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Virginia Heart Attack Coalition

PE Response Team

MICHAEL KELLEY, MD

INTERVENTIONAL CARDIOLOGY
CARILION CLINIC NRV
CHRISTIANSBURG, VA

Proud partner of VCSQI

Introduction

OBJECTIVE: Align all hospitals in Virginia with a standardized approach to PE management to ensure consistency in care delivery.

GOALS:

- **Adoption of Best Practices:** Encouraging the use of evidence-based protocols across all institutions.
- **Interdisciplinary Collaboration**: Emphasizing the importance of communication between different specialties to provide holistic care.
- **Data Collection and Sharing:** Developing a statewide registry to track outcomes, complications, and the effectiveness of different treatment approaches.

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VHAC PULMONARY EMBOLISM RESPONSE TEAM (PERT) WORKGROUP

presents

PERT *Virtual* ROUNDTABLE

The PE Response Team (PERT) Workgroup under VHAC is a multidisciplinary team focused on improving PE diagnosis, treatment, and outcomes.

Key Focus Areas:

- Low-Dose Thrombolytics – When and how to use them.
- ECMO & RV Support – Identifying patients needing early transfer.
- Chronic vs. Acute RV Dysfunction – Differentiating pulmonary hypertension cases.
- Standardized PE Protocols – Enhancing triage and treatment strategies.
- Collaboration Across Hospitals – Connecting specialists for better patient care.

This workgroup advances early intervention and lifesaving care for PE patients across Virginia.

Advancing Pulmonary Embolism (PE) Management Together

Topics of Discussion

- Low-Dose Thrombolytics – When to use & selection criteria
- ECMO & RV Support Strategies – Identifying transfer needs before thrombectomy
- Chronic RV Strain vs. Acute RV Dysfunction – Distinguishing chronic pulmonary hypertension

Who Should Attend?

Doctors, PE Response Team Members, ICU/ED Staff, Cardiology & Pulmonology Specialists

Why Join?

- Learn from real-world cases
- Exchange best practices
- Improve rapid response strategies

Michael Kelley, MD (Carilion)
Workgroup Champion

REGISTER NOW
WWW.VAHEARTATTACKCOALITION.ORG

Bi-Monthly Meeting

3rd Wednesday of every even month at 8PM via Zoom.

Register at VAHeartAttackCoalition.org

Case of the Year

- 58 y/o female who presents with acute dyspnea.
- h/o bladder CA s/p surgical resection 9/2024.
- h/o DVT 9/2024. Eliquis stopped 3 weeks prior.
- VS: BP 110/70, P 140, RR 25, O2 sat 97%.

Case of the Year

- Intermediate-high risk PE:
  - Chest CTA: RV strain: RV/LV 1.7
  - Elevated troponin, 98
  - Chest CTA: Large central clot R and L main PA
- Venous Duplex: L femoral and popliteal vein DVT

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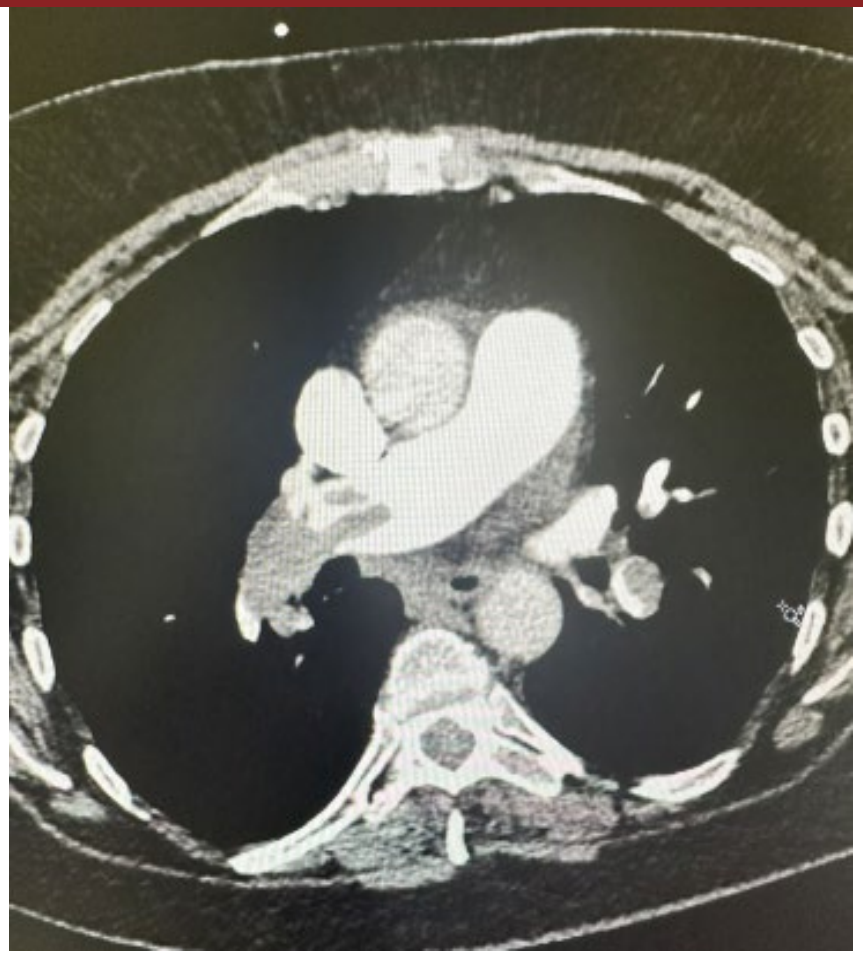
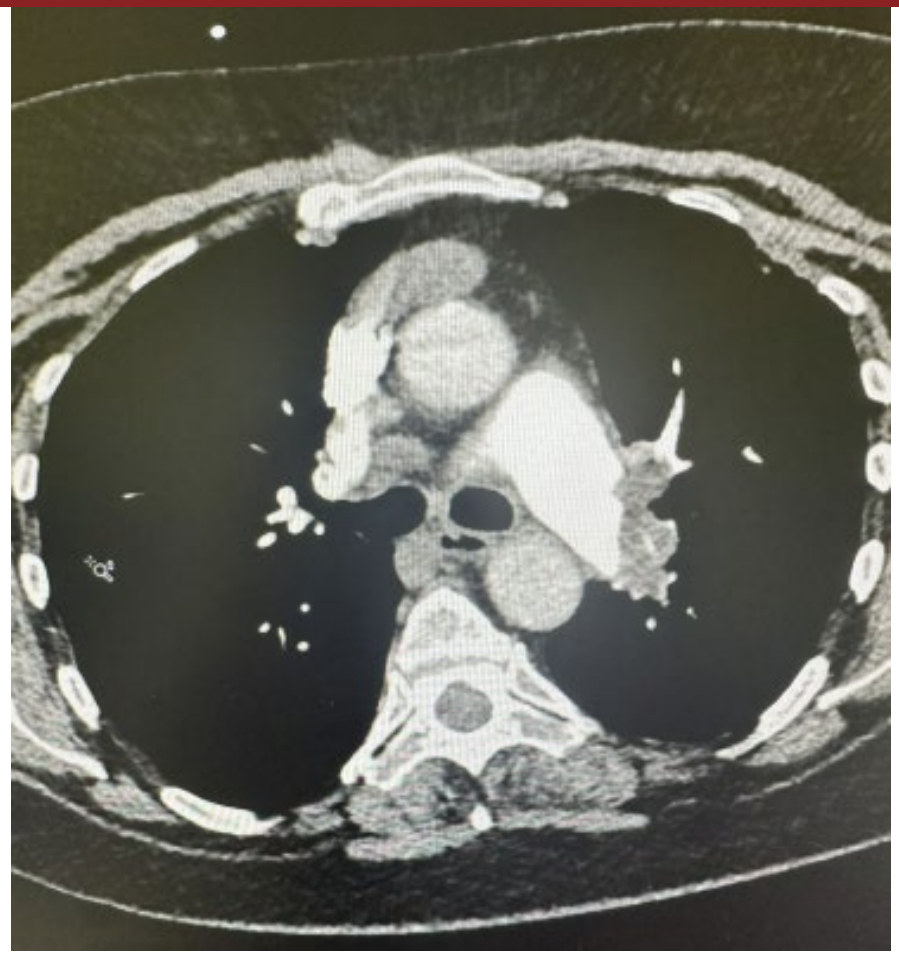
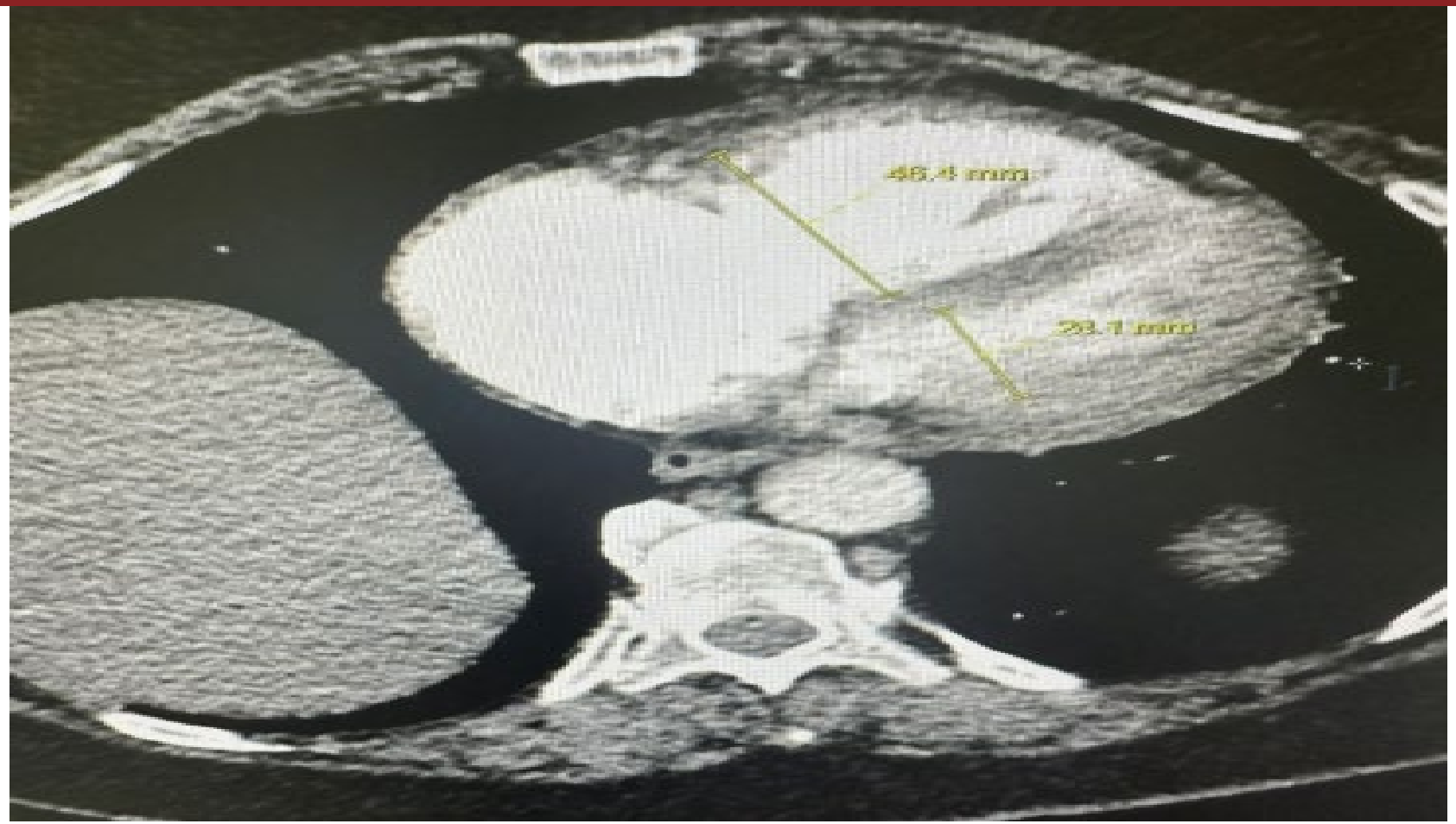
Chest CTA: Bilateral PE

