Catheter Based Management of Pulmonary Embolism

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Financial Disclosures:

-none

NONMASSIVE (Low Risk)	SUBMASSIVE (Intermediate Risk)	MASSIVE (High Risk)
No sustained hypotension	No sustained hypotension	Sustained hypotension (SBP < 90 for 15 + minutes or requiring vasopressor therapy)
No evidence of right heart dysfunction	Evidence of right heart dysfunction High risk →elevated biomarkers	
Mortality <1%	Mortality 3-15%	Mortality >15%

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Treatment Gap

<5 % of patients with PE receive advanced therapy

Why?

-PERT team

-Absence of data to support the treatments

-Fear of complications – ICH/major bleeding

Clinical Presentation and Risk of Death

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Who to Intervene on?

Massive Pulmonary embolism → Reduction in mortality rate

Goals?

Mortality reduction with lower complication rate

Prevent decompensation

Expedite symptom relief and return to functional status

Chronic thromboembolic pulmonary hypertension ?

Prevent recurrent PE?

Pulmonary Embolism Response Team

Pulmonary Embolism Response Team- improved responsiveness

Collaborative decision making

Algorithmic approach

AIDOC app

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Clinical Trials

Catheter Directed Thrombolysis

- SEATTLE II
- KNOCKOUT PE
- OPTALYSE
- PE RESCUE

Catheter Directed Thrombectomy

- FLARE
- FLAME
- FLASH
- STRIKE PE
- EXTRACT PE
- APEX AV

Clinical Trials

HI-PEITHO

- Randomized
- Ekos+AC vs AC
- Intermediate-High Risk PE
- 7 days, 30 days, 6 months, 1 year.
- PE related mortality
- PE reoccurrence
- Cardiopulmonary decompensation

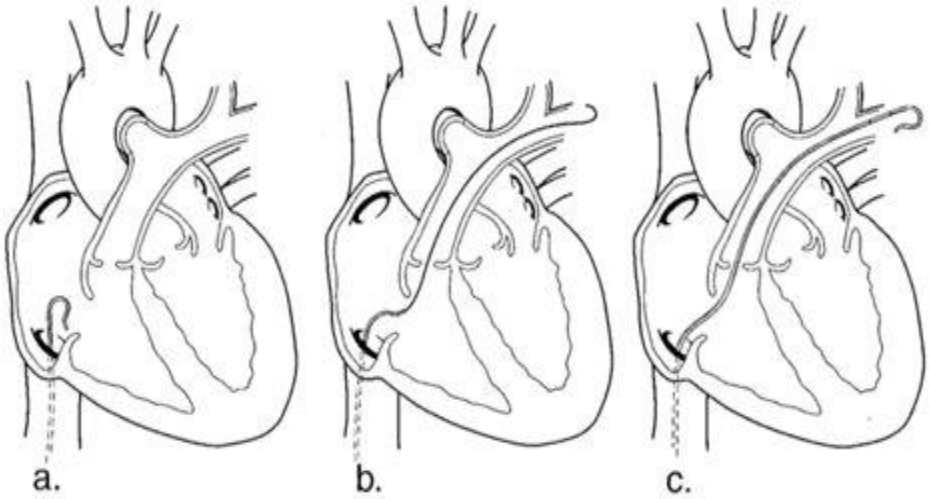
PE-TRACT

- Randomized
- CDT+AC vs AC
- Submassive PE
- Peak Oxygen Consumption(3 months)
- NYHS (12 months)
- Incidence of bleeding (7 days)

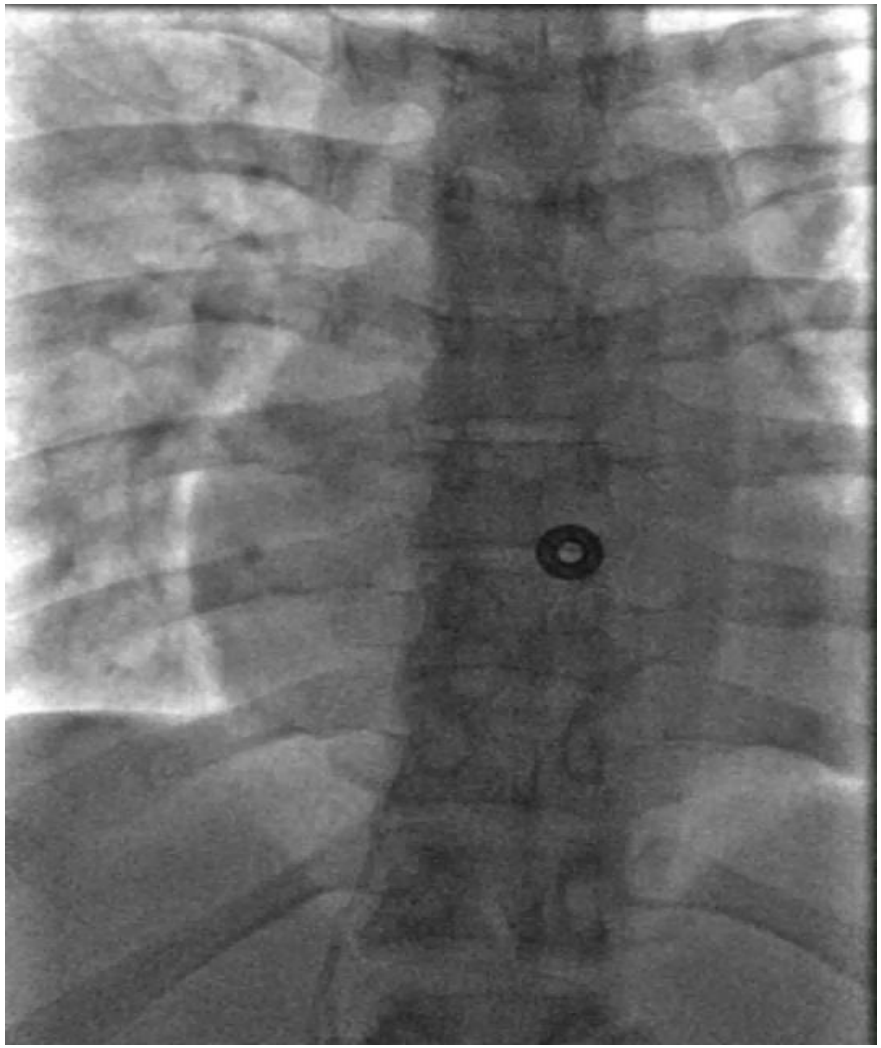
Catheter-Directed Devices

Device	Mechanism	Technical Considerations	Regulatory Status in US
EKO Sonic	USAT	5F catheter	510(k) Clearance for infusion for treatment of PE
Unifuse	CDL	4F–5F catheter	510(k) Clearance for treatment of peripheral vasculature
Cragg-McNamara	CDL	4F–5F catheter	510(k) Clearance for treatment of peripheral vasculature
Bashir Catheter	Pharmacomechanical CDL	7F catheter with a nitinol-supported infusion basket	510(k) Clearance for use in peripheral vasculature
AngioVac	Veno-veno bypass; funnel-shaped inflow tip to engage thrombi	26F access for inflow, 16F–20F access for outflow; requires perfusion team	510(k) Clearance for removal of undesirable intravascular material
FlowTreiver	Mechanical clot engagement with aspiration	20F catheter; must manage blood loss associated with large-bore aspiration	510(k) Clearance for treatment of PE
Indigo System	Mechanical clot engagement with mechanized aspiration	8F catheter; large size of some proximal PE renders en bloc aspiration difficult with 8F device	510(k) Clearance for peripheral artery and venous systems
Aspire Max	Suction thrombectomy with specially designed handheld aspirator	5F–6F catheters	510(k) Clearance for removal of thrombi from the peripheral and coronary vasculature

