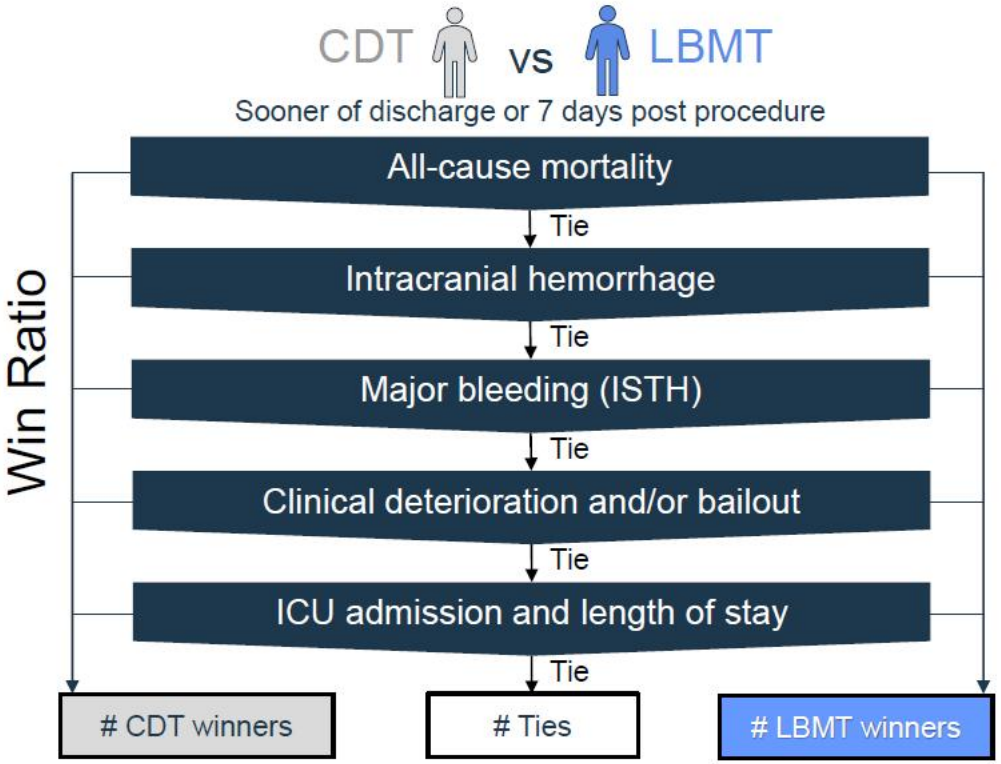
PEERLESS

Trial endpoints

Primary



Secondary

Win ratio components assessed individually Win ratio of first 4 components of primary endpoint Clinically relevant non-major and minor bleeding	Discharge (or 7 days)
Change in RV/LV ratio from baseline Dyspnea score (mMRC and Borg*) RV function* (echo) Respiratory rate* NYHA classification*	24h visit
All-cause mortality All-cause and PE-related readmissions Hospital length of stay Dyspnea score (mMRC and Borg*) PEmb-QOL and EQ-5D-5L NYHA classification* Device- or drug-related SAEs	30 days or 30d visit

All safety endpoints were adjudicated by an independent CEC

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PEERLESS

Enrollment:

57 sites in the USA, Germany, and Switzerland

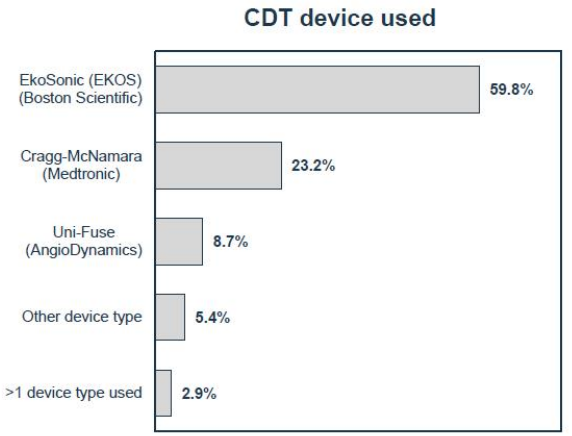
February 2022 to February 2024

Patient population

Baseline Characteristics	CDT N = 276	LBMT N = 274
Age, years	61.2 ± 14.8	63.7 ± 13.0
Female sex	134 (48.6)	125 (45.6)
Race and ethnicity		
White	193 (74.5)	184 (72.4)
Black or African American	56 (21.6)	67 (26.4)
Other	10 (3.9)	3 (1.2)
Hispanic or Latino	27 (10.8)	13 (5.2)
Relative contraindication to lytics	11 (4.0)	12 (4.4)
VTE-BLEED score ≥ 2	77 (27.9)	68 (24.8)
BMI, kg/m^2	36.3 ± 9.4	34.5 ± 8.6
Active cancer	17 (6.2)	13 (4.7)
Concomitant DVT	168 (60.9)	178 (65.0)
Saddle PE	109 (39.5)	104 (38.0)
Elevated cardiac troponin	265 (96.0)	256 (93.4)
RV/LV ratio (CTPA or echo)	1.31 ± 0.27	1.27 ± 0.26
Mean PA pressure, mmHg	31.1 ± 7.2	30.0 ± 7.6

Values reported as mean ± SD or n (%). Other race category includes patients self-reporting as American Indian or Alaska Native, Asian, "Other" race, or multiple races. Sample size: N=259-276 for CDT, N=254-274 for LBMT.

Device and procedure information



	CDT N = 276	LBMT N = 274
Procedure time, minutes	65.3 ± 42.5	93.2 ± 36.1
Treatment catheter dwell time, minutes	915.7 ± 464.7	47.9 ± 27.2
Estimated blood loss, mL	14.4 ± 22.2	87.7 ± 87.6

Values reported as mean ± SD.
Procedure time: N=274 CDT, N=272 LBMT.
Treatment catheter dwell time: N=269 CDT, N=272 LBMT.
Estimated blood loss: N=228 CDT, N=245 LBMT.

tPA infusion rate per lung, mg/hour	1.0 [0.5, 1.0]
tPA infusion duration per lung, hours	12.0 [6.0, 15.6]
Total tPA dose per patient, mg	16.0 [12.0, 24.0]

Values reported as median [IQR].
tPA infusion rate and duration per lung: N=242.
Total tPA dose: N=261.

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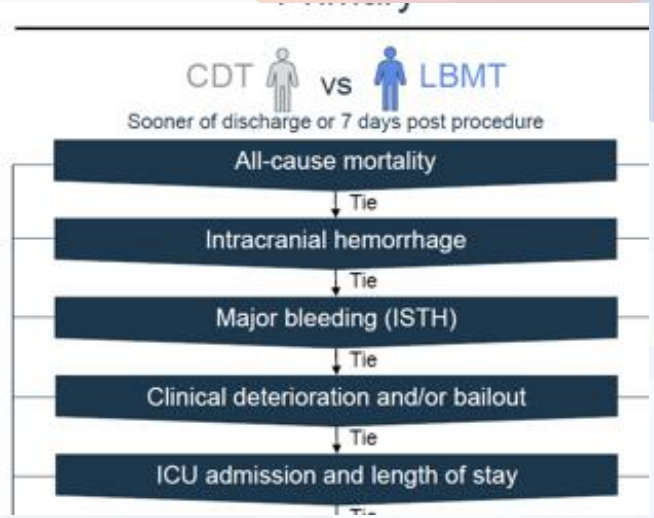
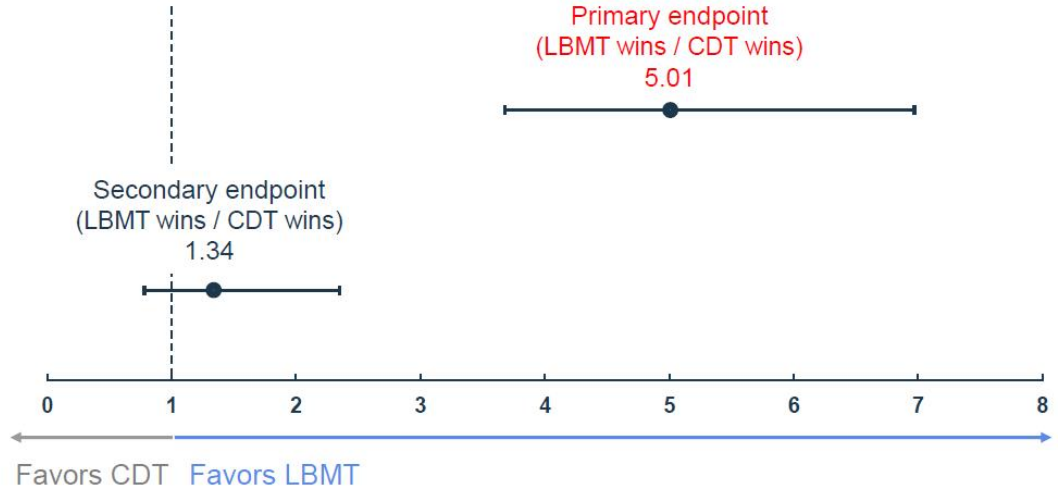