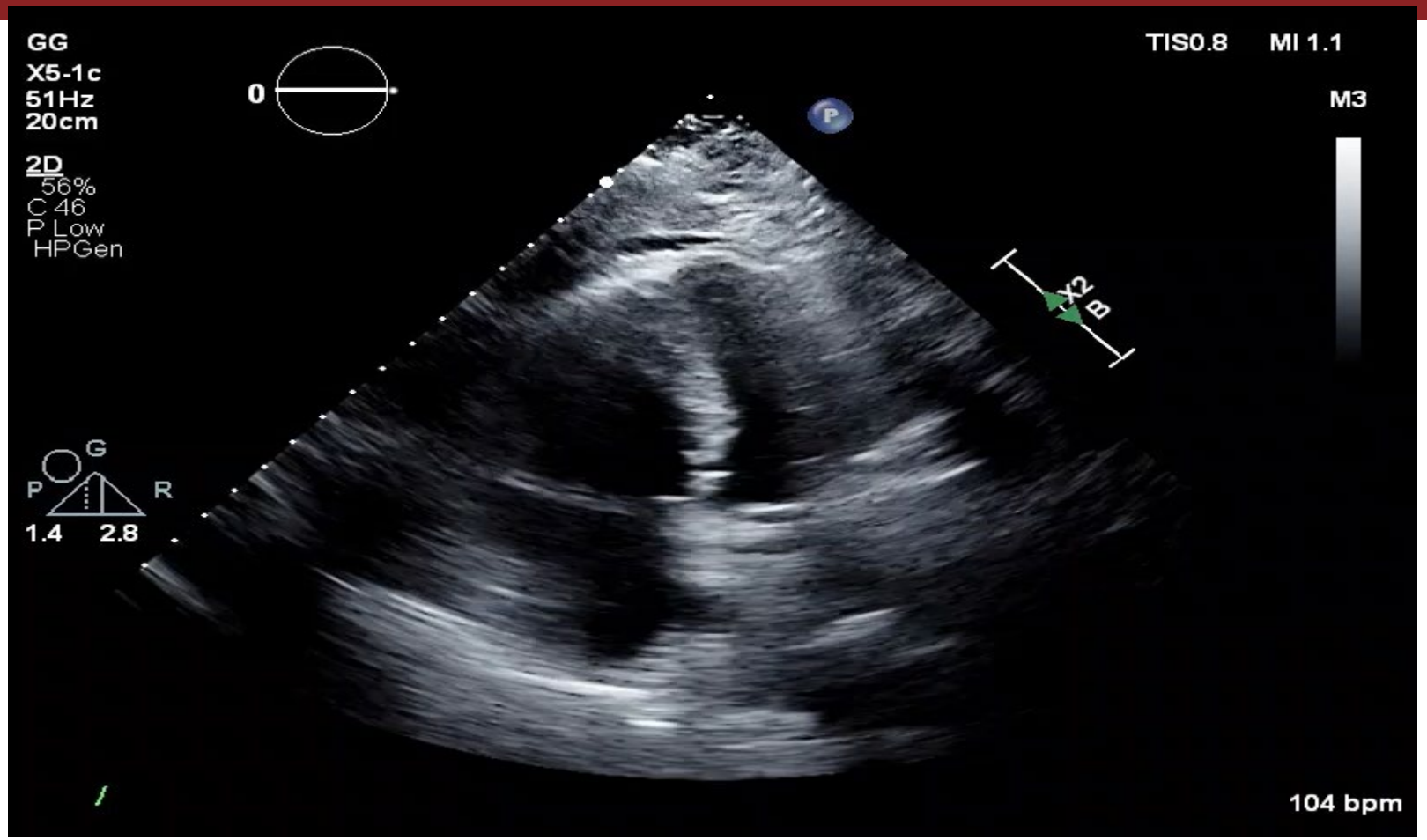




Chest CTA: RV/LV 1.7



Echo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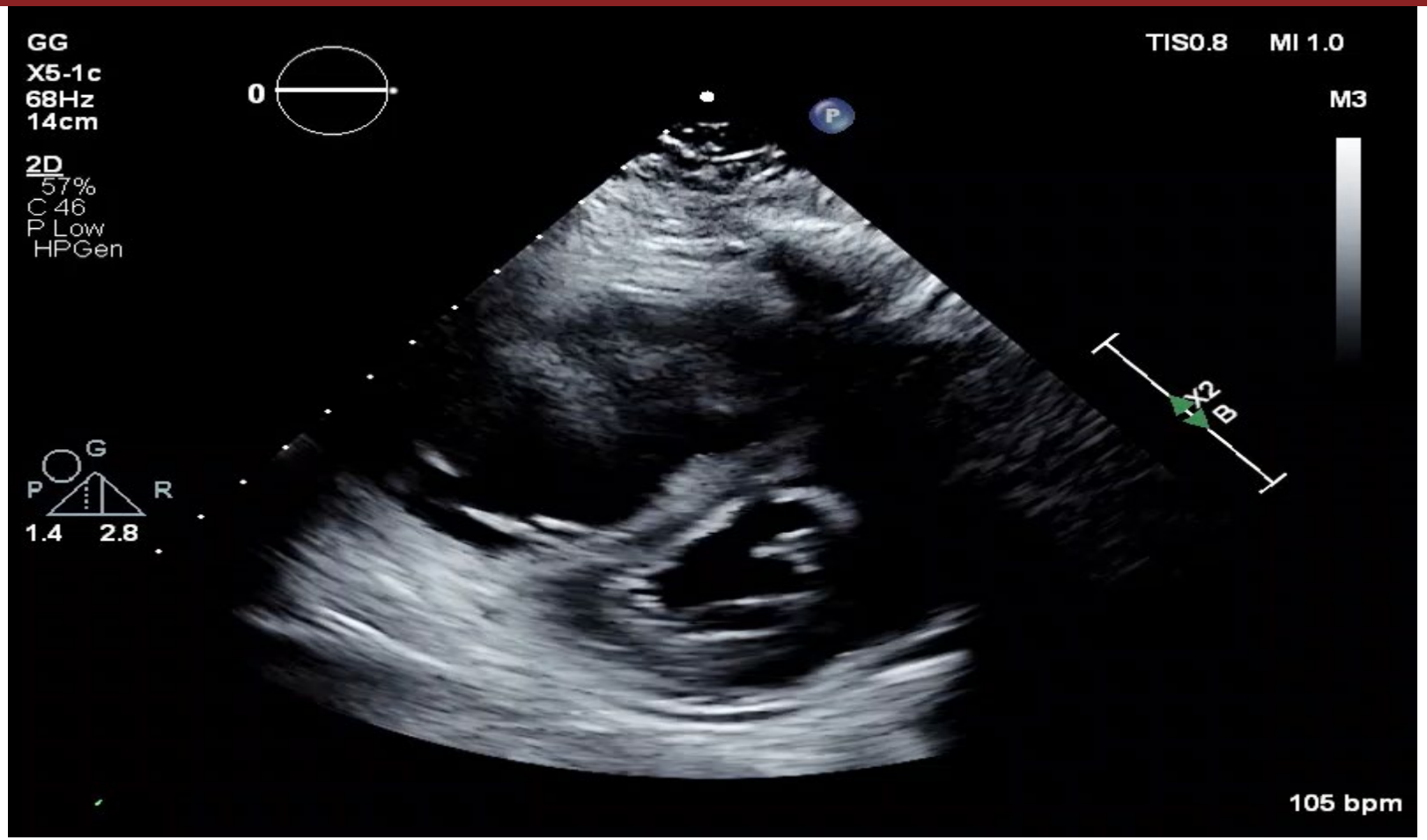
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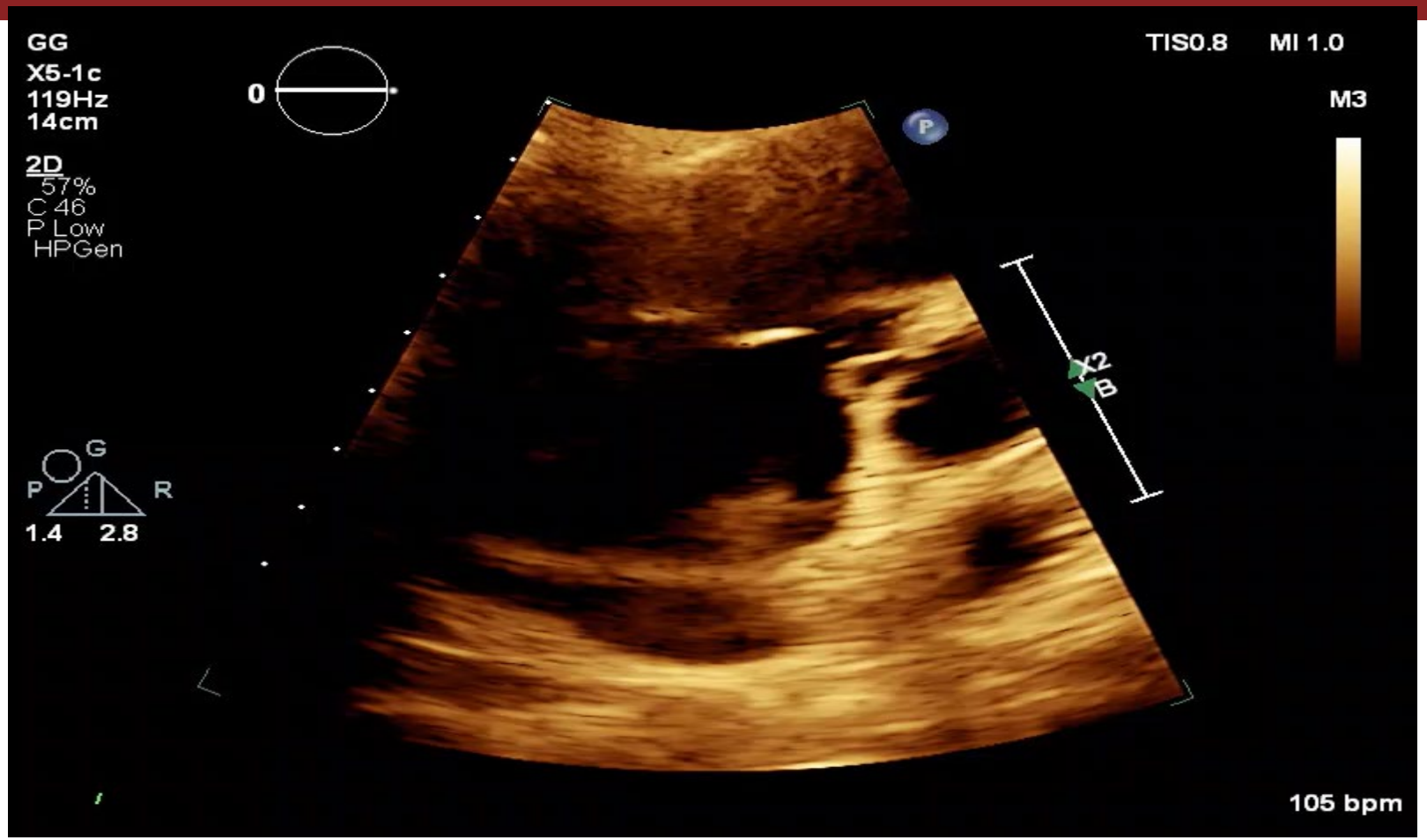
Echo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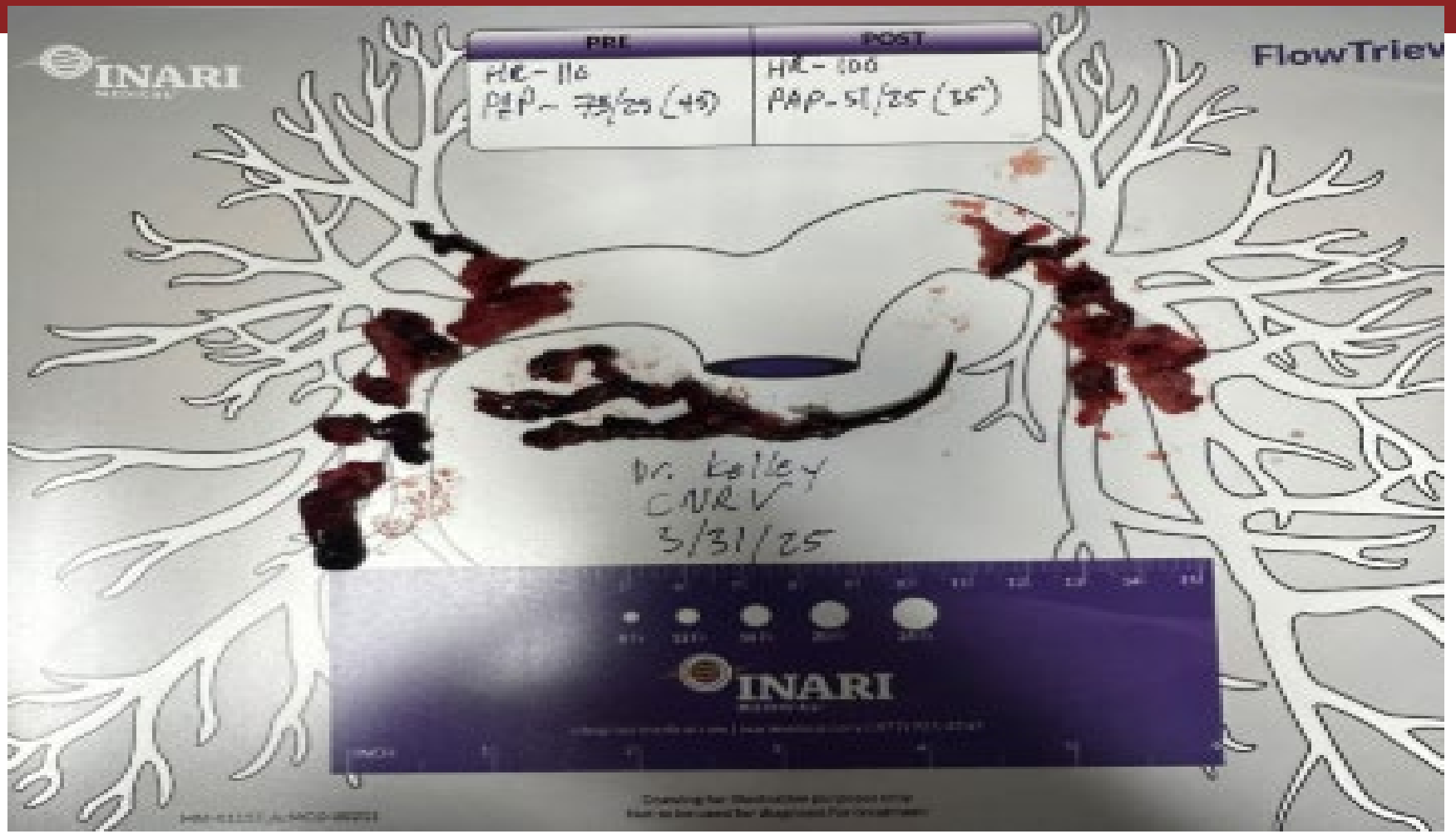
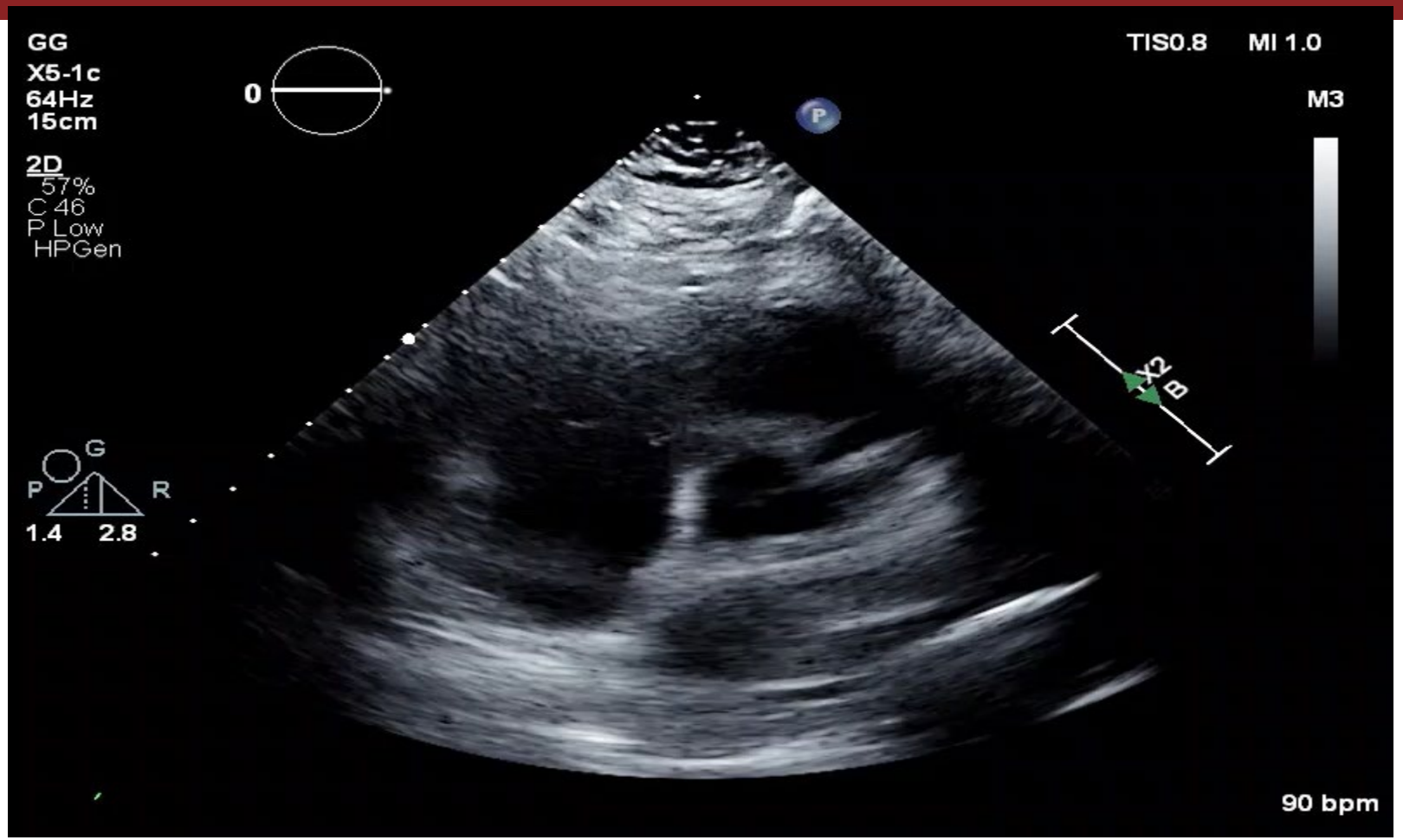
RA and PE Thrombectomy