Pulmonary Artery Catheterization

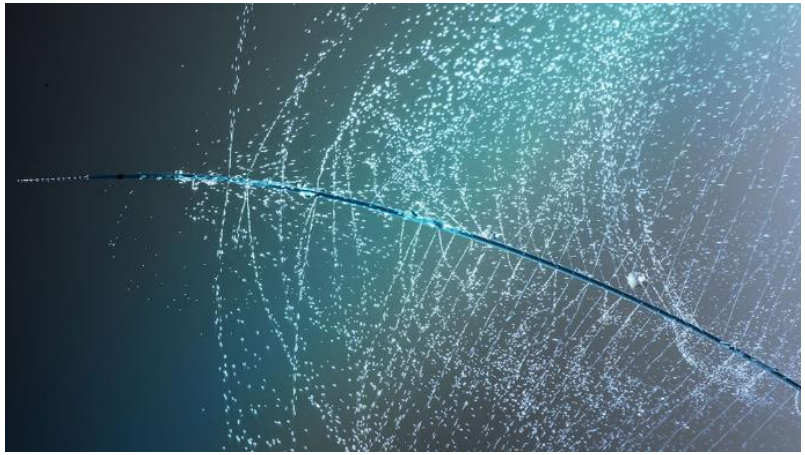


Velling et al. JVIR 2000.



Catheter-Directed Thrombolysis

- Placement of infusion catheters through major clot burden
- Appropriate length
- Sheath and catheter(s) secured
- Check mean pulmonary artery pressure
  - Expect decrease and reversal of right heart strain within hours



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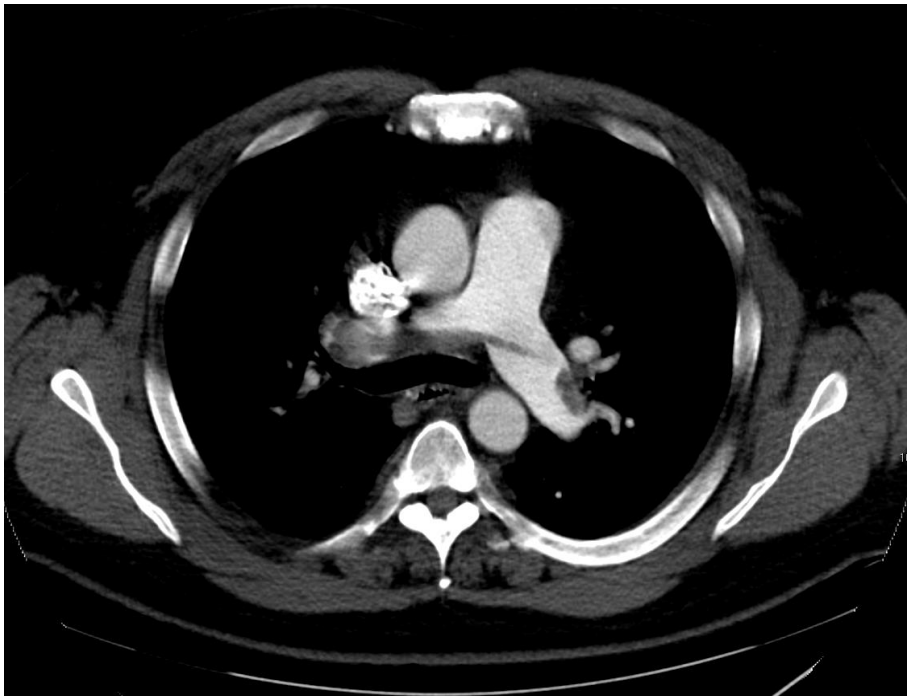
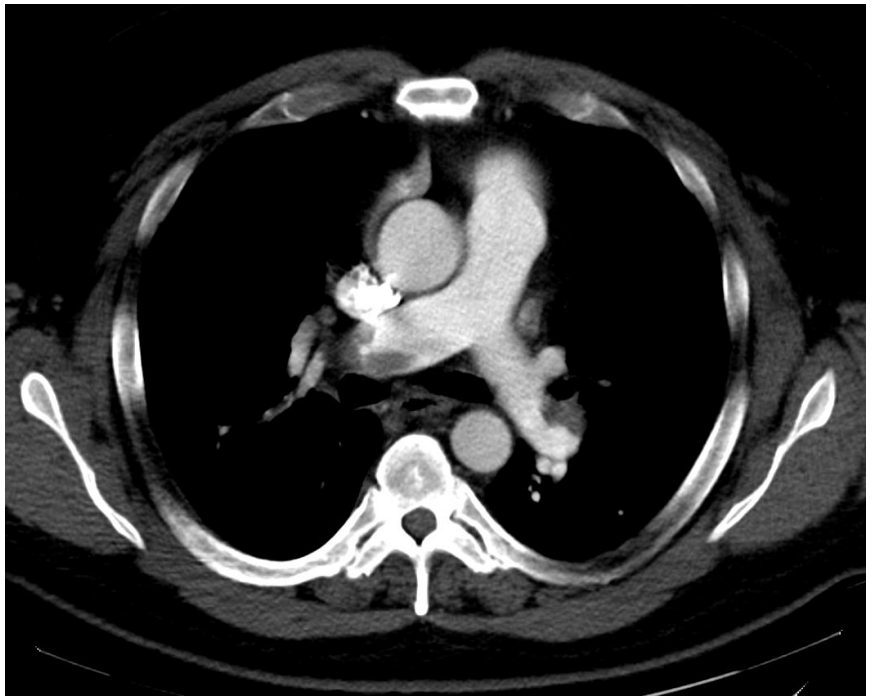
Catheter-Directed Thrombolysis





