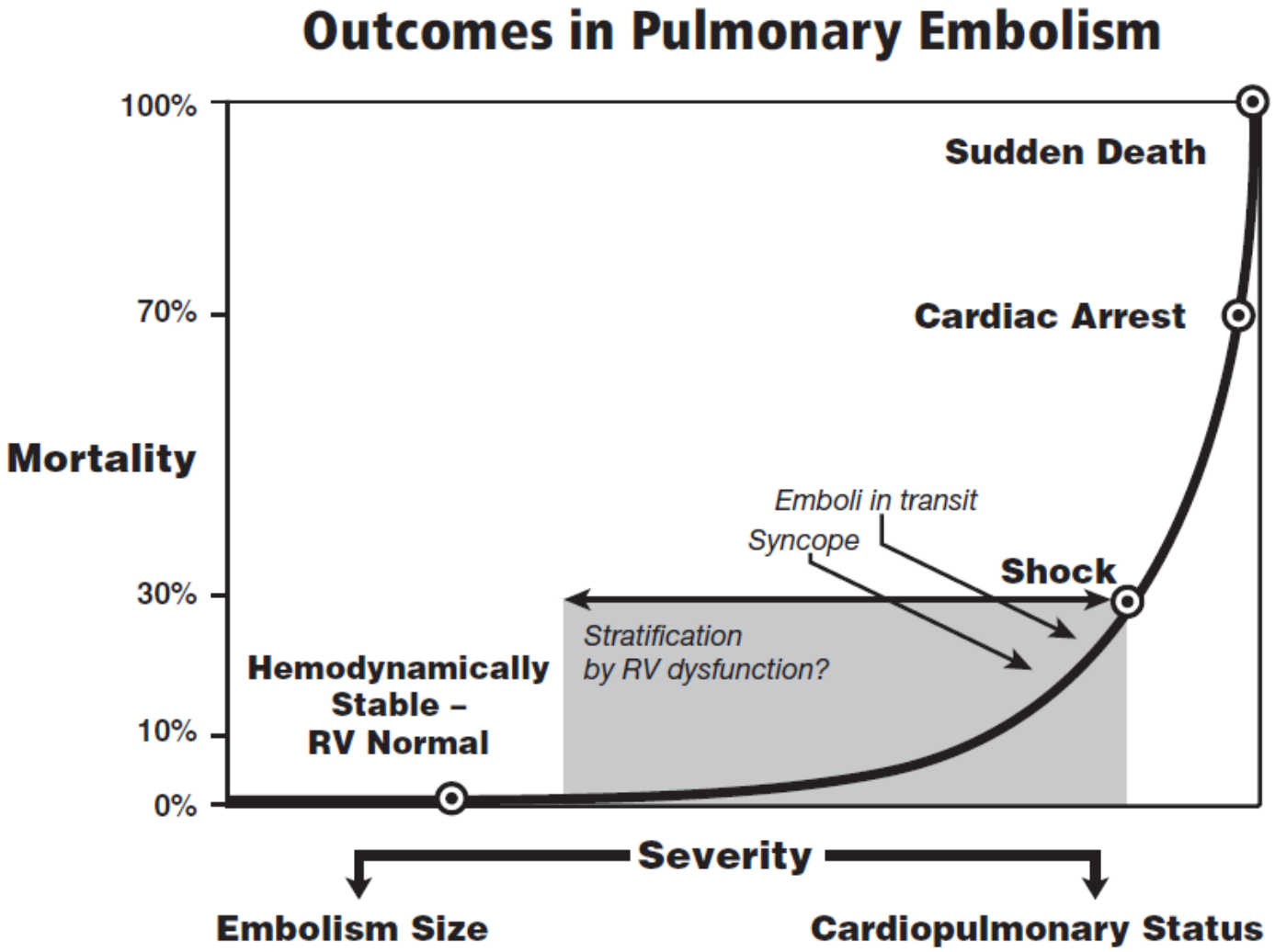
Why Risk Stratify?