Echo Post Thrombectomy



PE patient population profile

MASSIVE PE
[High risk]
5% PE population
30% in-hospital mortality
40%[1] mortality @ 3 months

SUBMASSIVE PE
[Moderate/Intermediate risk]
40% PE population
4%[2,3] in-hospital mortality
12%[1] mortality @ 3 months

MINOR PE
[Low risk]
55% PE population
Good prognosis
Low mortality rate

1. Goldhaber SZ et al. Acute pulmonary embolism: clinical outcomes in the International Cooperative Pulmonary Embolism Registry (ICOPER). Lancet 1999;353:1386-1389
2. Meyer G et al. Fibrinolysis for Patients with Intermediate Risk Pulmonary Embolism. New Engl J Med 2014; 370: 1402-11
3. Casazza F et al. Clinical features and short term outcomes of patients with acute pulmonary embolism. The Italian Pulmonary Embolism Registry (IPER). Thrombosis Research 2012; 130:847-852

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European Society of Cardiology PE Guidelines 2019

Early mortality risk		Indicators of risk			
		Haemodynamic instability[a]	Clinical parameters of PE severity and/or comorbidity: PESI class III–V or sPESI ≥1	RV dysfunction on TTE or CTPA[b]	Elevated cardiac troponin levels[c]
High		+	(+)[d]	+	(+)
Intermediate	Intermediate–high	-	+[e]	+	+
	Intermediate–low	-	+[e]	One (or none) positive	
Low		-	-	-	Assesment optional; if assessed, negative

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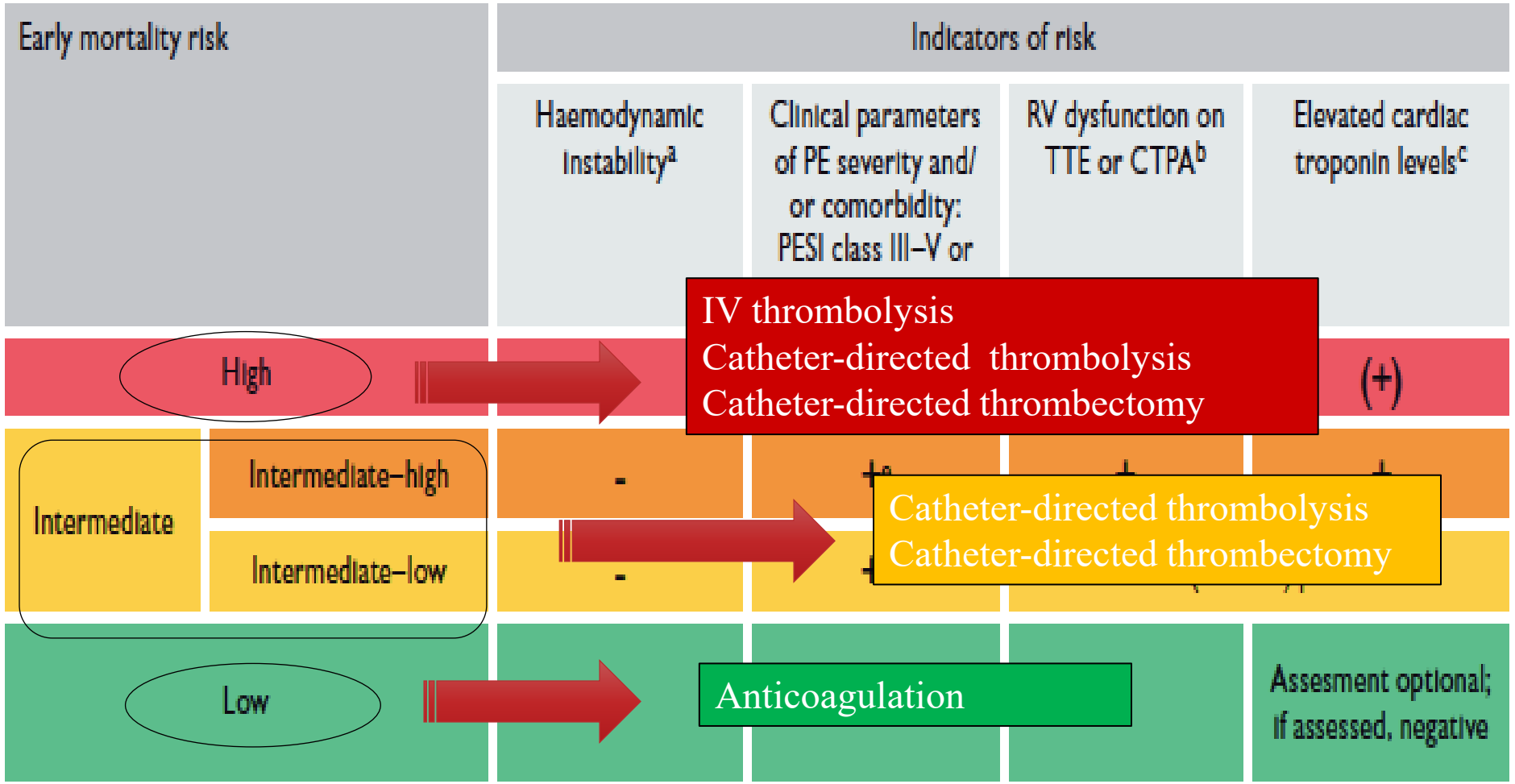
Management



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PEERLESS Trial Design

RCT: FlowTriever vs. catheter-directed thrombolytics (CDT) in pulmonary embolism (PE)

550 PATIENTS RANDOMIZED 1:1

Intermediate-risk acute PE, low contraindication to lytics (low risk of bleeding).

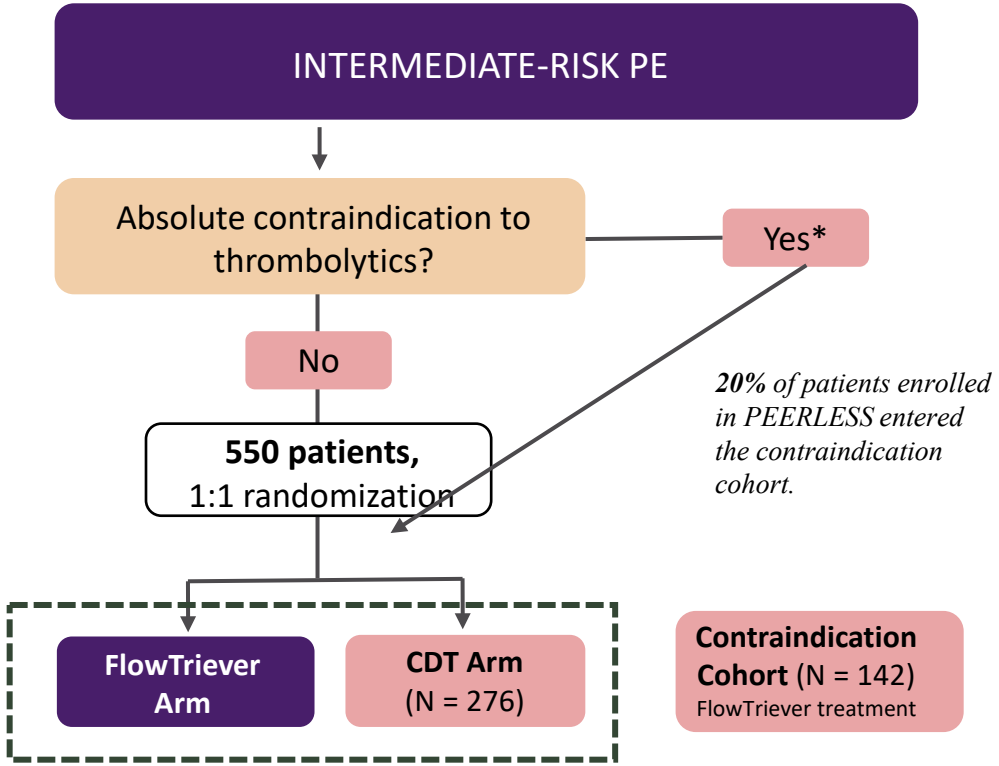
PRIMARY ENDPOINT

Win Ratio composite at discharge (7d max):

1. All-cause mortality
2. Intracranial hemorrhage
3. Major bleeding (ISTH)
4. Clinical deterioration and/or bailout
5. ICU admission and ICU length of stay (LOS)

FOLLOW UP

Through 30 days

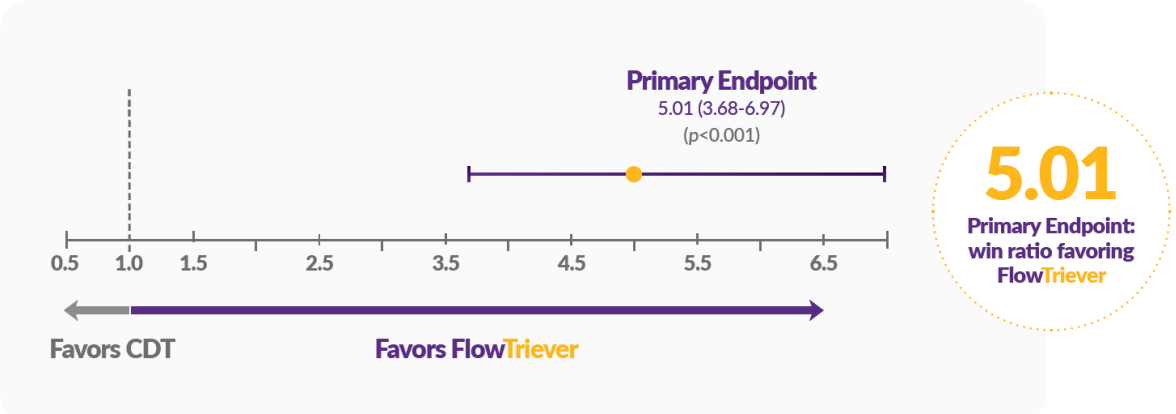


*Patients deemed contraindicated by intervening physician based on appropriate local/hospital guidelines

Results: Clear Superiority Win for FlowTriever

5X more wins with FlowTriever vs. CDT on primary endpoint of 5 clinically relevant components

The primary advantage of a win ratio approach is the ability to rank the outcomes included in the composite by clinical importance and assess them in a hierarchical manner.