51-year-old man with Intermediate-High Risk Submassive Pulmonary Embolism

Catheter-Directed Thrombolysis

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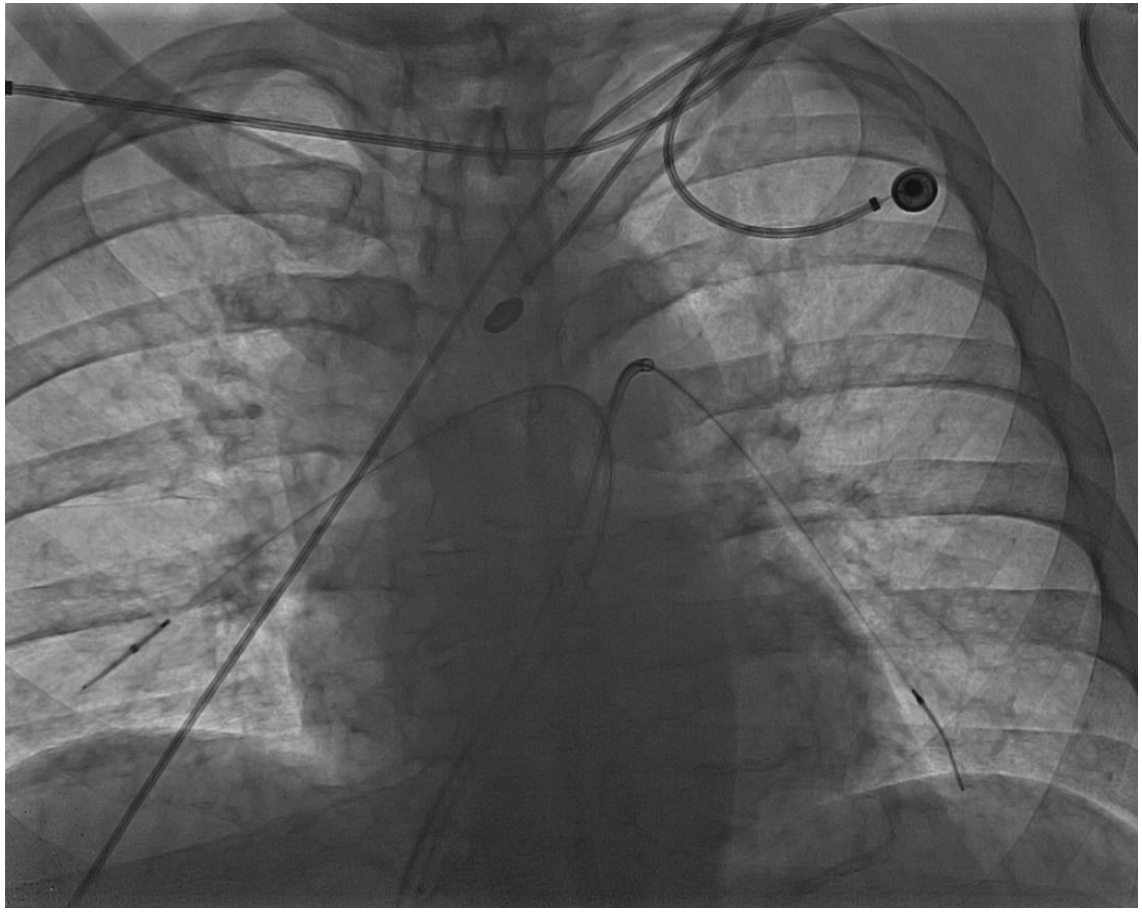
Catheter-Directed Thrombolysis

- Placement of bilateral PA multi side hole catheters
- **Right**
  - Bolus 6 mg tPA
  - Infusion 1 mg/hr
- **Left**
  - Bolus 3 mg tPA in left
  - Infusion of 0.5mg/hr

  - Heparin 300-500 units/hr
  - 24-hour infusion in ICU



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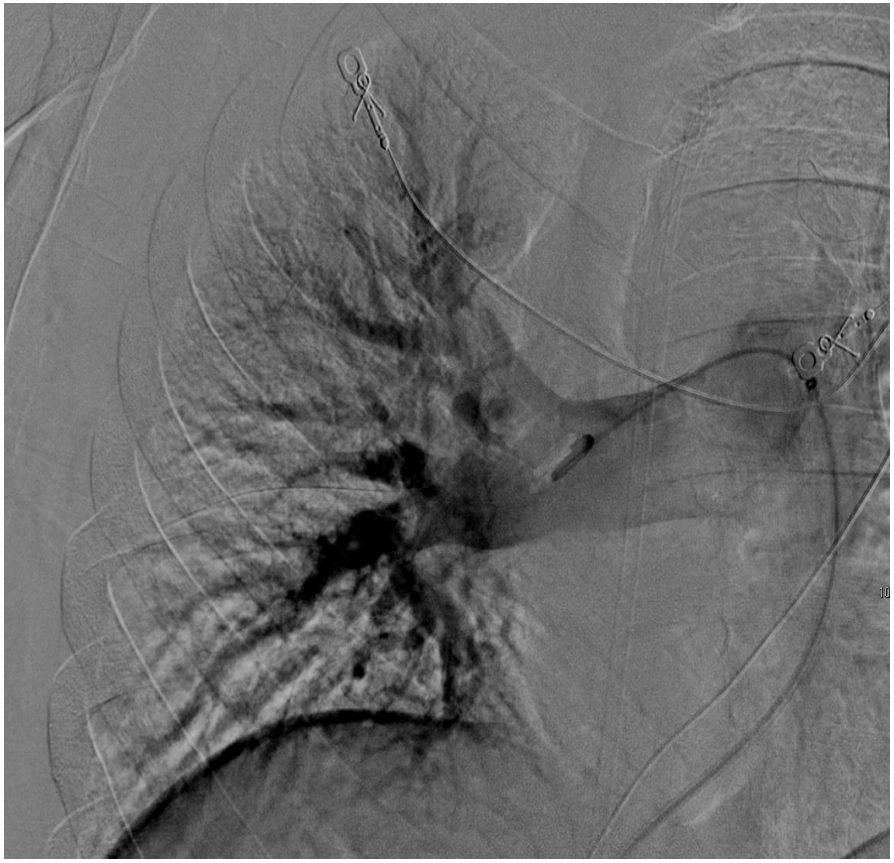