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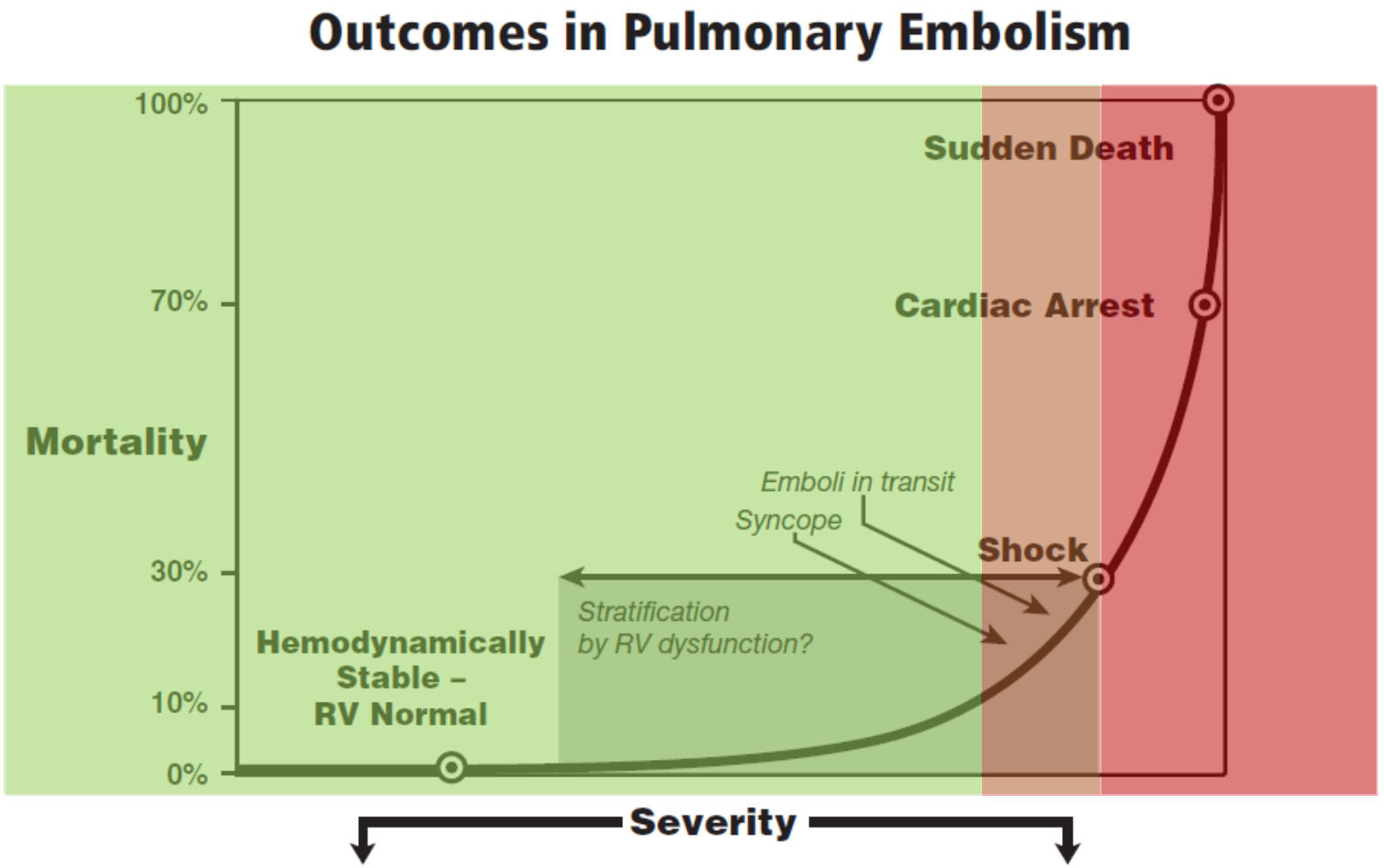
Wood KE. Major pulmonary embolism: review of a pathophysiologic approach to the golden hour of hemodynamically significant pulmonary embolism. *Chest* 2002; 121:877-905.
Modified in Wood KE. Major pulmonary embolism. *Crit Care Clin* 2011; 27:885-906.

Treatment? Not so long ago..



?