	Win ratio [95% CI]	*P* value
Primary Endpoint: 5-component win ratio*	**5.01** [3.68 – 6.97]	**<0.001**

***Primary endpoint components:** 1) all-cause mortality, 2) intracranial hemorrhage, 3) major bleeding,
4) clinical deterioration and/or escalation to a bailout therapy, and 5) ICU admission and length of stay.

Two-sided *P* value calculated using a modified generalized Wilcoxon test (F-S test) proposed by Finkelstein & Schoenfeld.
A win ratio of 5.01 represents 5.01 times more wins for FlowTriever than CDT when every patient in each study arm is compared across the study's 5 components in hierarchical order: 1. all-cause mortality; 2. intracranial hemorrhage (ICH); 3. major bleeding; 4. clinical deterioration and/or escalation to bailout; and 5. ICU admission and ICU length-of-stay (LOS). The win ratio primary endpoint was assessed through discharge or 7 days post-procedure, whichever occurred first.

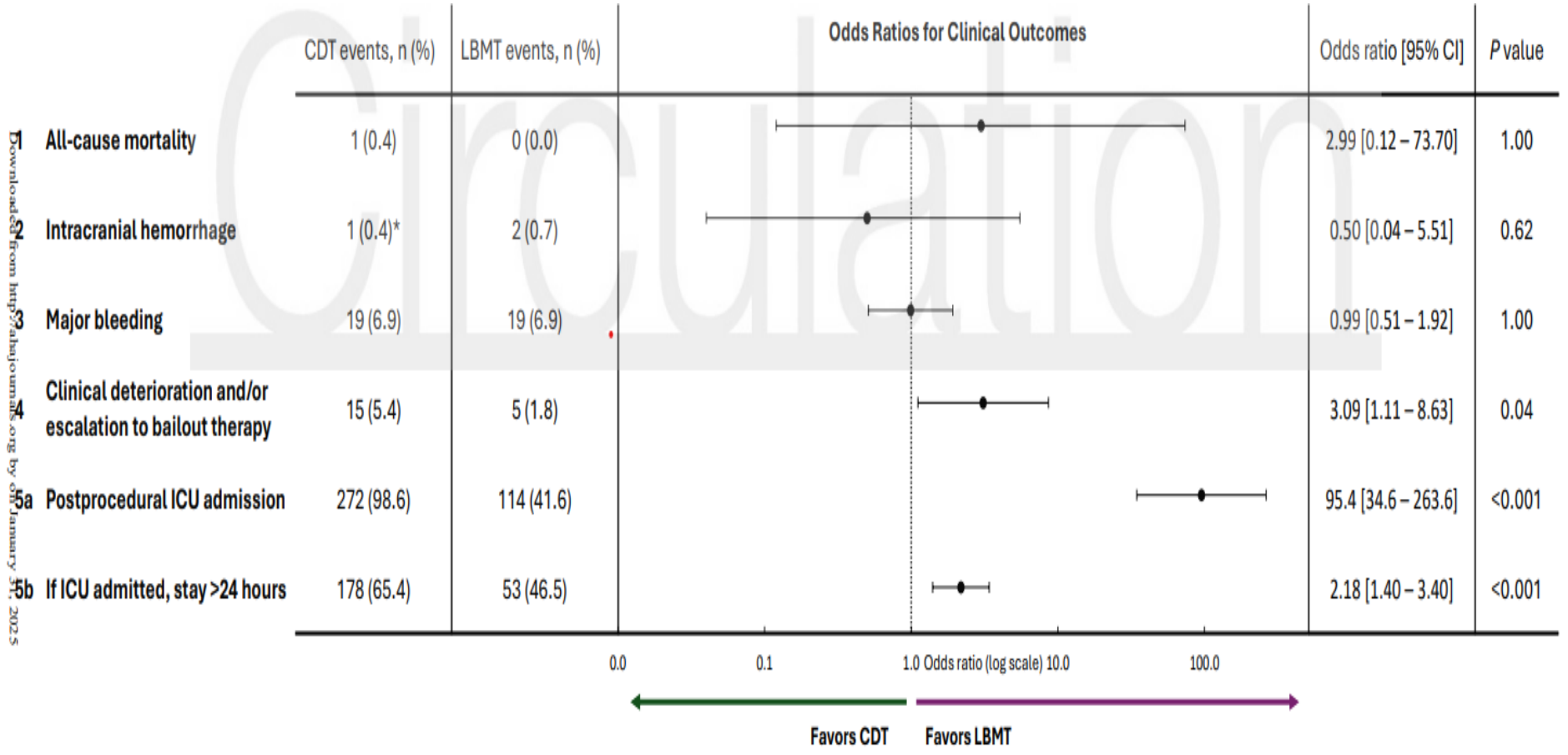
FlowTriever Had 3X Fewer Deteriorations/Bailouts

Deteriorations were also more severe in the CDT arm

	CDT N = 276	FlowTriever 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 FlowTriever bailout procedure without adverse event, experienced postprocedural improvement, and were discharged without further intervention. ‡1 patient in each arm had a PE that could not be treated after multiple bailout attempts (systemic tPA, FlowTriever, CDT) and ultimately died after >7 days.

PEERLESS Results: Composite Outcomes



Conclusions

In an acute, intermediate-risk PE population where 96% had no contraindications to lytics,
PEERLESS met its primary endpoint*, demonstrating superiority of FlowTriever vs. CDT.

FlowTriever patients also experienced:

- ✓ **Less clinical deterioration or escalation of therapy**
- ✓ **Faster clinical and hemodynamic improvement** at 24 hours
- ✓ **Less ICU admission/stay** and shorter hospital length of stay
- ✓ **Fewer readmissions** through 30 days
- ✓ **Excellent safety** and low 30-day mortality, validating previous studies[1,2]

*Primary endpoint win ratio of 5 components: 1) all-cause mortality, 2) intracranial hemorrhage, 3) major bleeding, 4) clinical deterioration and/or escalation to a bailout therapy, and 5) ICU admission and length of stay.

1. Toma, C., et al. Acute Outcomes for the Full US Cohort of the FLASH Mechanical Thrombectomy Registry in Pulmonary Embolism. EuroIntervention.2023; 18:1201-1212.
2. Silver et al. Outcomes in High-Risk Pulmonary Embolism Patients Undergoing FlowTriever Mechanical Thrombectomy or Other Contemporary Therapies: Results From the FLAME Study. Circulation: Cardiovascular Interventions. 2023 Oct.

Future Randomized Trials

- **PEERLESS 2: LBMT(Inari) vs AC (1200 patients)**
- **STORM-PE: LBMT (Penumbra) vs AC (100 patients)**
- **HI-PEITHO: CDT (EKOS) vs AC (550 patients)**
- **PE-TRACT: LBMT or CDT vs AC (500 patients)**

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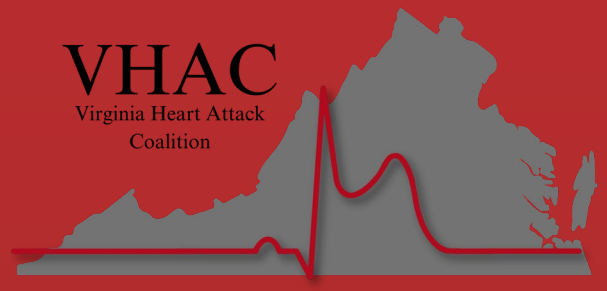

VHAC PERT Protocol

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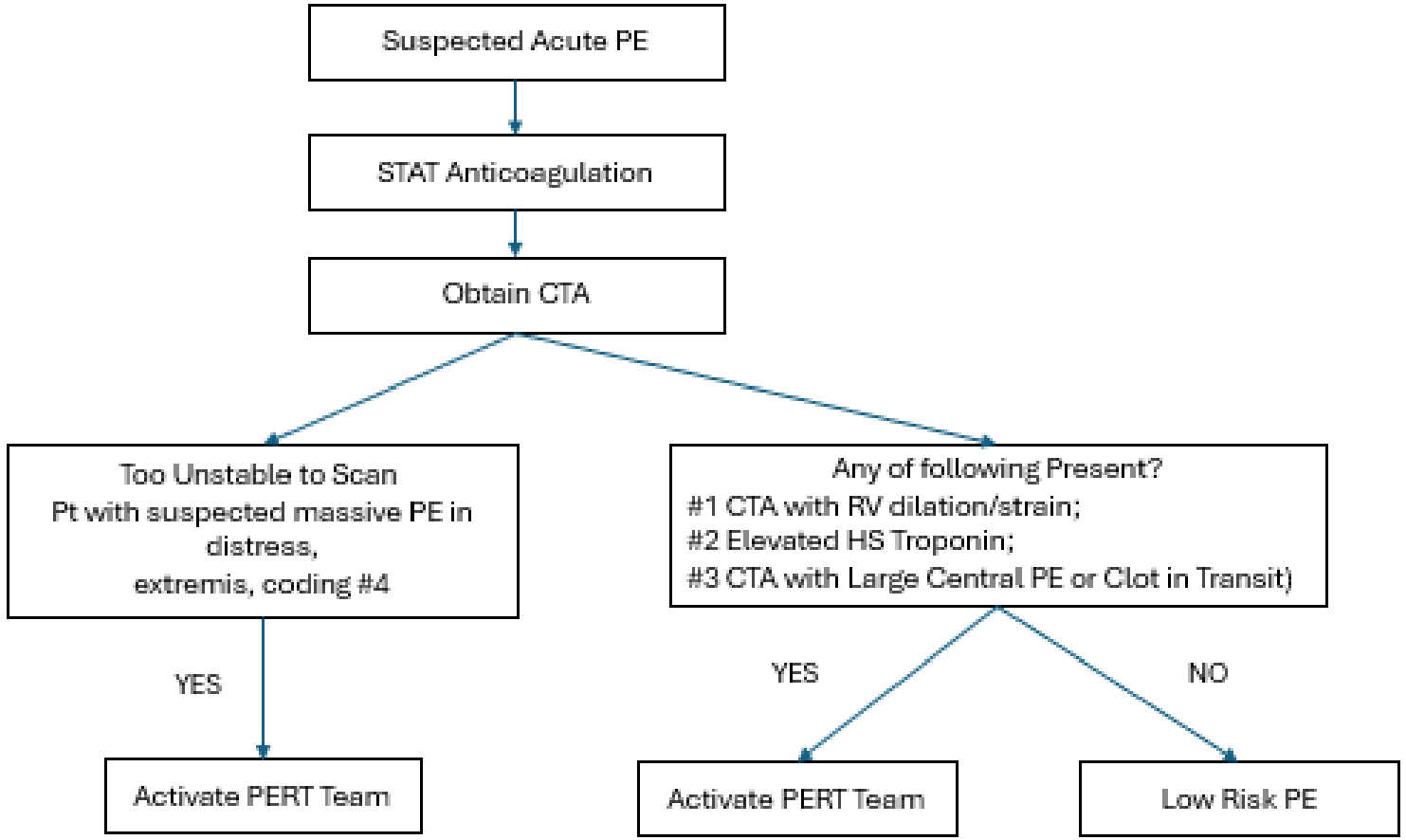
This protocol has been developed by the VHAC PE Response Team Workgroup as part of the statewide effort to standardize pulmonary embolism response and care pathways across Virginia. It reflects current best practices, incorporates feedback from member institutions, and is intended to serve as the foundation for statewide adoption and implementation.

ADDITIONAL REMARKS:
Work up of Suspected PE:
- CBC, BMP, Trop, Pro-BNP, Lactic, EKG, CXR, CTA, PT, PTT, Type & Screen
- CrCl/GFR > 15: Enoxaparin 1mg/kg (Pharmacy adjusted based on CrCl). Max dose 150mg
- CrCl/GFR < 15: or AXI: Heparin bolus + Infusion

#1 CTA findings of RV Strain or Dilation (RV:LV chamber ratio >1, Contrast Reflux into IVC, Septal Flattening or bowing)
#2 HS Trop Elevation >= 50mg/L
#3 Large Central PE = Saddle PE, L or R main PA PE; or a Clot in Transit (RA, RV, IVC)
#4 Suspected massive/unstable PE: High degree of suspicion based on presentation, risk factors, or known VTE.