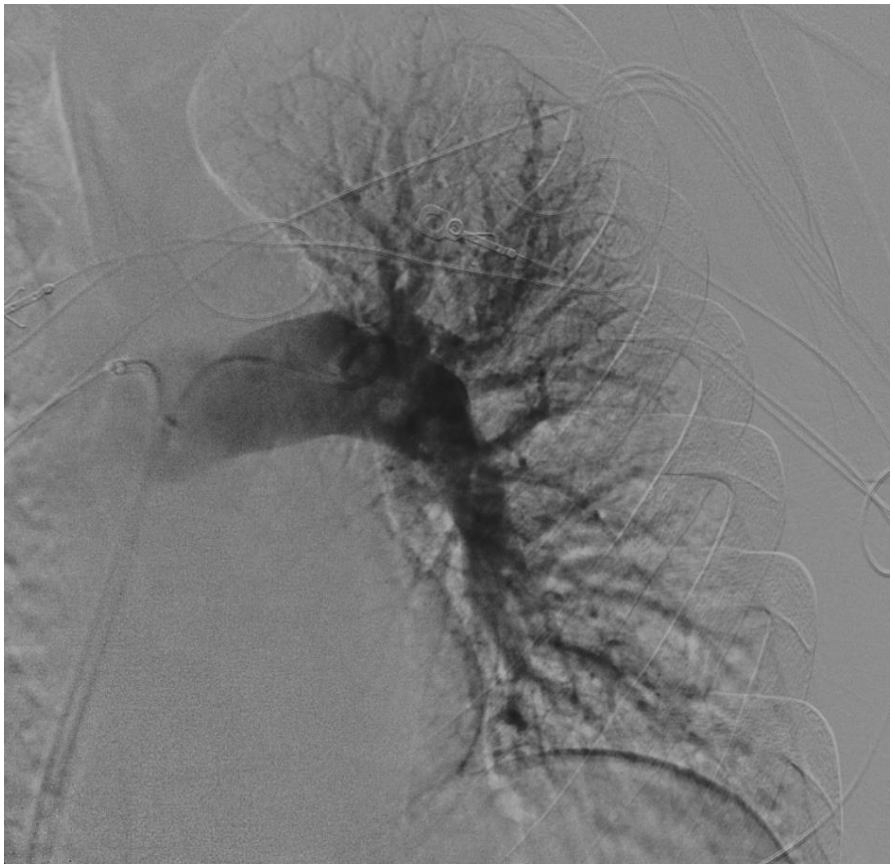

Decrease in Mean Pulmonary Artery Pressure

40 mmHg →27 mmHg

No significant filling defects

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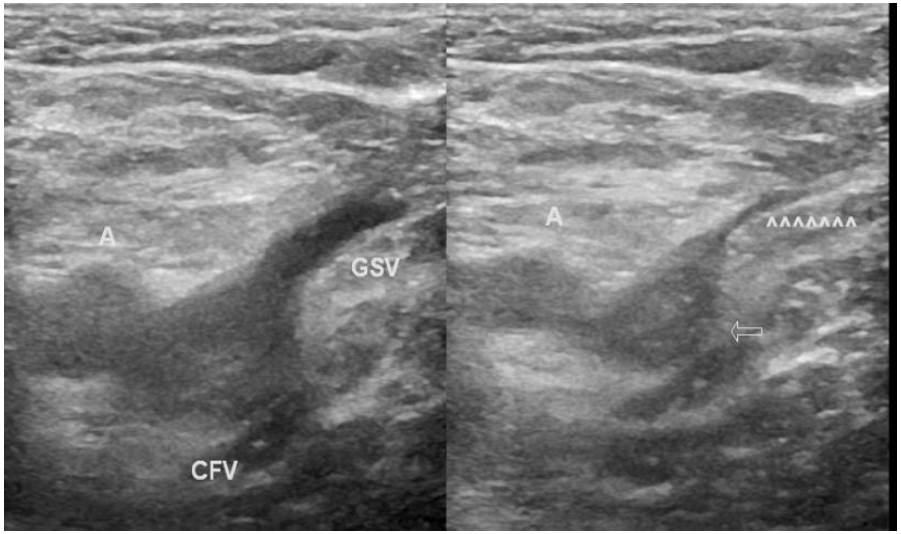
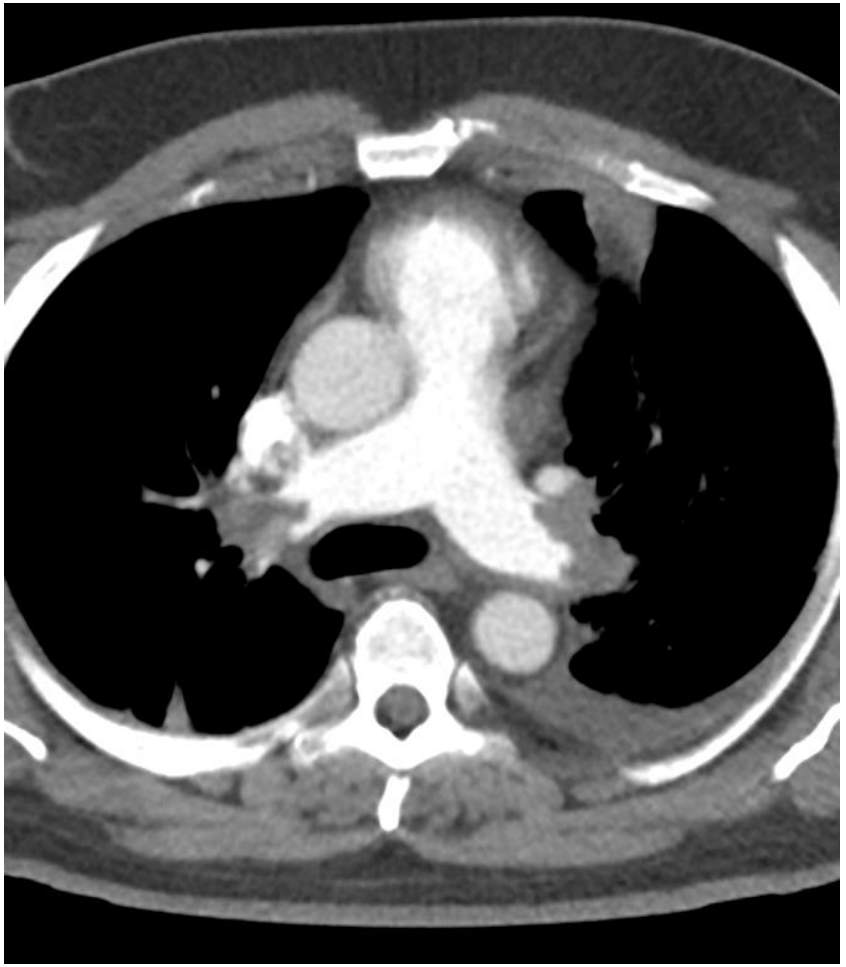
Catheter-Directed Thrombolysis

62-year-old man with chest pain and near syncopal episode.

Intermediate-High risk Submassive PE

Extensive bilateral lower extremity DVT's





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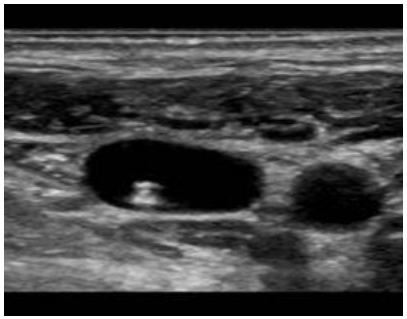
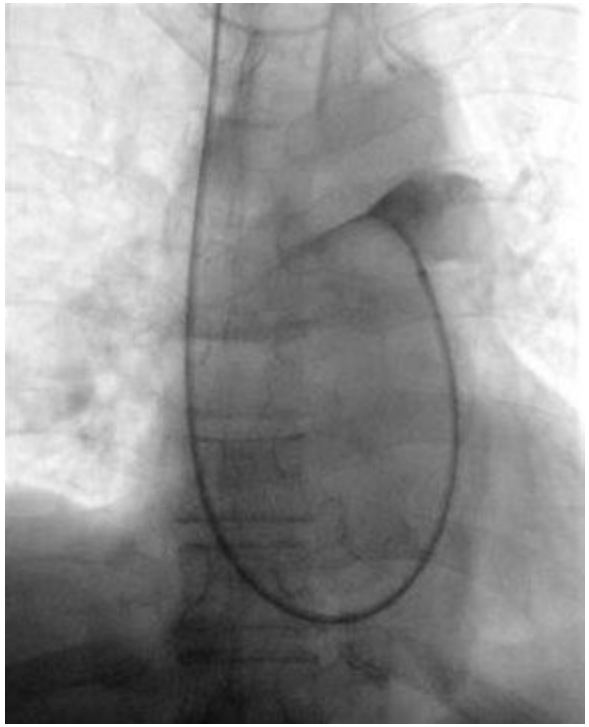
Catheter-Directed Thrombolysis





- US guided RIJ access
- Single PA
  - 7French
- Bilateral PA
  - Double access
  - 5French sheath

Catheter-Directed Thrombectomy

- Large bore suction aspiration catheter
- Catheter ranges from 16-24 French
- Access sheath size 24-26 French
- Measure PA pressure
- Ability to return blood loss
- Immediate improvement of hemodynamics and PA pressure
- No need for tPA