Anticoagulation **Thrombolysis/Fibrinolysis**

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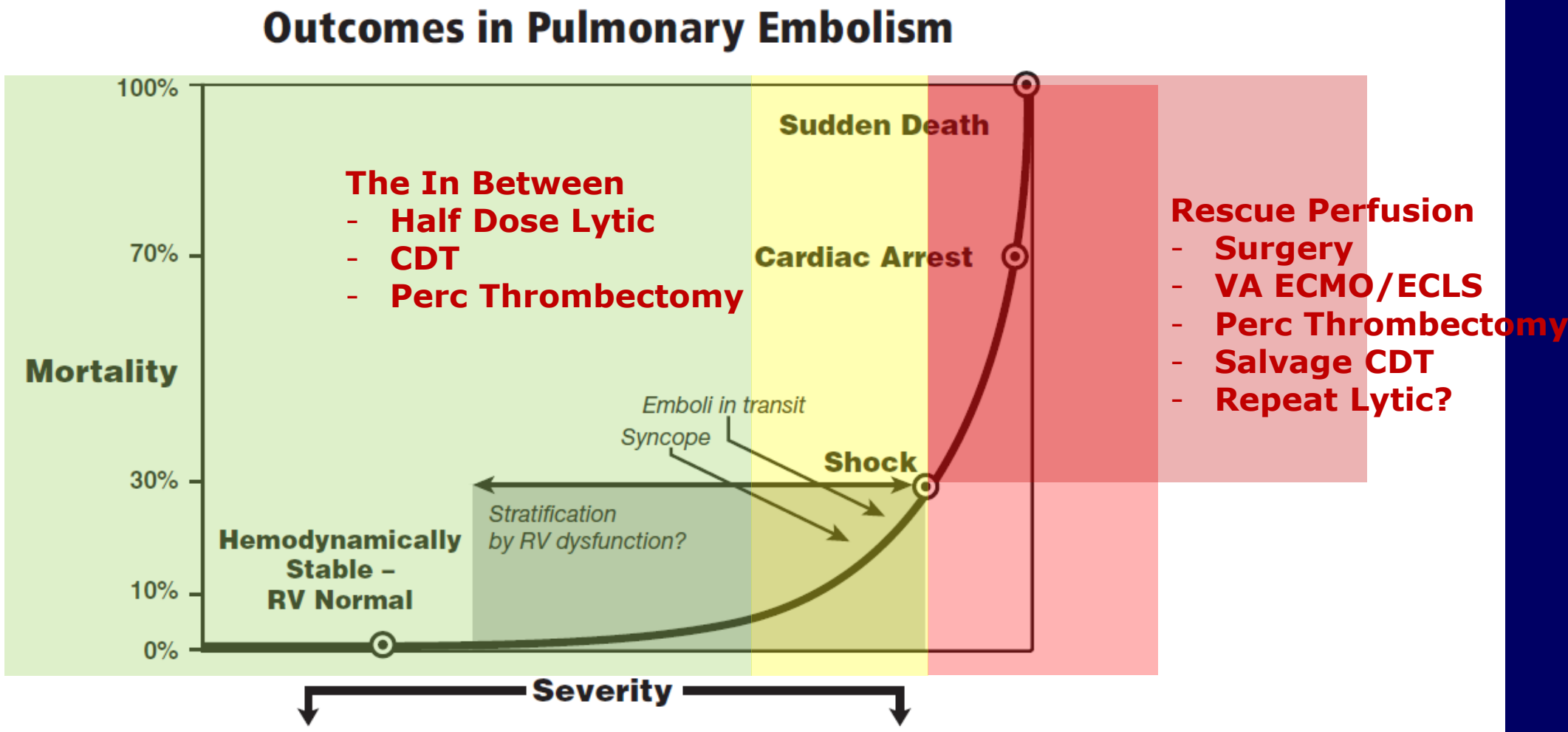
Wood KE. Major pulmonary embolism: review of a pathophysiologic approach to the golden hour of hemodynamically significant pulmonary embolism. *Chest* 2002; 121:877-905.
Modified in Wood KE. Major pulmonary embolism. *Crit Care Clin* 2011; 27:885-906.

Treatment?? More toys, more data, even more confusion



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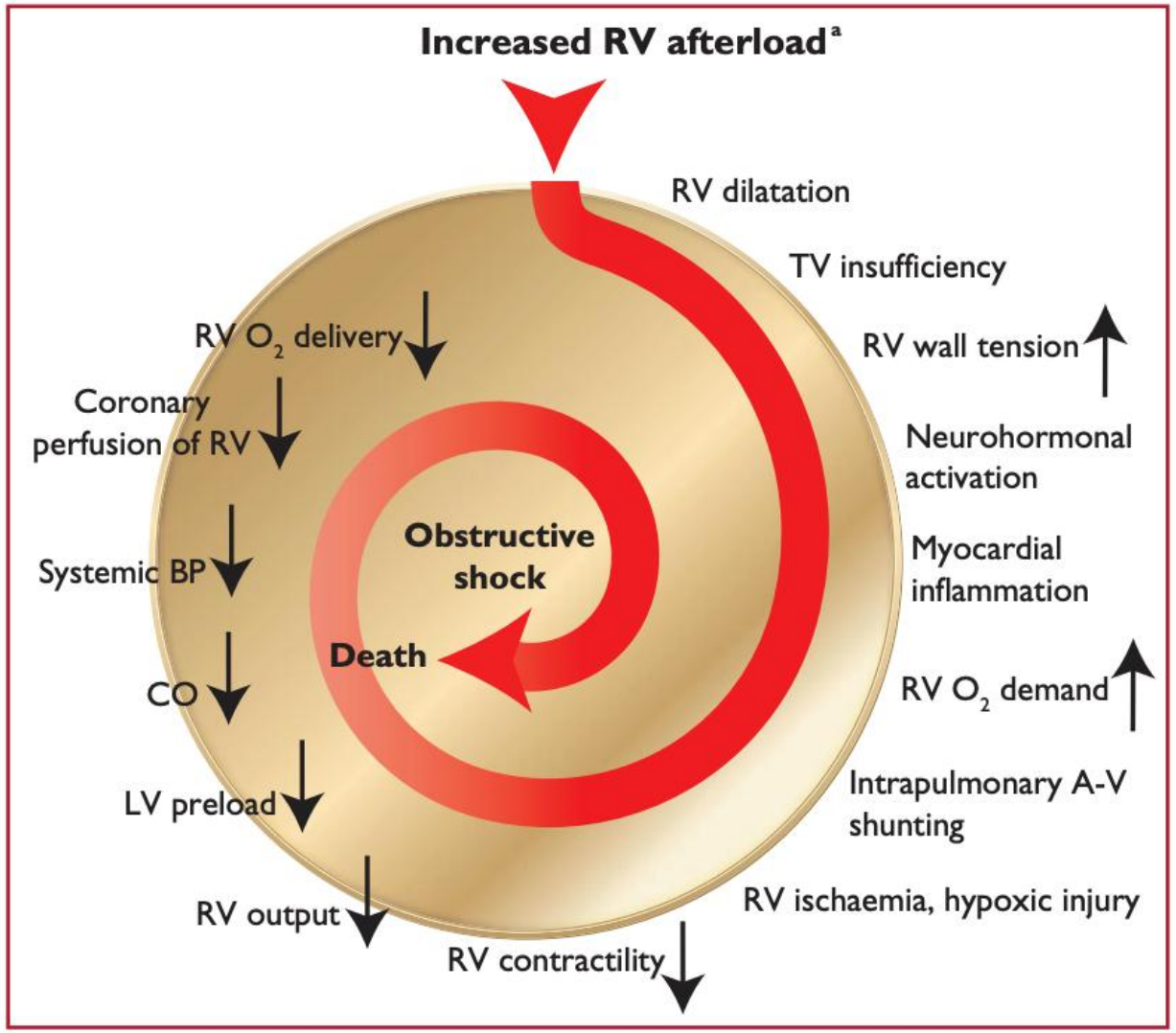
Why Does Early Death Occur?