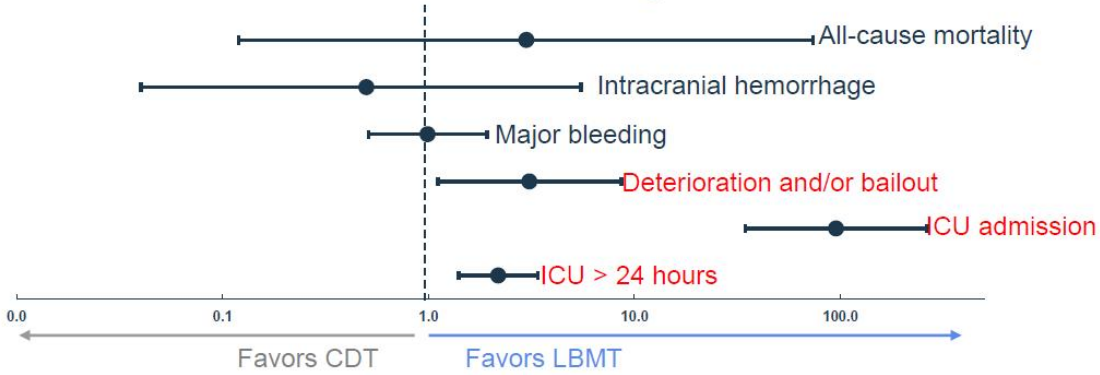
Results: Win ratio endpoints



	Win ratio [95% CI]	*P* value
Primary Endpoint: 5-component win ratio*	5.01 [3.68 – 6.97]	**<0.001**
Secondary Endpoint: 4-component win ratio†	1.34 [0.78 – 2.35]	0.30

Two-sided P value calculated using a modified generalized Wilcoxon test (F-S test) proposed by Finkelstein & Schoenfeld.

Results: Win ratio components



	CDT events	LBMT events	Odds ratio [95% CI]	*P* value
All-cause mortality	1 (0.4)	0 (0.0)	2.99 [0.12–73.70]	1.00
Intracranial hemorrhage	1 (0.4)	2 (0.7)	0.50 [0.04–5.51]	0.62
Major bleeding	19 (6.9)	19 (6.9)	0.99 [0.51–1.92]	1.00
Clinical deterioration and/or escalation to bailout therapy	15 (5.4)	5 (1.8)	3.09 [1.11–8.63]	**0.038**
Postprocedural ICU admission	272 (98.6)	114 (41.6)	95.4 [34.6–263.6]	**< 0.001**
ICU stay > 24 hours*	178 (65.4)	53 (46.5)	2.18 [1.40–3.40]	**< 0.001**

Values reported as n (%) or OR [95% CI]. *P* values calculated using two-sided Fisher's exact test. ICH: N=275 CDT. *Percentages reported out of patients with postprocedure ICU admission.