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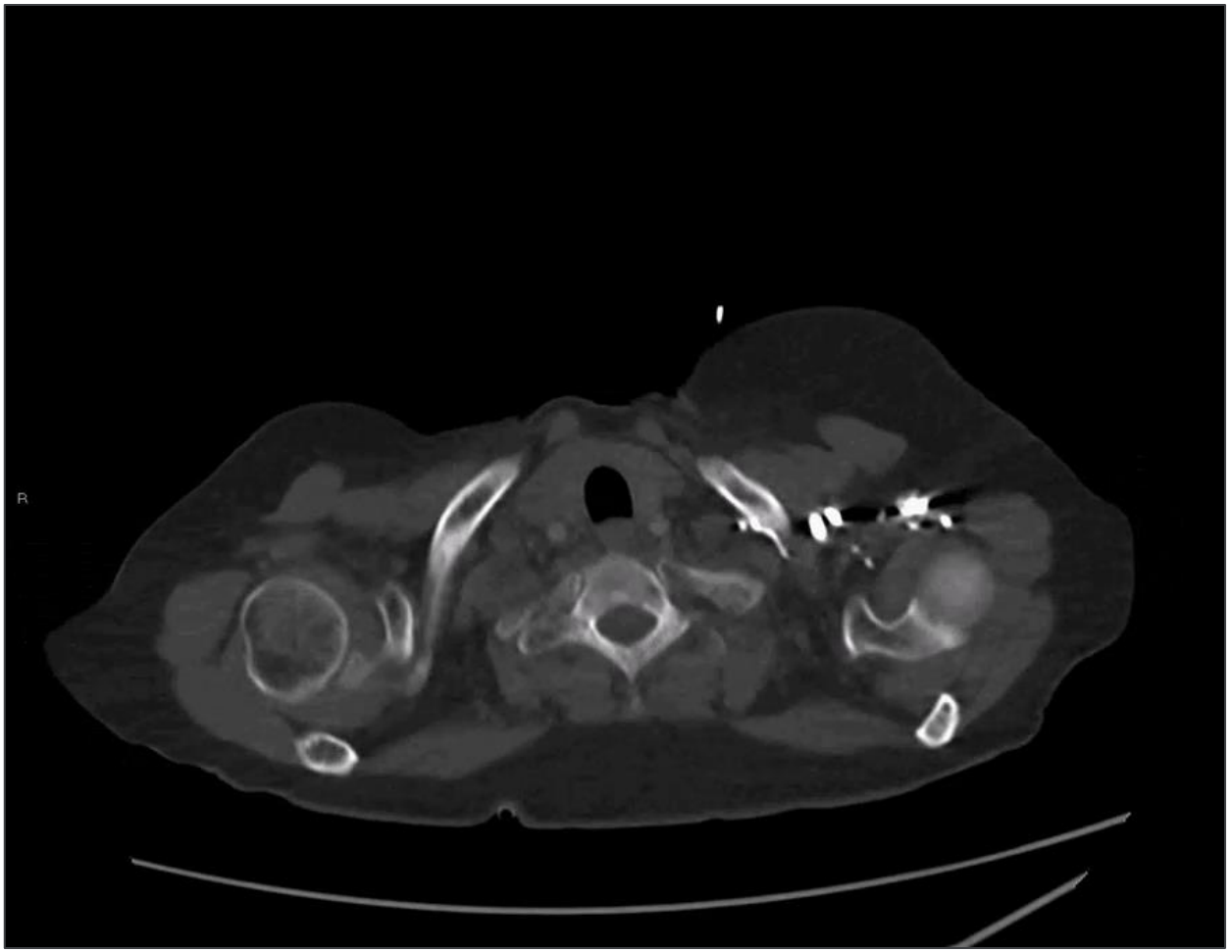
Catheter-Directed Thrombectomy

- 60-year-old female with recent hysterectomy.
- Developed near syncopal episode and found to have bilateral PE via CTA with evidence of right heart strain, elevated cardiac biomarkers.



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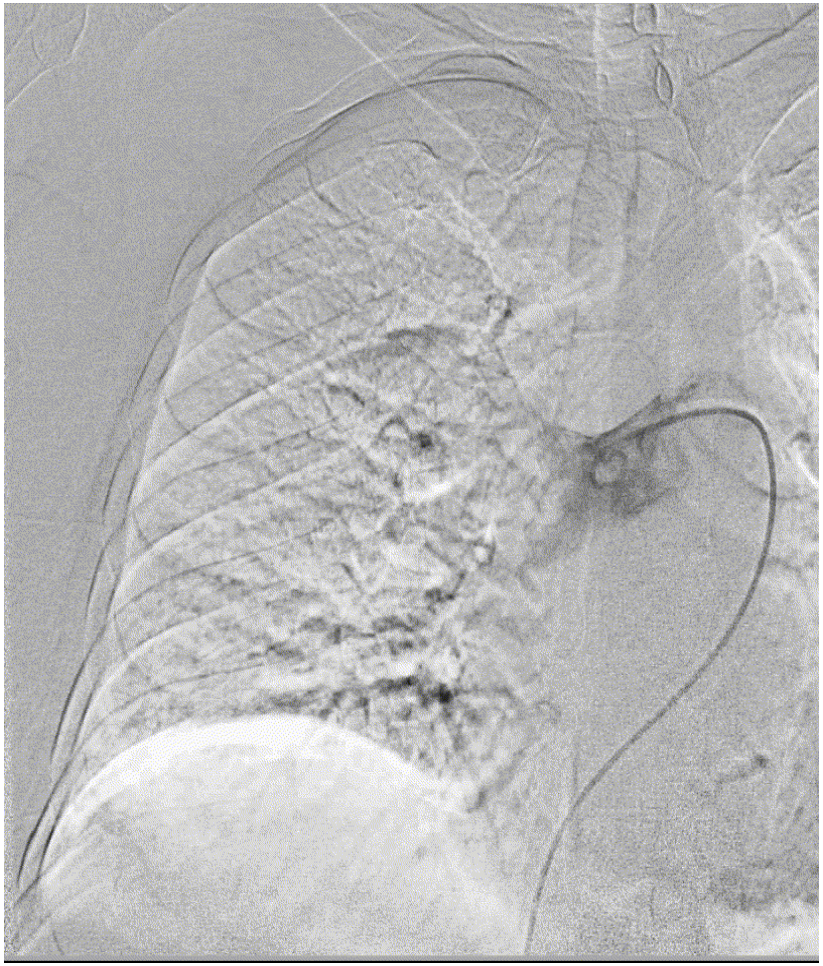
Catheter-Directed Thrombectomy



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Catheter-Directed Thrombectomy