STAT ECHO: No longer necessary for activation do not delay POCUS may be helpful or r/o alternative etiologies ECHO and Duplex can be completed next day
(POCUS) = Point of Care Ultrasound

Appendix A: PERT Consult Activation



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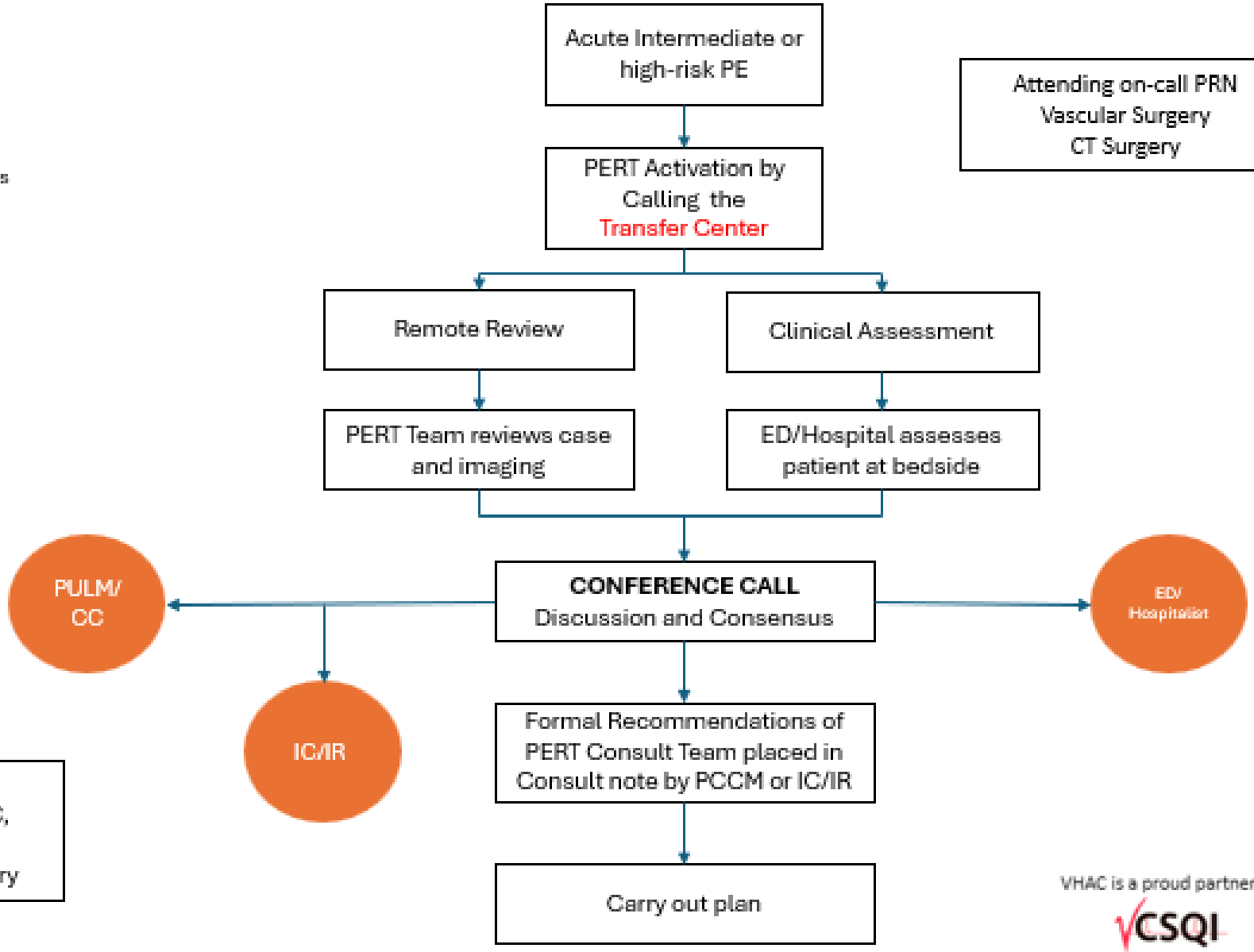
Appendix B: PERT Decision Process



1. ED/Hospitalist assess patient at bedside
2. Transfer Center connects the PERT team (PCCM, IC, ED, Hospitalist)
3. Attendings on call PRN: Vascular Surgery, CT Surgery

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Simplified PESI Scoring (1 point each):
- Age >80
- History of Cancer
- History of chronic cardiopulmonary disease
- HR >= 100 bpm
- SBP < 100 mmHg
- O2 Saturation <90%

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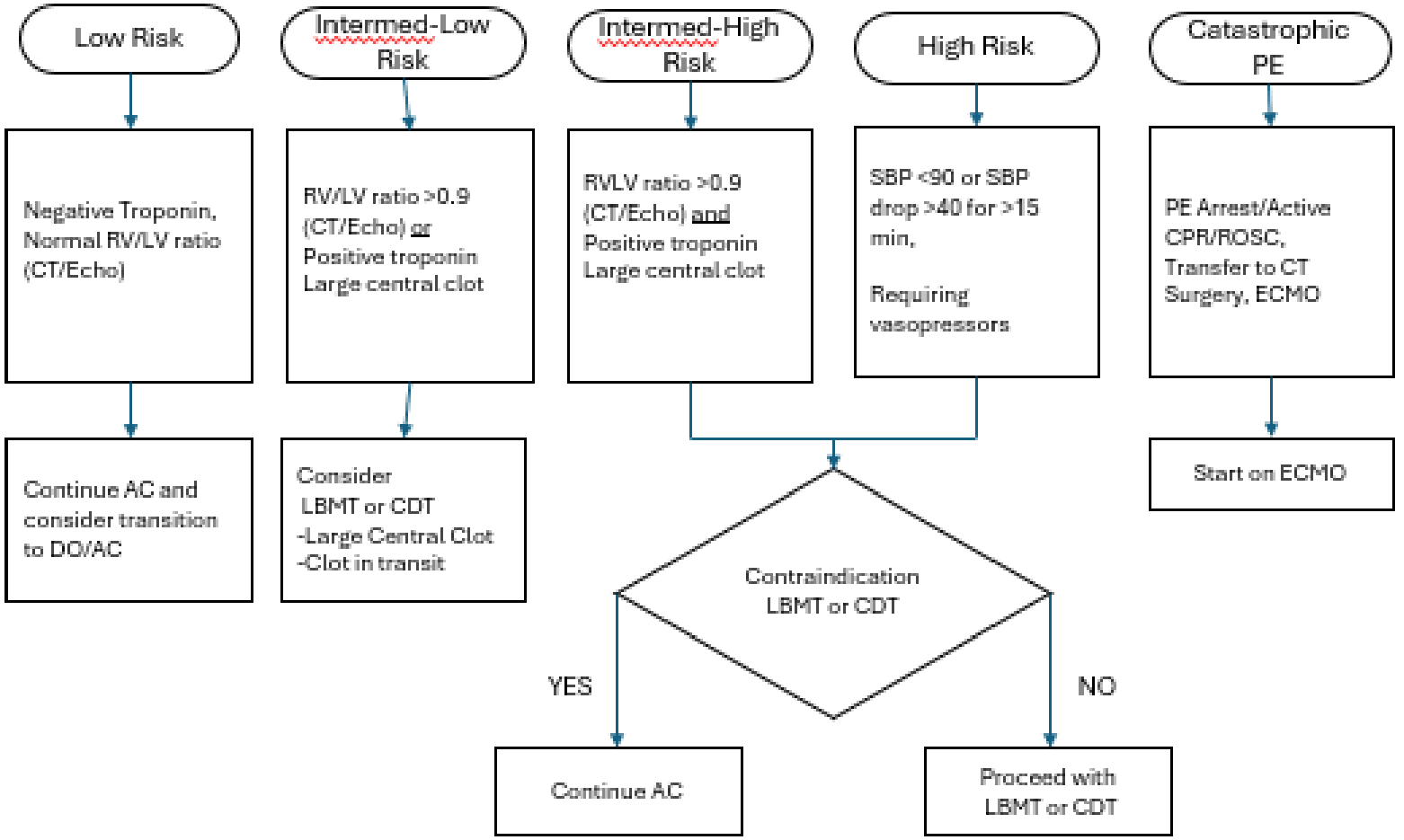
Appendix C: PERT Treatment Algorithm

Acute Pulmonary Embolism Clinical Treatment – Details and Decision Tree

Unless contraindicated, all patients with high suspicion for PE, start IV Heparin or Enoxaparin
- OBTAIN CTA
- Troponin Level
- Obtain echo (if stable)
- Calculate sPESI Score (>/=1 often Int or High Risk)



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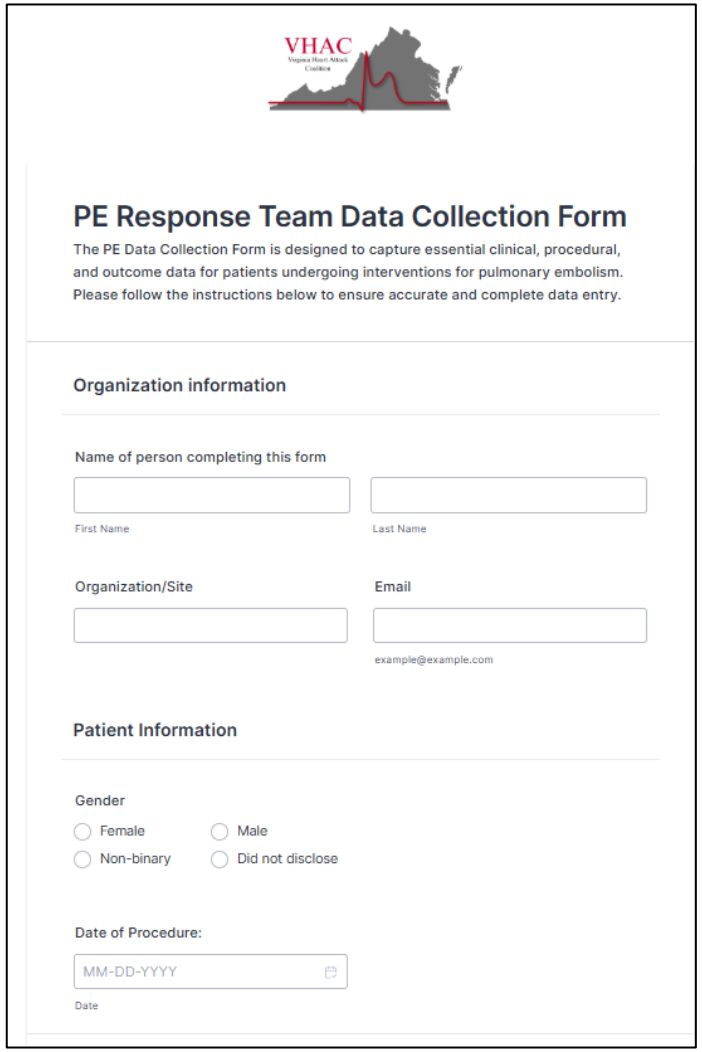
PE Response Data Collection Form

LAUNCHED AUGUST 2025

PE Response Data Collection Form – Key Domains

- Demographics
- Clinical Presentation
- Diagnostics
- Treatment / Procedure
- Outcomes
- Adverse Events



PE Response Team Data Collection Form

The PE Data Collection Form is designed to capture essential clinical, procedural, and outcome data for patients undergoing interventions for pulmonary embolism. Please follow the instructions below to ensure accurate and complete data entry.

Organization information

Name of person completing this form

First Name

Last Name

Organization/Site

Email

example@example.com

Patient Information

Gender

Female

Male

Non-binary

Did not disclose

Date of Procedure:

MM-DD-YYYY

Date

Demographics & Baseline Info

Patient & Administrative Information

- Patient demographics (Age, Gender, Date of Procedure)
- Organization / Site
- Person completing form

Risk Stratification & Vitals

Baseline Risk & Clinical Presentation:

- RV strain
- Troponin > 50
- Syncope event
- Hypotension (SBP < 90 / low BP 90–100)
- O_2 Sat < 90%
- Need for pressors

Vital Signs on Presentation:

- Blood pressure, heart rate, O_2 saturation
- Number of pressors

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Procedures & Interventions

- Anticoagulant given (Heparin, Lovenox, Other)
- Treatment used (Thrombectomy, Catheter Thrombolysis, IV Thrombolysis)
- Device used (Penumbra, EKOS, Inari, Other)
- Thrombolytic agent (tPA, NK, etc.)
- Hemodynamics measured pre- & post-procedure (RA pressure, PA pressure, Cardiac Index)
- Mechanical circulatory support if required

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Outcomes

- In-hospital mortality (Yes/No; cause if applicable)
- Recurrent PE within 30 days
- Bleeding events (with source)
- ICU admission & length of stay
- Post-procedure therapy (Eliquis, Xarelto, Coumadin, etc.)