Massive PE



Konstantinides S, Meyer G, Becattini C, et al. 2019 ESC guidelines for the diagnosis and management of acute pulmonary embolism developed in collaboration with the European Respiratory Society (ERS). *Eur Heart J* 2020; 41:543-603

Early Risk Stratification-sPESI and Hypotension

- Simplified from the Pulmonary Embolism Severity Index and validated similar outcomes
- Three Historical Variables
- Three Clinical Variables
- Score <1 predicts low risk PE with <1% 30-day mortality
- Score 1 or more with 10.9% 30-day mortality
- Hypotension with SBP <90 mmHg for >15 minutes, not attributable to sepsis or hypovolemia OR >40 mmHg decrease from baseline

Variable	Score
Age >80 years	**+1**
History of Cancer	**+1**
History of Heart Failure or Chronic Lung Disease	**+1**
Pulse > 110 beats/min	**+1**
Systolic Blood Pressure < 100 mm Hg	**+1**
Oxygen Saturation < 90%	**+1**

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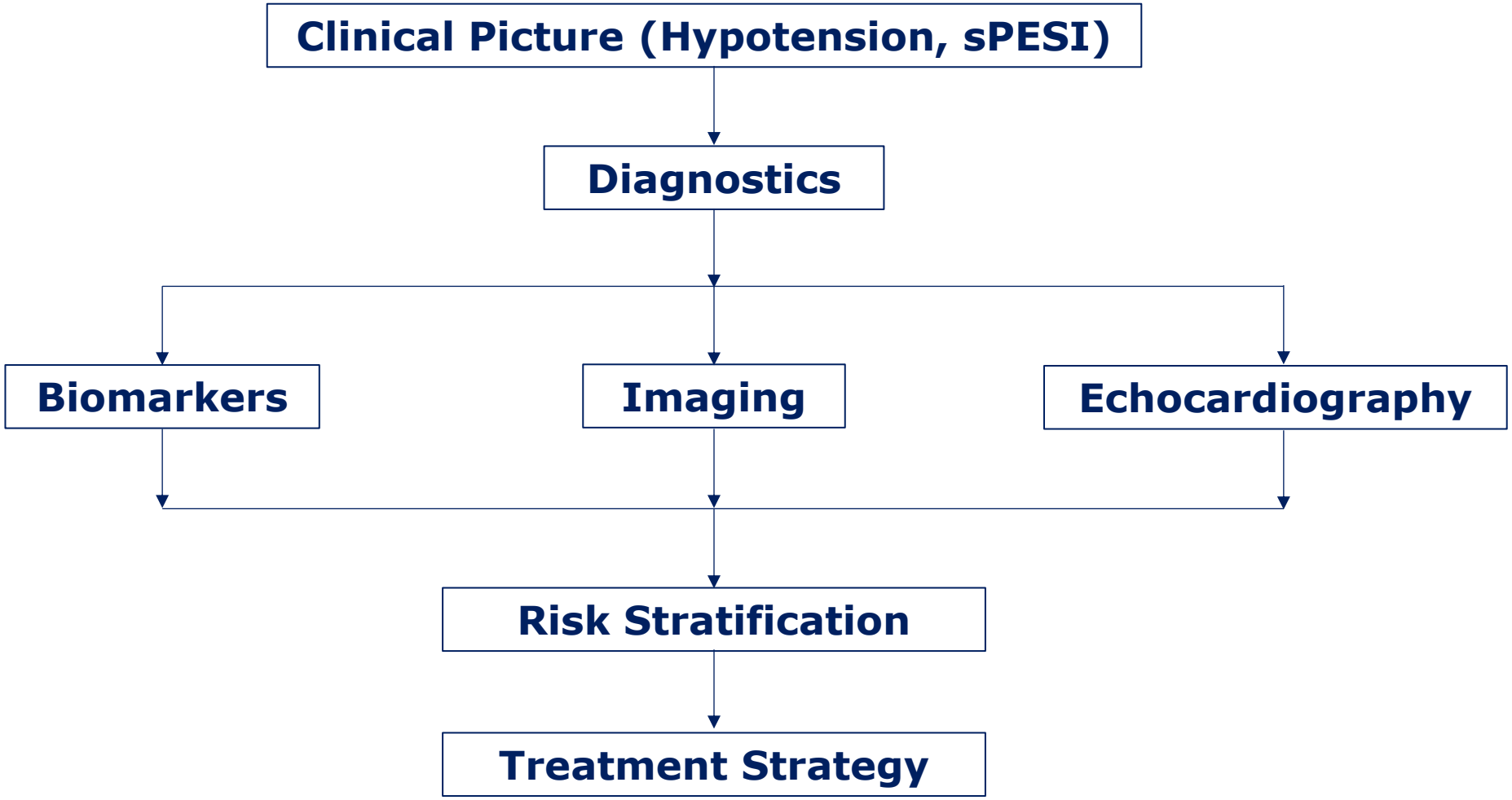
Jiminez D, Aujesky D, Moores L, et al. Simplification of the pulmonary embolism index for prognostication in patients with acute symptomatic pulmonary embolism. *Arch Intern Med* 2010; 170(15):1383-89.