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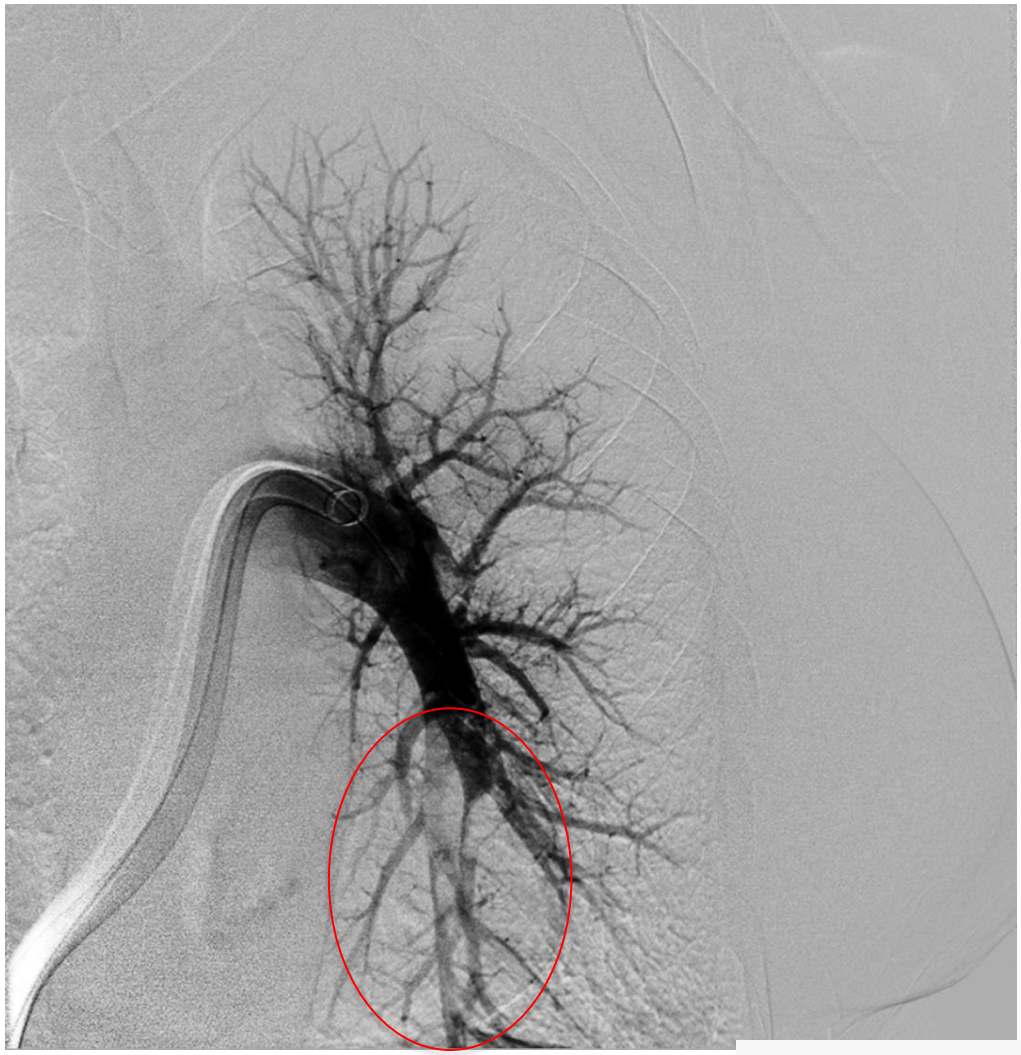
Catheter-Directed Thrombectomy



FT2

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Catheter-Directed Thrombectomy

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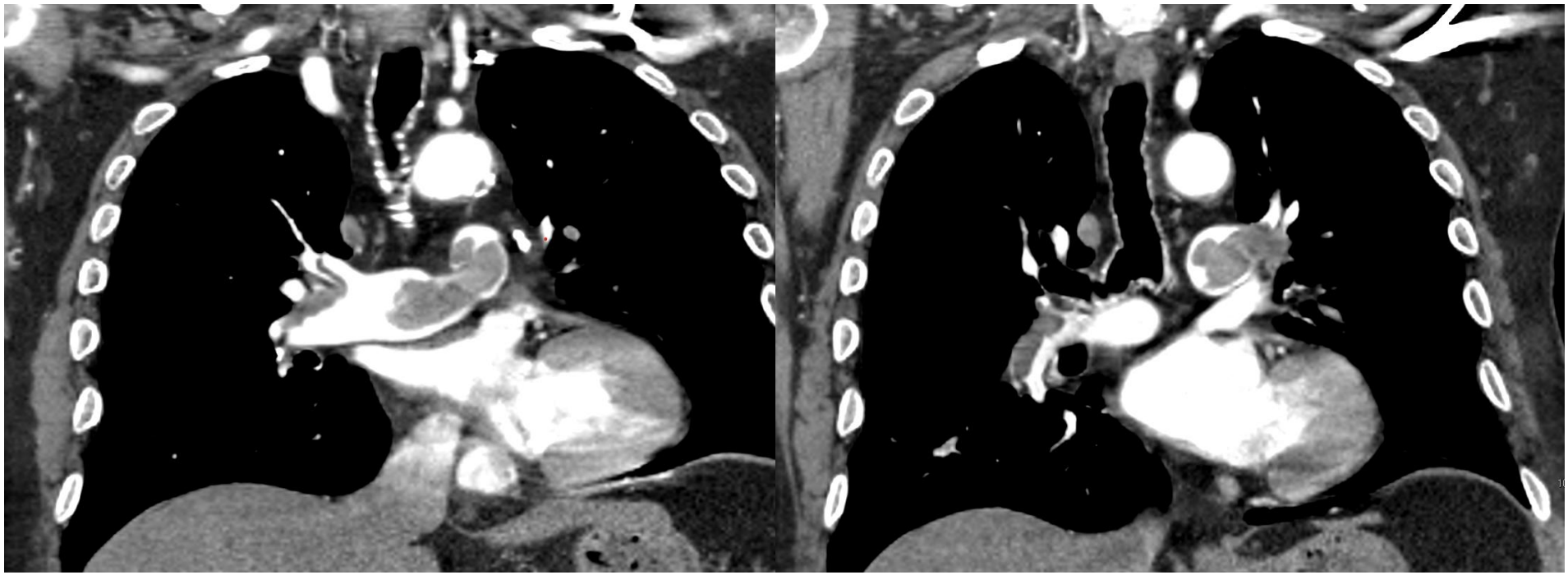
Catheter-Directed Thrombectomy



80-year-old man with sudden onset of shortness of breath.
CTPA –Saddle PE with extension into right and left PA
Right heart dilation- RV/LV Ratio of 1.88
Elevated troponins and BNP

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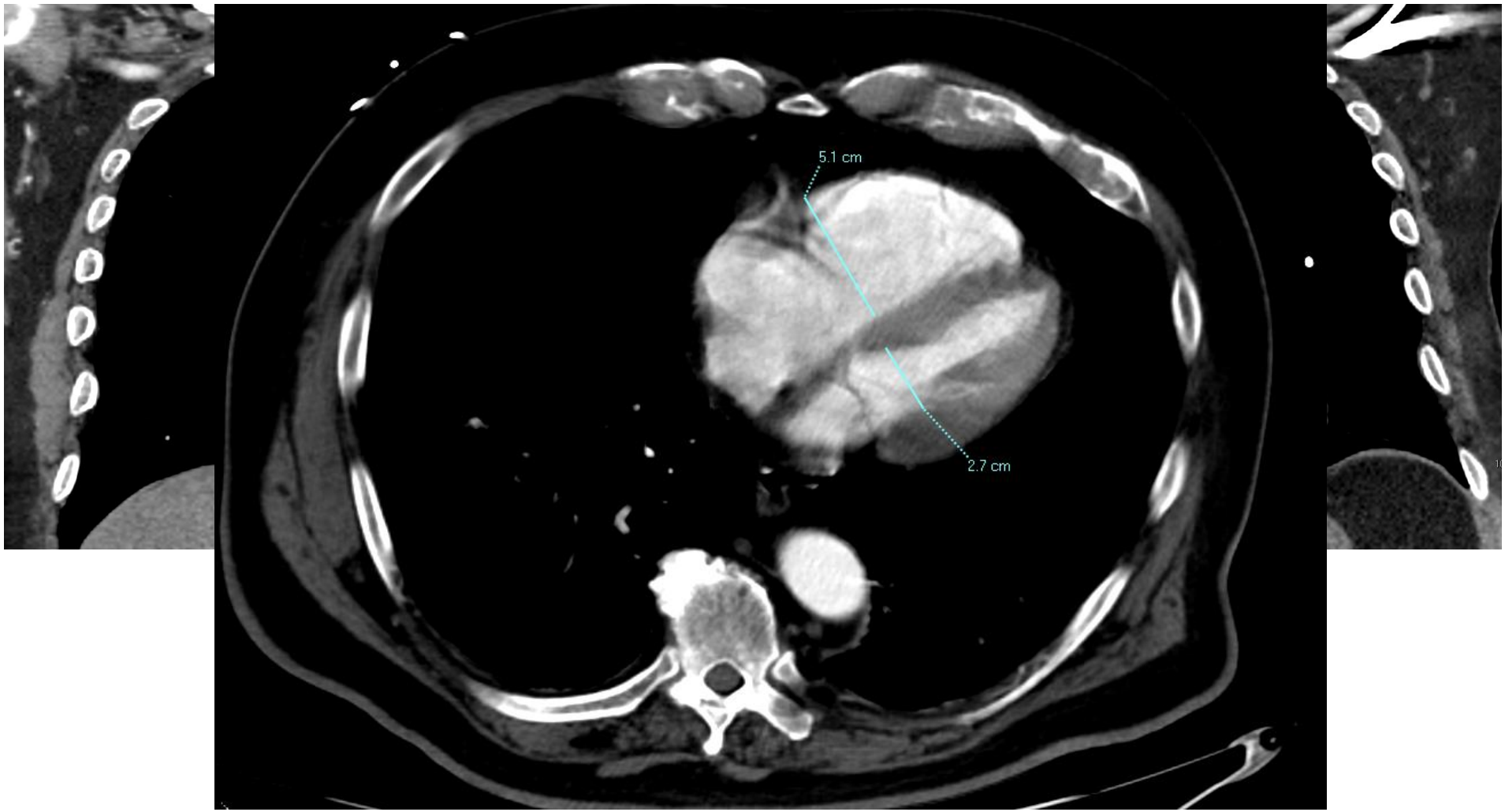
Catheter-Directed Thrombectomy