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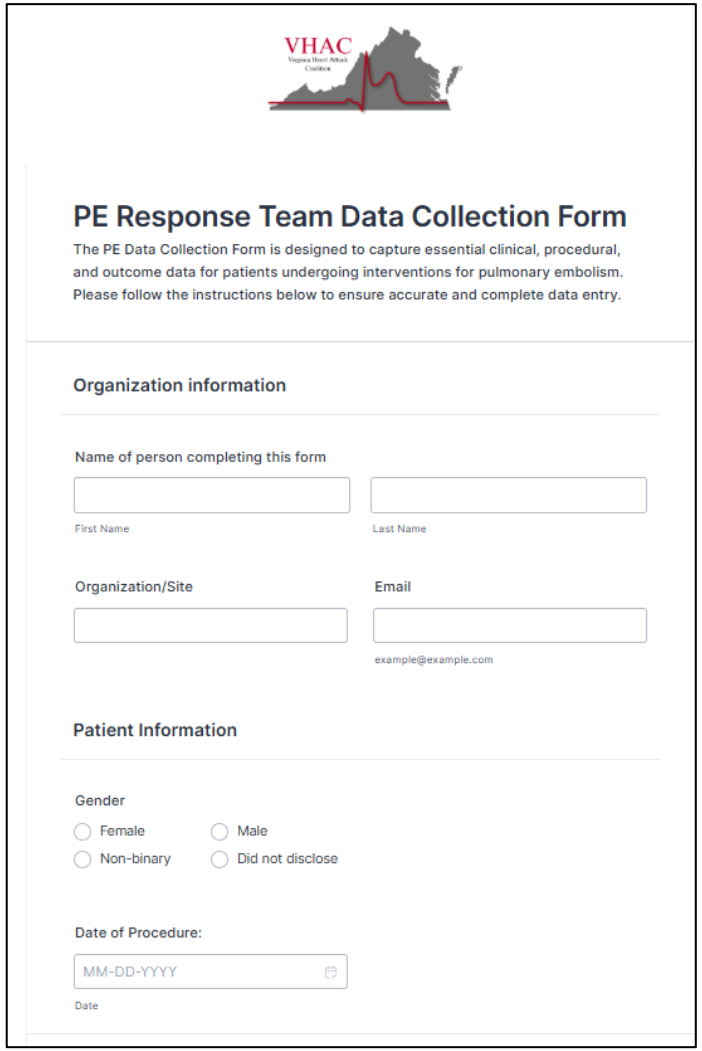
PE Response Data Collection Form

Why This Matters

- Standardize PE response across programs
- Assess effectiveness of interventions
- Track complications and patient outcomes
- Drive quality improvement and research initiatives



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Gender

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Male

Non-binary

Did not disclose

Date of Procedure:

MM-DD-YYYY

Date

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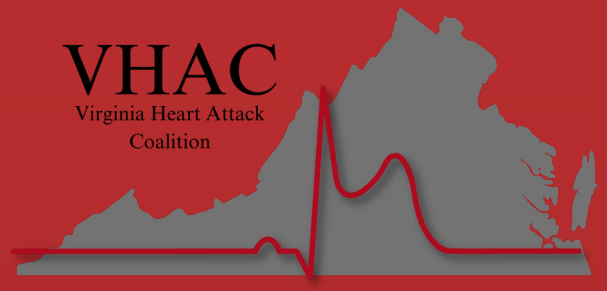

Preliminary Data

Dataset Overview

- Total Records: 20
- Programs Represented: 2 sites
- Case Distribution:
  - Program 1: 5 cases
  - Program 2: 15 cases
- Date Range: October 1, 2024 – September 20, 2025

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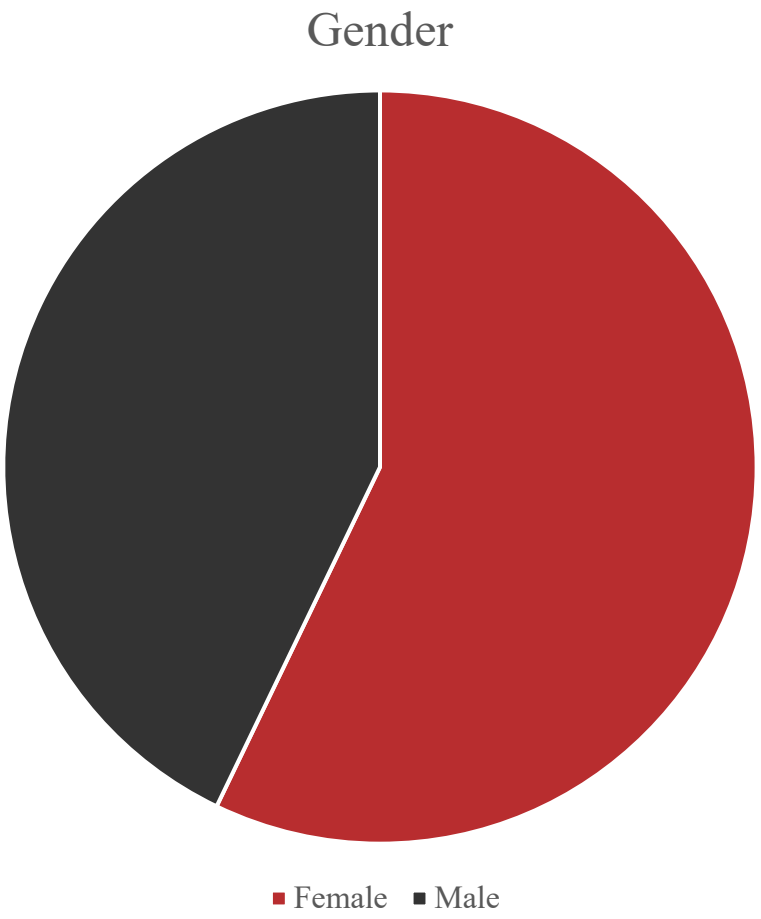
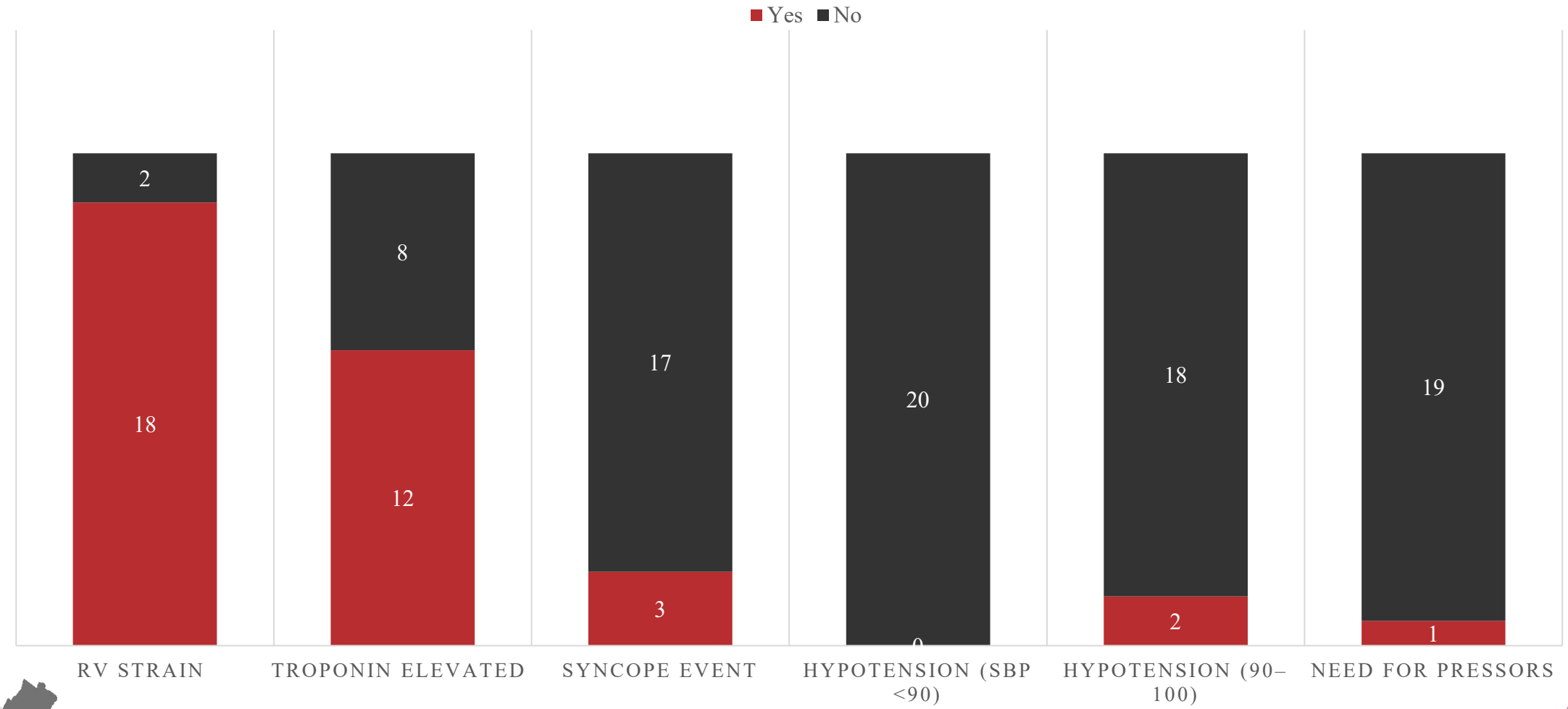
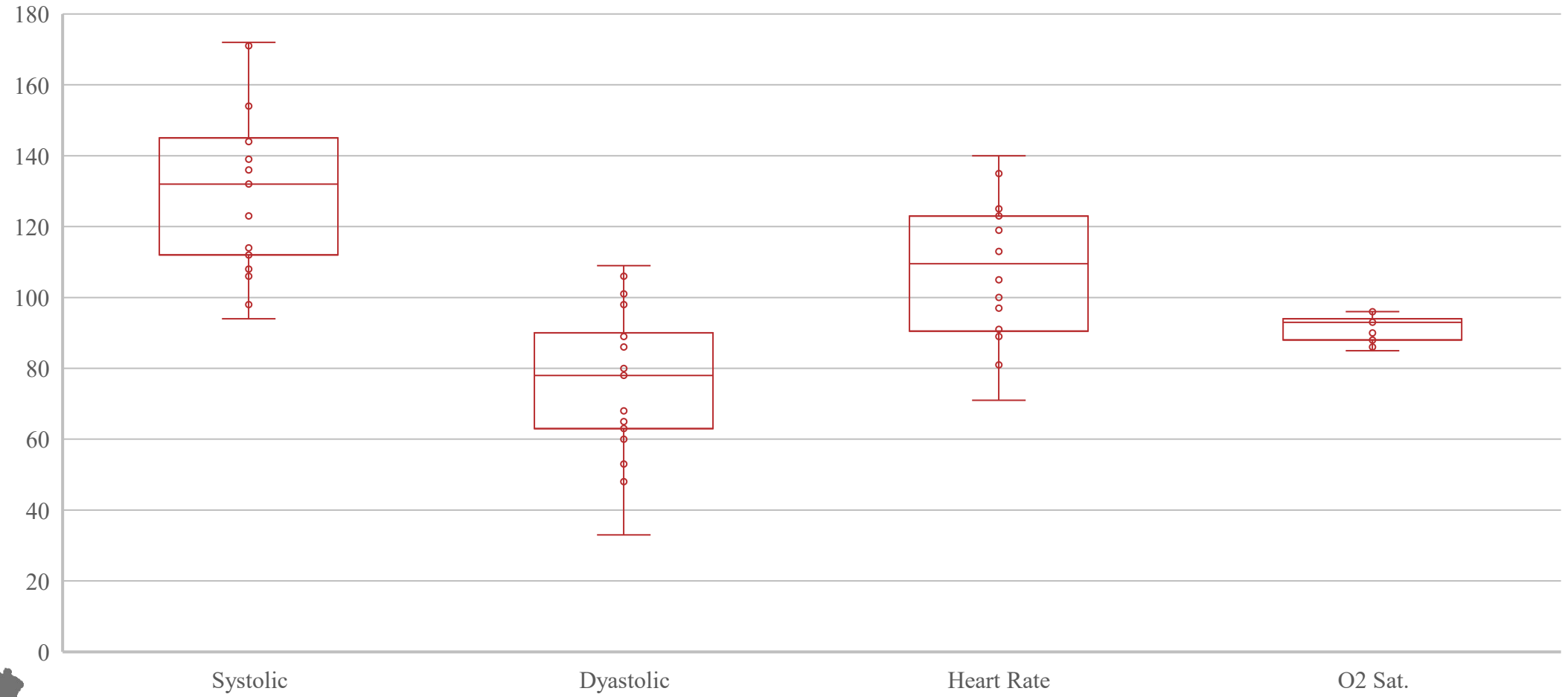
Gender Distribution