Current Model for Rapid Risk Stratification



Prior Model for Rapid Risk Stratification

Early mortality risk		Indicators of risk			
		Haemodynamic instability[a]	Clinical parameters of PE severity and/or comorbidity: PESI class III–V or sPESI ≥I	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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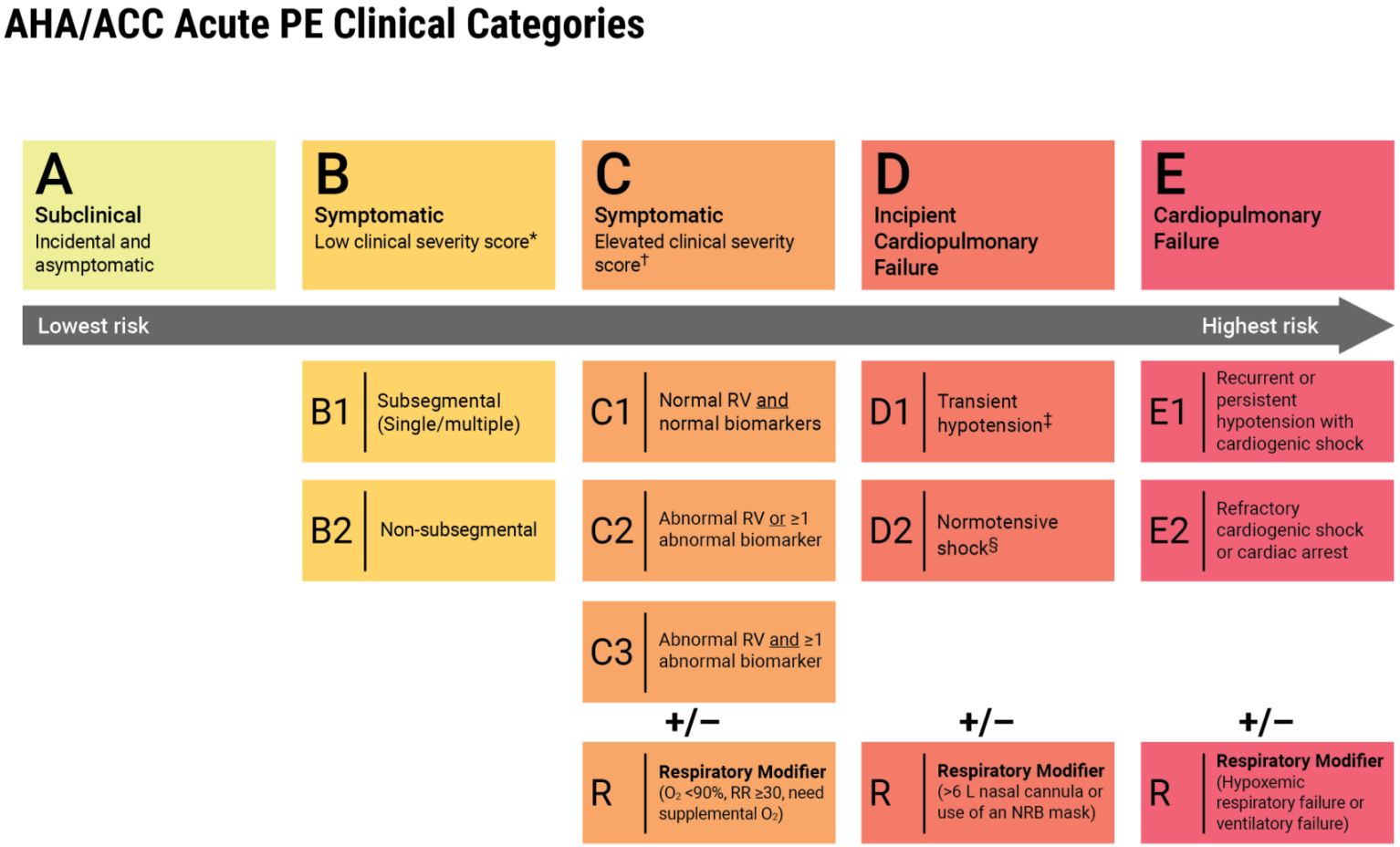
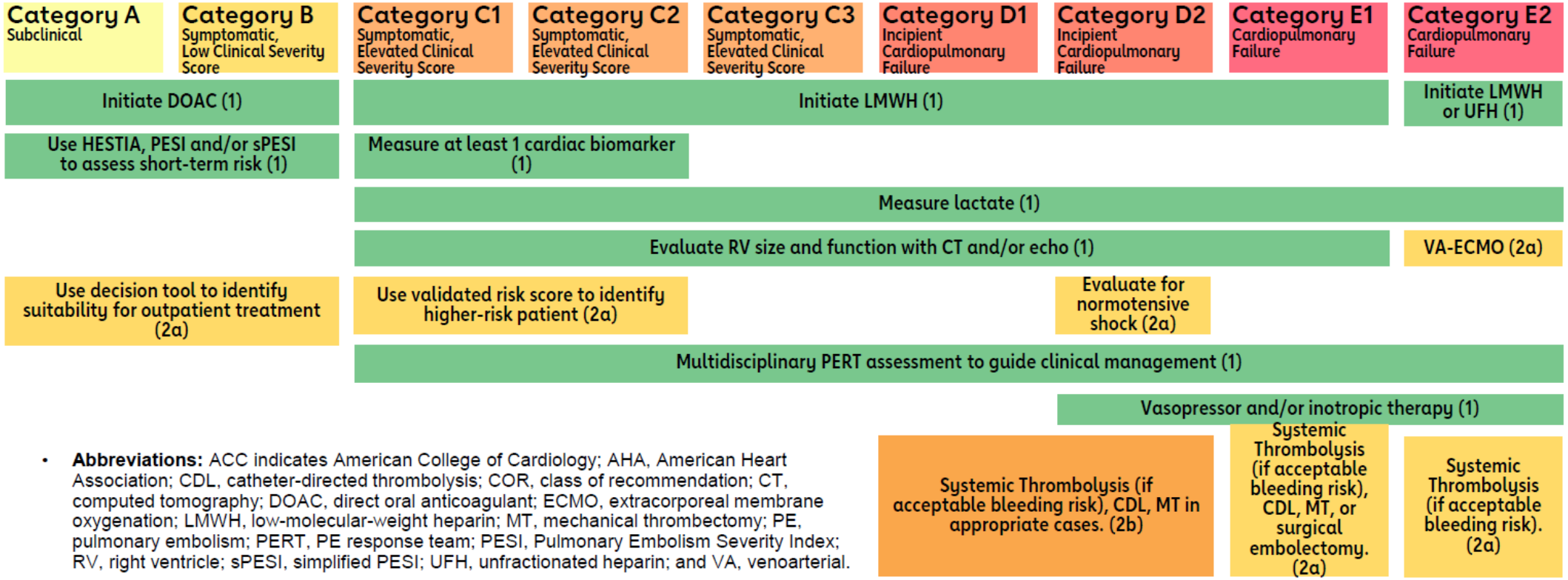
Konstantinides S, Meyer G, Becattini C, et al. 2019 ESC guidelines for the diagnosis and management of acute pulmonary embolism developed in collaboration with the European Respiratory Society (ERS). *Eur Heart J* 2020; 41:543-603

AHA/ACC Acute PE Stratification



AHA/ACC Acute PE Risk Stratification



- **Abbreviations:** ACC indicates American College of Cardiology; AHA, American Heart Association; CDL, catheter-directed thrombolysis; COR, class of recommendation; CT, computed tomography; DOAC, direct oral anticoagulant; ECMO, extracorporeal membrane oxygenation; LMWH, low-molecular-weight heparin; MT, mechanical thrombectomy; PE, pulmonary embolism; PERT, PE response team; PESI, Pulmonary Embolism Severity Index; RV, right ventricle; sPESI, simplified PESI; UFH, unfractionated heparin; and VA, venoarterial.

Early PERT process

- **PERT Activation**
- Use new note template, go live May 1, email and shared templates to follow
- .PERTACTIVATIONTEMPLATE

Pulmonary Embolism Response Team Activation

Time of PERT Activation: ***
Time of PERT Discussion: ***

Brief History:

Vitals:
@VS24HRS@

S-PESI: ***
☐ Age >80?
☐ History of Cancer?
☐ History of Chronic Cardiopulmonary Disease?
☐ Heart Rate >110?
☐ Systolic BP <100?
☐ O2 Sat <90%?