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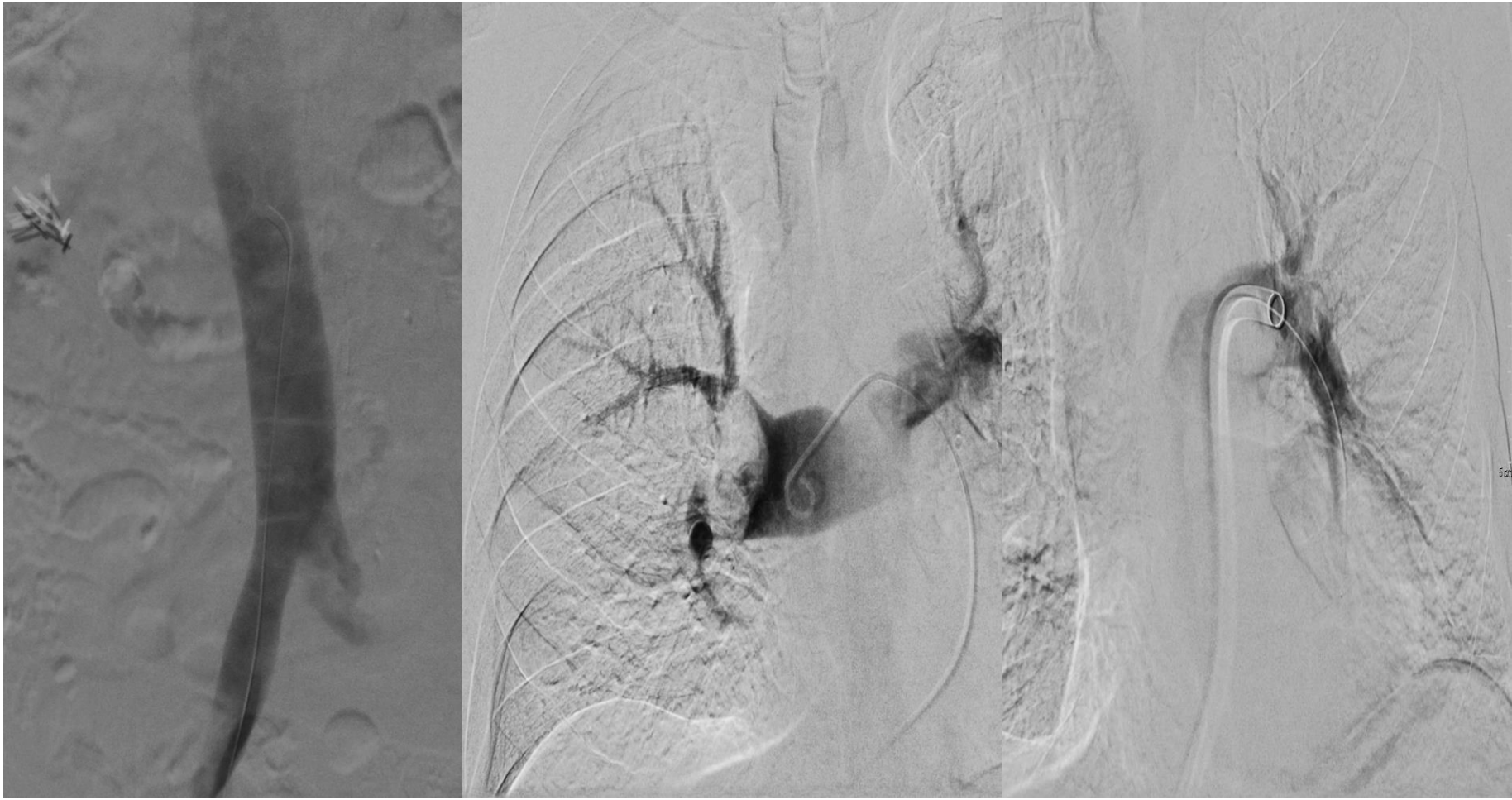
Catheter-Directed Thrombectomy