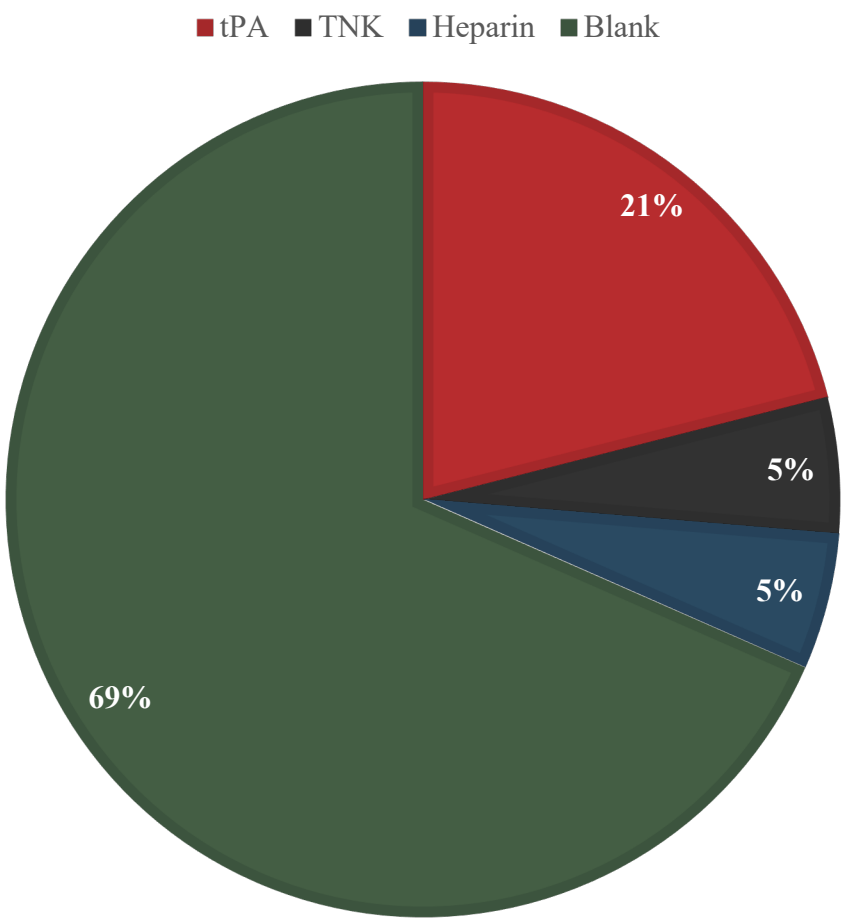
Risk Stratification



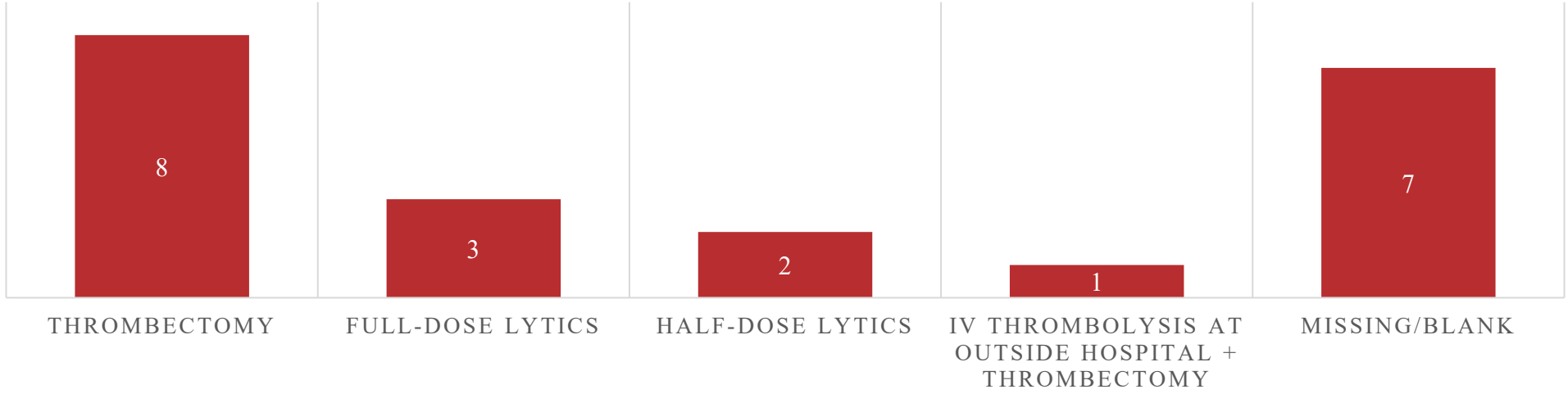
Distribution of Vital Signs on Presentation