CIRCULATION. 2024;[published online ahead of print] DOI: 10.1161/CIRCULATIONAHA.124.072364

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Clinical deterioration and therapy escalation events through discharge / 7 days

	CDT N = 276	LBMT N = 274	*P* value
Clinical deterioration and/or escalation to bailout	**15 (5.4)**	**5 (1.8)**	**0.038**
Patients with clinical deterioration	10 (3.6)	4 (1.5)	
Cardiac arrest	2 (0.7)	0 (0.0)	
High-grade atrioventricular block	1 (0.4)	0 (0.0)	
Respiratory failure	3 (1.1)	0 (0.0)	
Increased oxygen requirement	0 (0.0)	1 (0.4)	
Hypotension	4 (1.4)	3 (1.1)	
Patients with escalation to bailout	6 (2.2)	1 (0.4)	
Successful bailout†	5 (1.8)	0 (0.0)	
Unsuccessful bailout‡	1 (0.4)	1 (0.4)	

Values reported as n (%). *P* value calculated using two-sided Fisher's exact test. Bailout: N=275 CDT. †5 CDT patients underwent LBMT bailout procedure without adverse event, experienced postpr were discharged without further intervention. ‡1 patient in each arm had a PE that could not be treated after multiple bailout attempts (systemic tPA, LBMT, CDT) and ultimately died after >7 days.

Hospital length of stay and 30-day readmissions

	CDT N = 276	LBMT N = 274	*P* value
Total hospital LOS, days	5.3 ± 3.9	4.5 ± 2.8	**0.002**
Postprocedure LOS, days	4.0 ± 3.7	3.2 ± 2.7	**< 0.001**
Postprocedure ICU admission	272 (98.6)	114 (41.6)	**< 0.001**
stay ≤ 24 hours	94 (34.1)	61 (22.3)	**< 0.001**
stay > 24 hours	178 (64.5)	53 (19.3)	
Postprocedure ICU LOS, hours	39.3 ± 28.0	14.2 ± 25.4	**< 0.001**
30-day all-cause readmission†	19 (7.9)	8 (3.2)	**0.03**
30-day PE-related readmission†	2 (0.8)	0 (0.0)	0.237

Values reported as n (%) or mean ± SD. †30-day readmission: N=239 CDT, N=251 LBMT. Total and postprocedure hospital stay reported through 30 days. Postprocedure ICU stay reported through discharge / 7 days. *P* values calculated using two-sided Fisher's exact test or two-sided Wilcoxon rank sum test with continuity correction.

CIRCULATION. 2024;[published online ahead of print] DOI: 10.1161/CIRCULATIONAHA.124.072364

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Conclusions

- PEERLESS met its primary endpoint, demonstrating superiority of LBMT compared to CDT in the treatment of acute intermediate-risk PE
- There was no difference between groups in mortality, ICH, or major bleeding
- Compared to CDT, LBMT was associated with:
  - Less clinical deterioration or escalation of therapy
  - Faster clinical and hemodynamic improvement at 24 hours
  - Less ICU use and shorter hospital length of stay
  - Fewer readmissions through 30 days

CIRCULATION. 2024;[published online ahead of print] DOI: 10.1161/CIRCULATIONAHA.124.072364


gracias
merci
obrigado
danke
teşekkür ederim
thank you
go raibh maith agat
bedankt
dziękuję
sukriya
mochchakkeram
dank je
tapadh leat
takk
grazie
kop khun krap
dakujem
mauruuru
taiku
hvala
arigatō
terima kasih
ngiyabonga
sagolun
mamnun
sobodi
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