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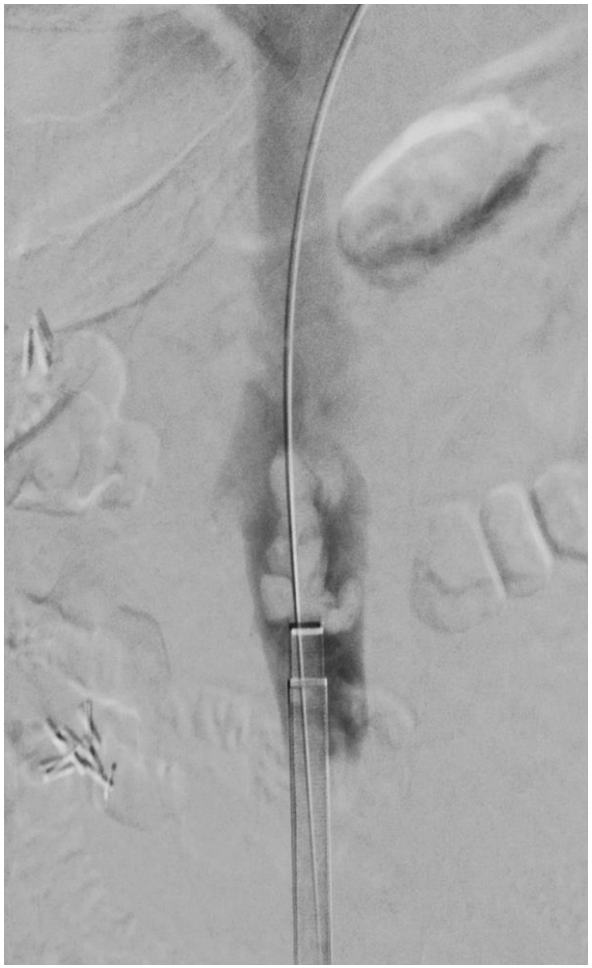
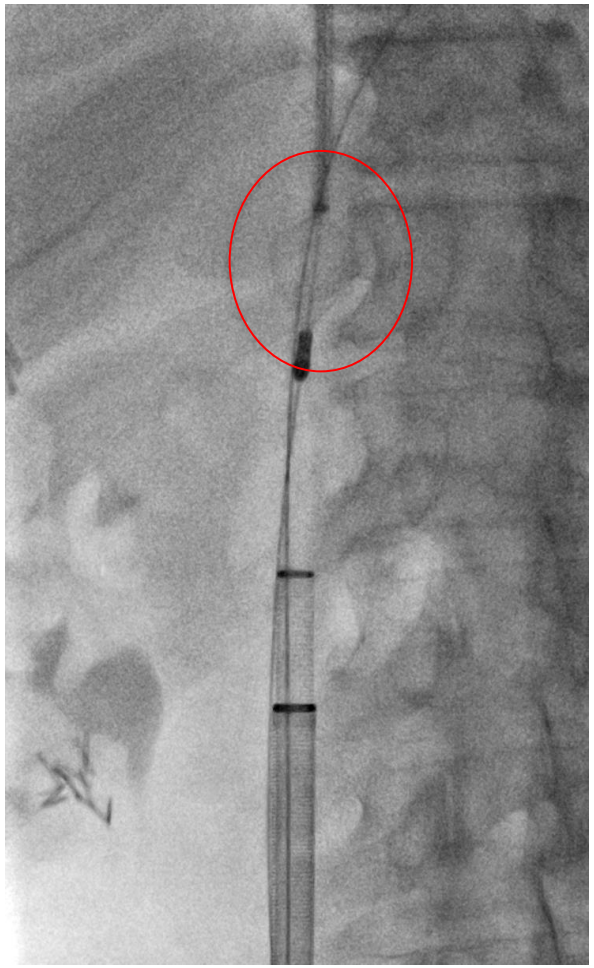
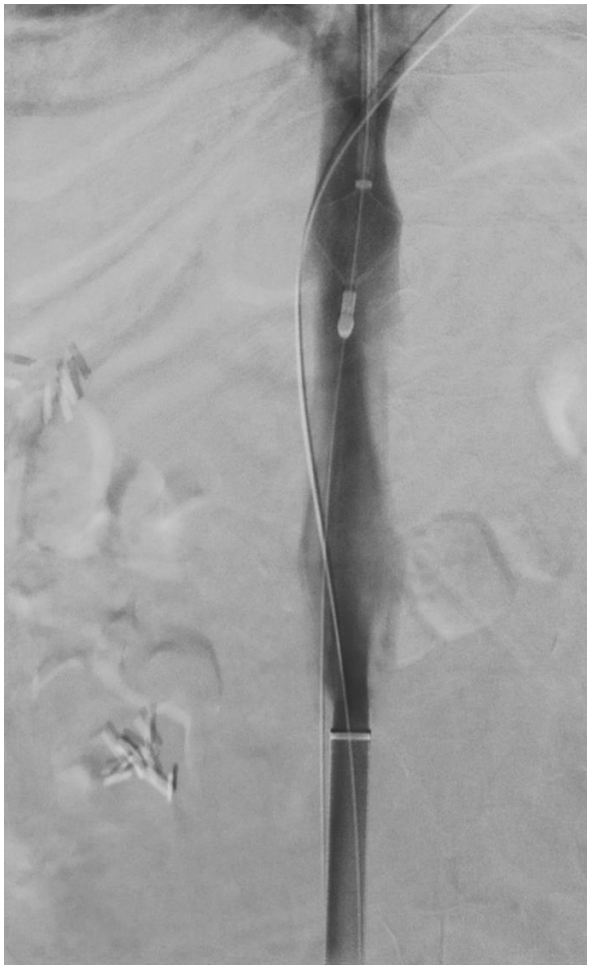
Catheter-Directed Thrombectomy



“Lollipop”



XL DISCS



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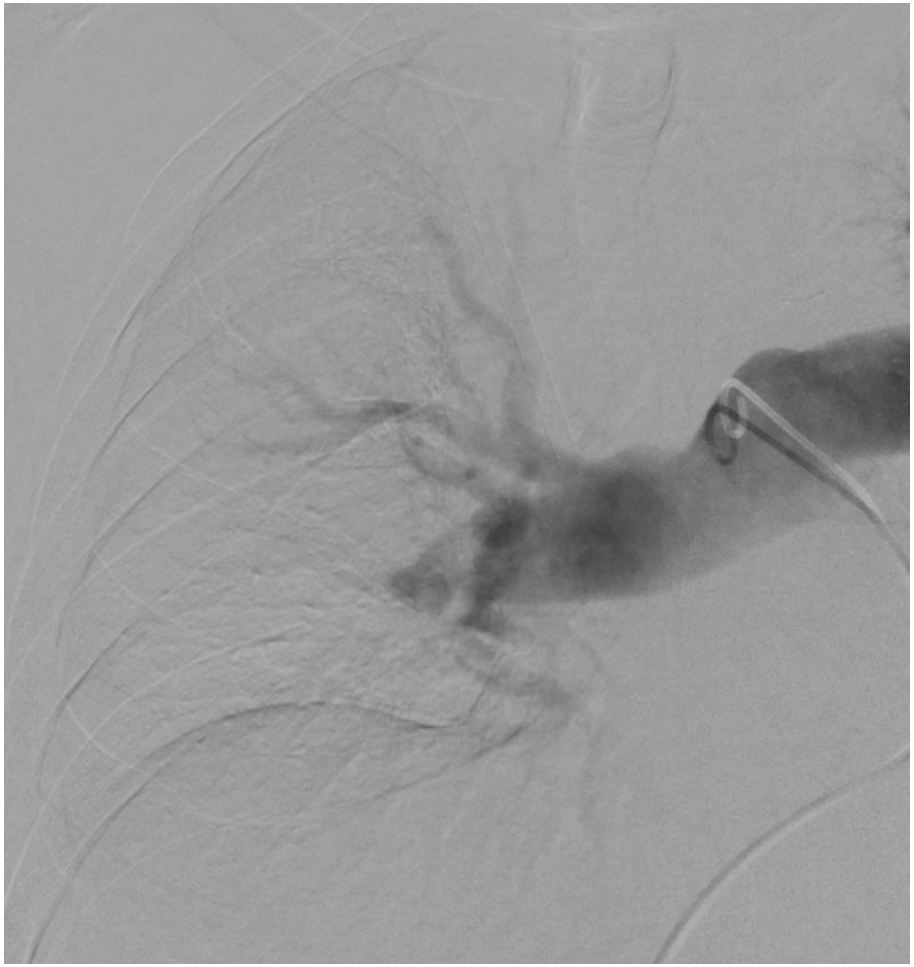
Catheter-Directed Thrombectomy



Mean PAP pressure 38 mmHg → 24 mmHg
1 night in ICU
Discharged 2 days later

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Summary

- Careful patient selection
- PERT in a high-volume center is essential for optimal outcomes
- Faster improvement in clinical symptoms and RV function
- Multiple devices available
- Require further data for treatment of submassive PE
- Not without complications but safer than systemic tPA

Thank You

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