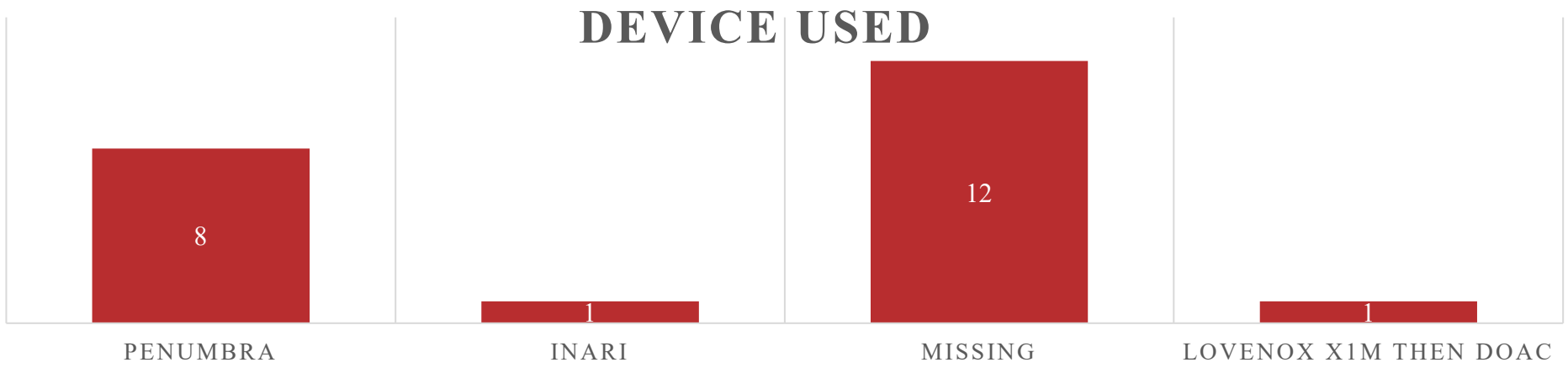


Agent Used for Thrombolytics

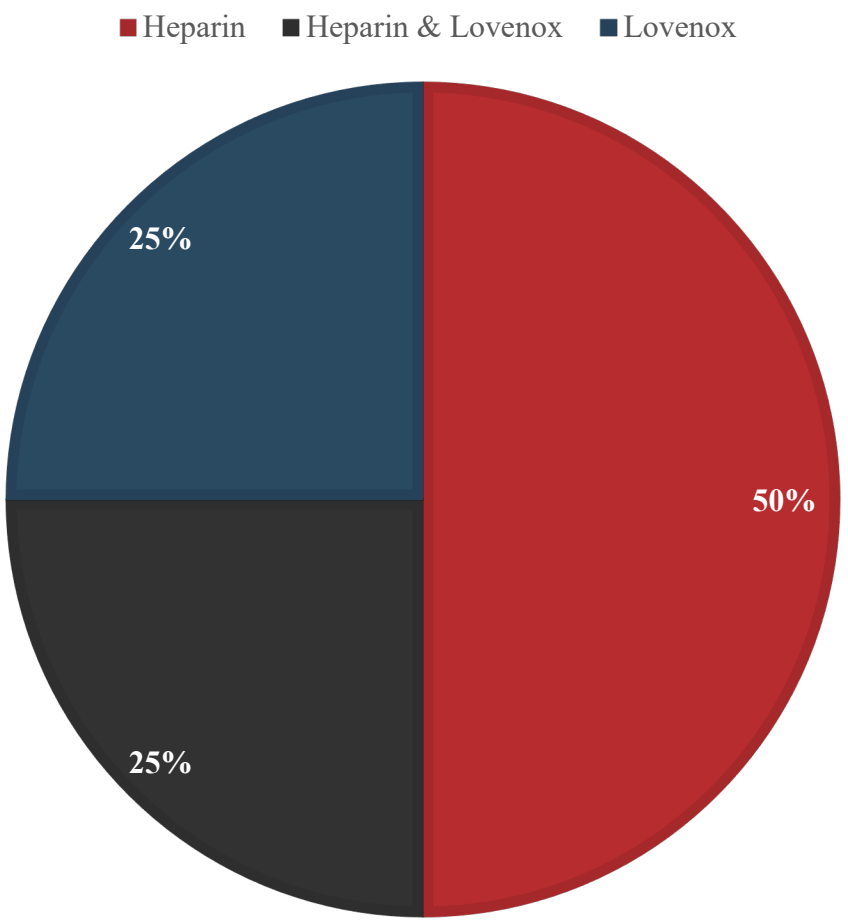


Treatment Used

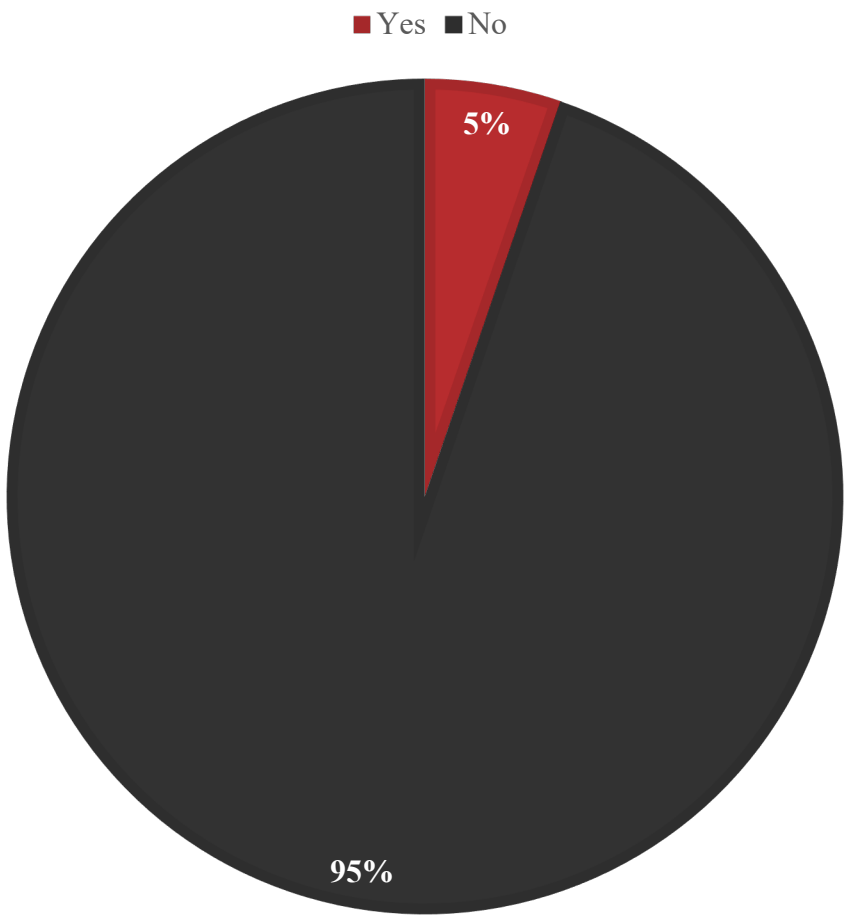




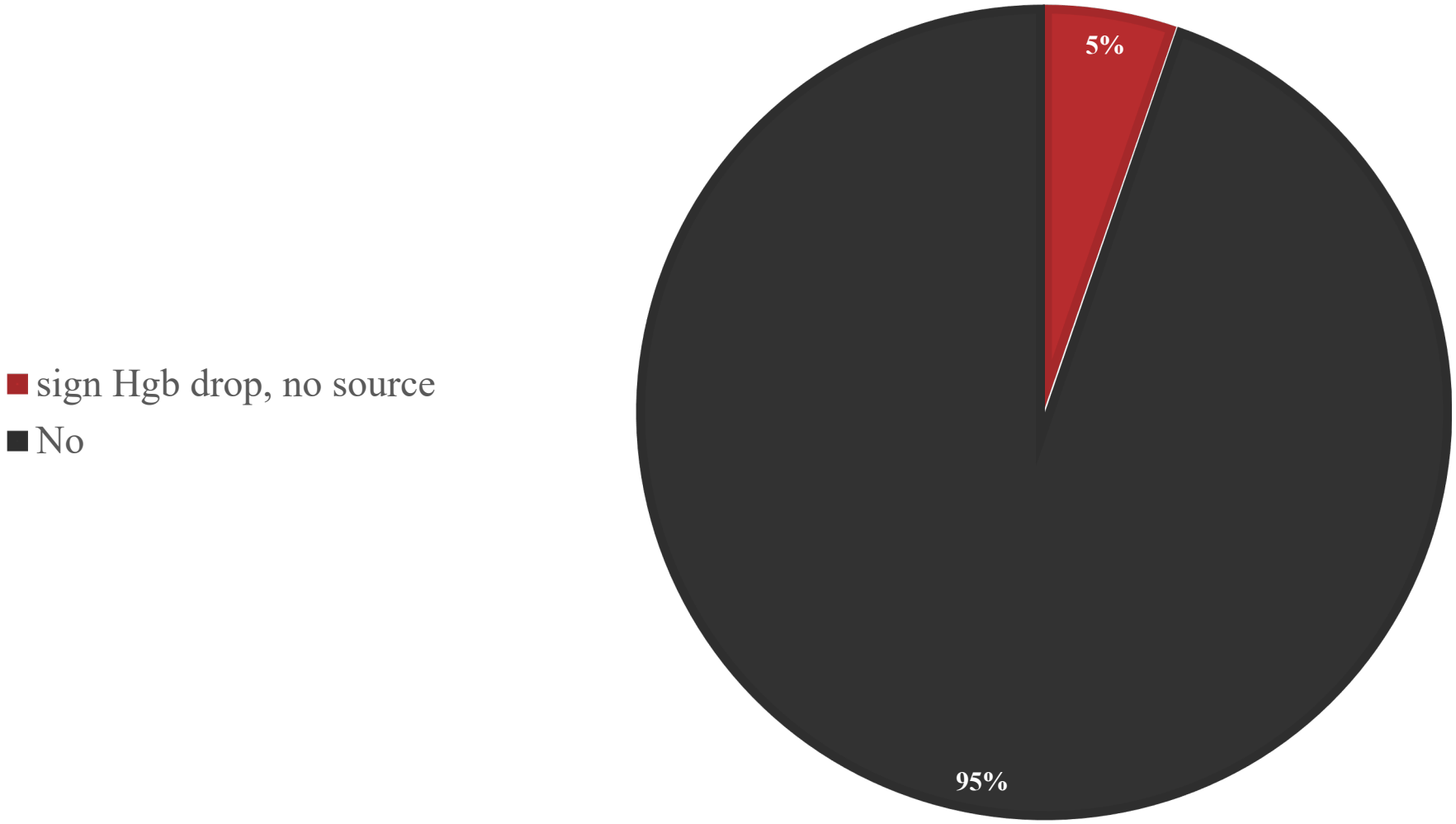
Type of anticoagulant used



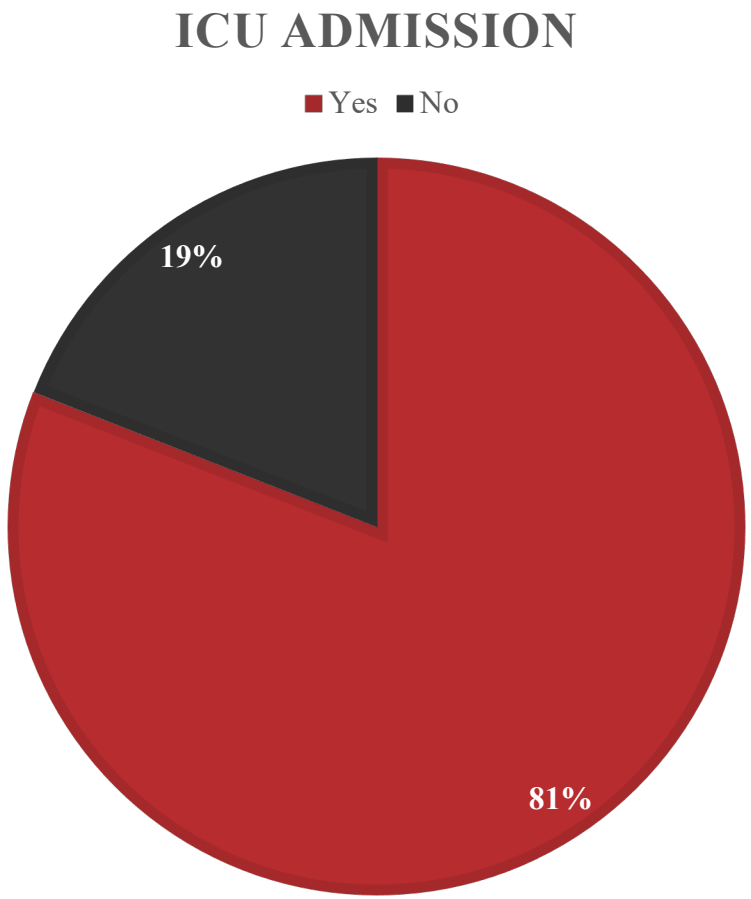
Cardiogenic Shock (cardiac index <2.2)



Bleeding Events and Source



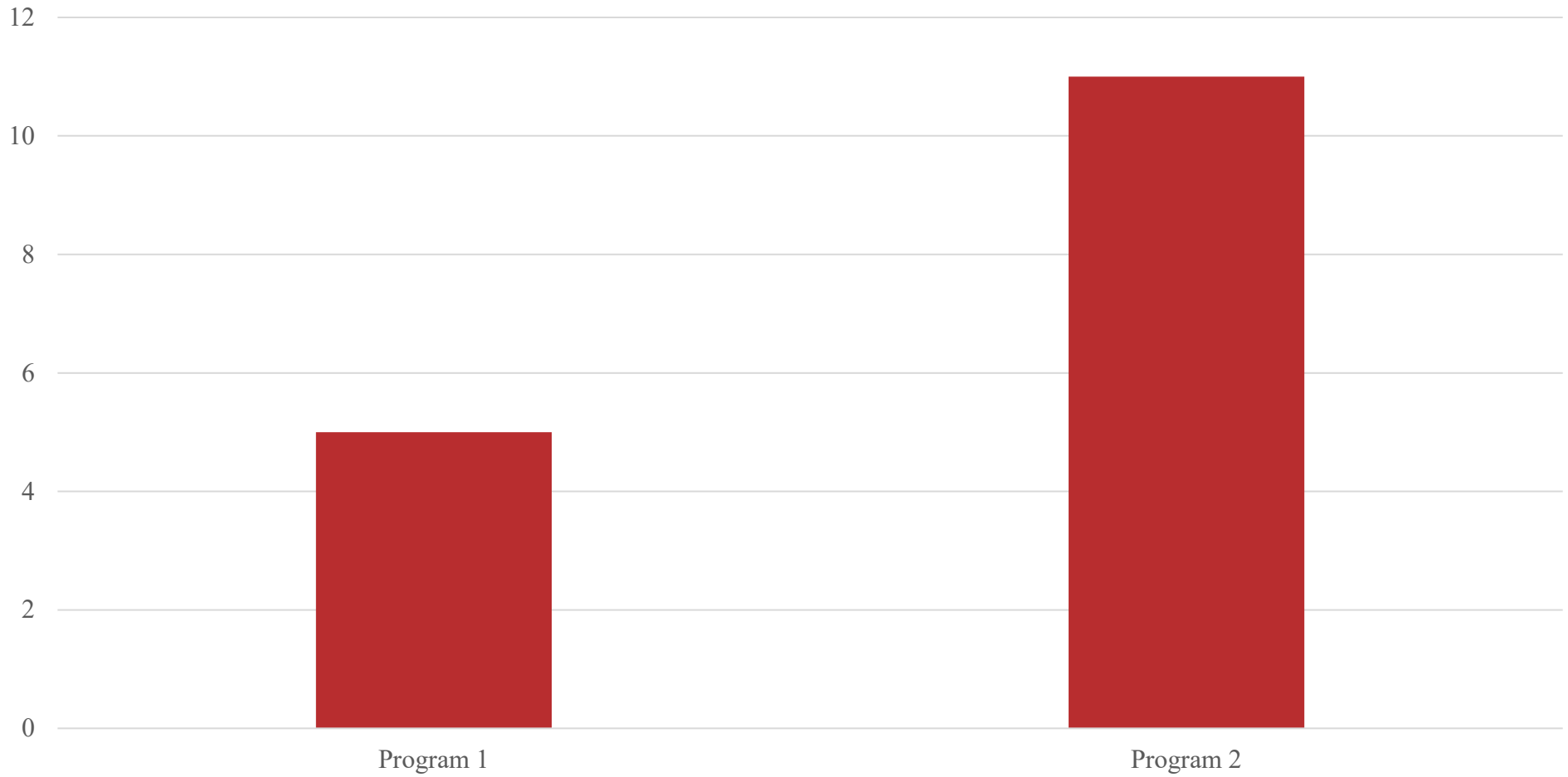
ICU Admission



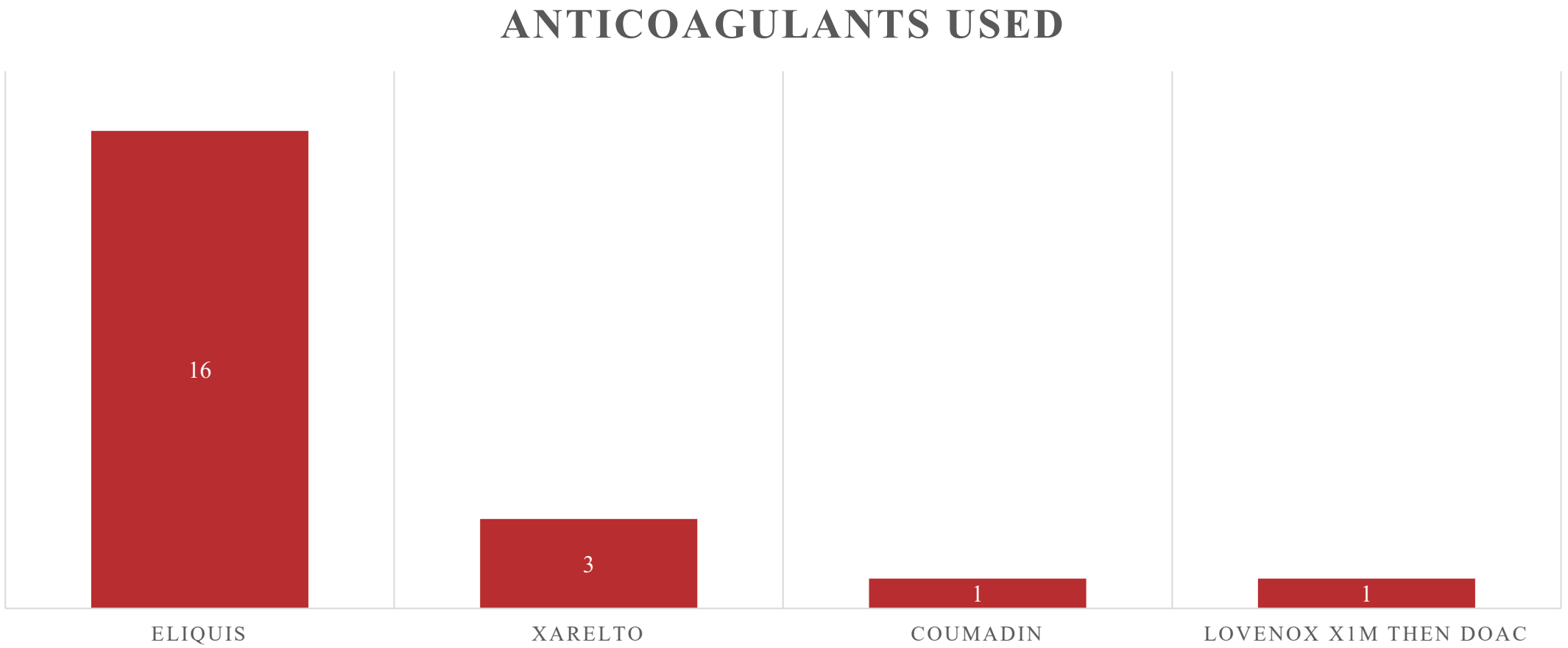
ICU LENGTH OF STAY

Statistic	Value
Mean	1.4
Min	1
Max	2
Median	1
Count	12

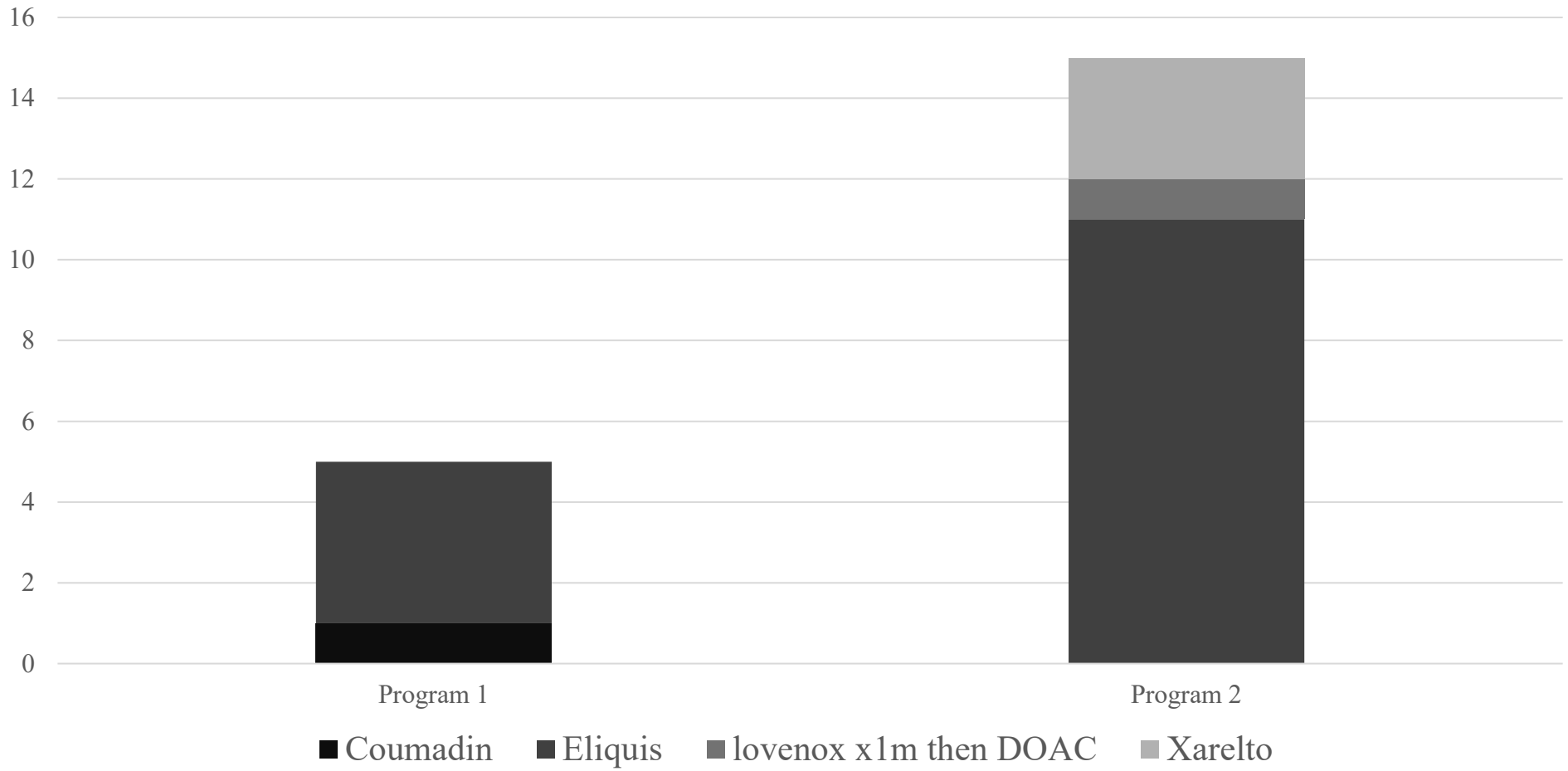
ICU Admission by Program



Post-Procedure Therapy



Post-Procedure Anticoagulant Use by Program



Thank You

info@VCSQI.org

mpkelley@carilionclinic.org

CLINICAL
WORKGROUP
RESOURCES

SCAN ME