S-PESI Score >0 suggests intermediate or higher risk PE

RV Strain Assessment:

Biomarkers
@LABRCNTIP(BNPRESU:1,HSCTNI:3)@ Lactate ***

Radiography	Echocardiogram
CTPA- Clot Distribution and RV Strain Pattern (if Present), other findings *** **VQ Scan**- If Applicable	**Echo**- (RV Function, McConnell's Sign, LV Function, Clot in Transit?) *** .

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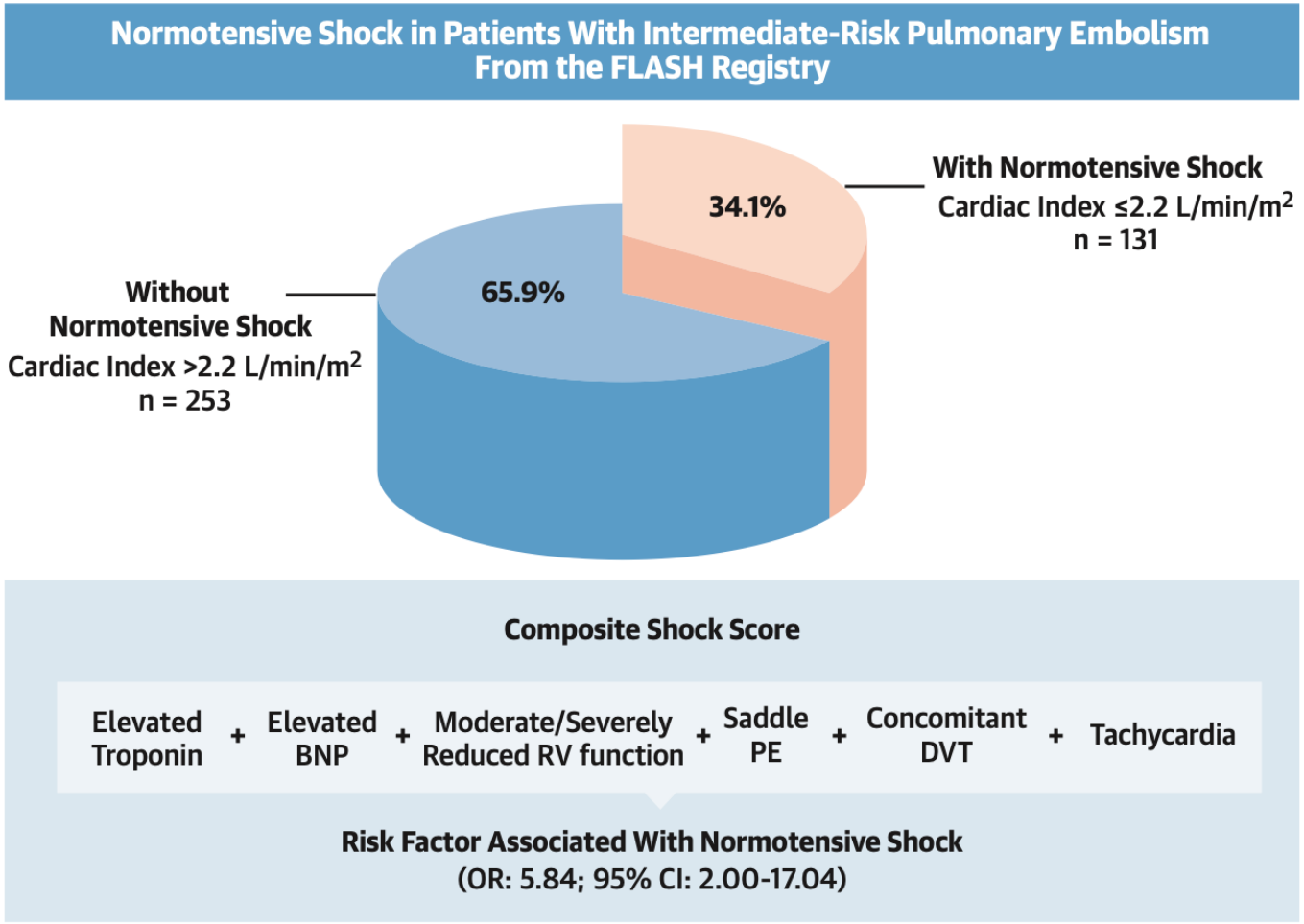
Early PERT Process

Clinical Classification and Risk Stratification:

ESC/ERS Clinical Classification	Composite PE Shock Score (For Intermediate Risk PE only)	Bleeding Risk* Click Here for PE-SARD Score
☐ Low Risk ☐ Intermediate - Low Risk ☐ Intermediate – High Risk ☐ High Risk **Risk Modifiers** ☐ Severe PH (Echo RVSP>60 mmHg) ☐ Clot-in-Transit ☐ Consideration for ECMO	☐ Highest HR Last 24 Hours > 100 BPM ☐ Troponin I > 40 ng/L ☐ BNP >100 or NTpBNP >300 pg/mL ☐ Saddle PE or PE in at least one main PA ☐ Moderate or Severe RV Dysfunction on Echocardiogram (including McConnell's Sign) ☐ Concomitant DVT **Total Score**:	☐ Low Risk ☐ Intermediate Risk ☐ High Risk *For assessment of early bleeding risk

Early PERT Process

- **CPES Score**
  - Using the FLASH Registry as a derivation cohort, factors for normotensive shock were collected into a scoring system
  - Composite Pulmonary Embolism Shock Score
    - Elevated Troponin > 0.04 ng/mL
    - Elevated BNP (>100 pg/mL) or NTpBNP (>300 pg/mL)
    - Moderate or Severe RV dysfunction on Echo
    - Saddle PE or PE in at least one main PA
    - Concomitant DVT
    - Tachycardia >100 BPM



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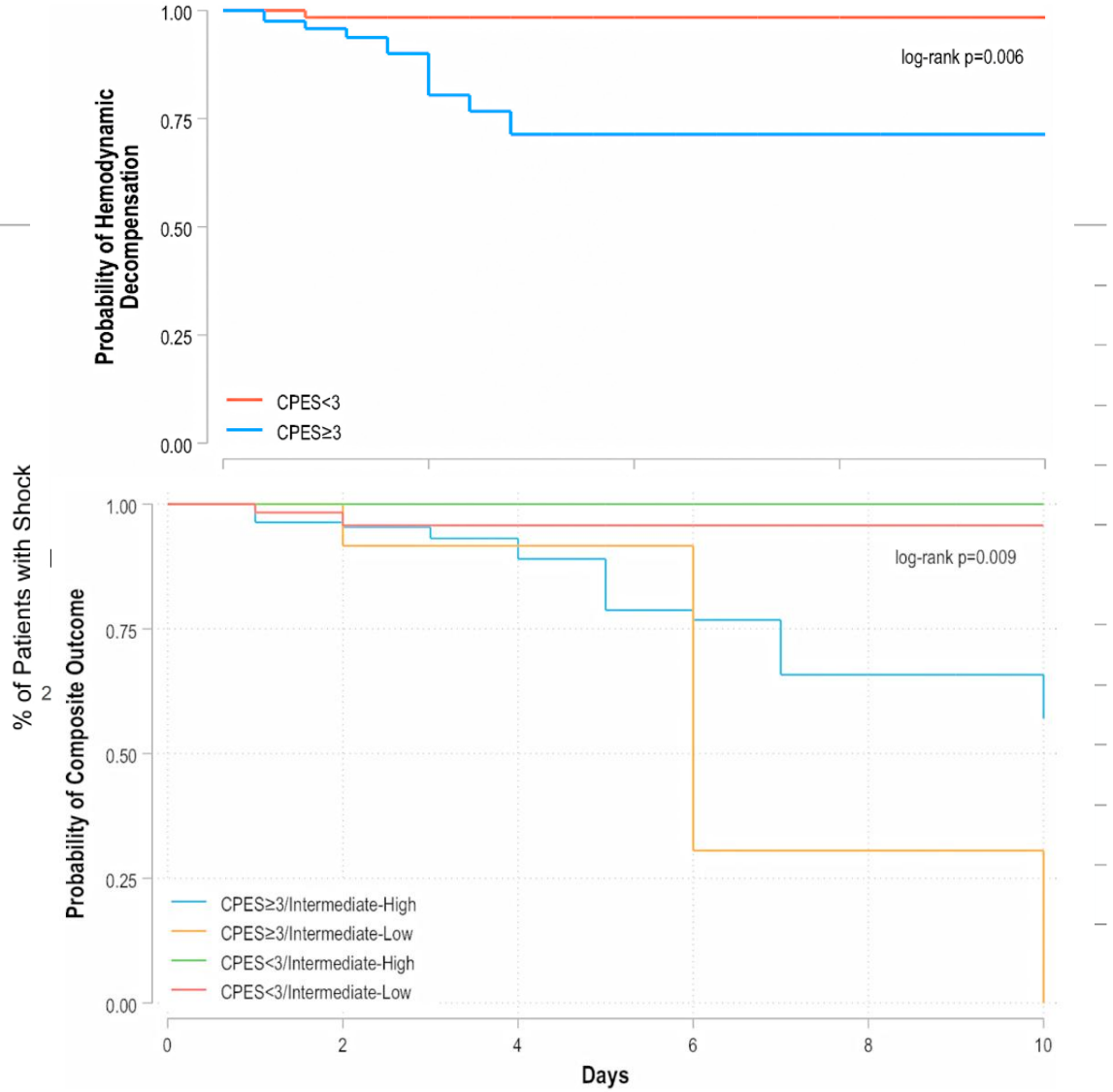
Bangalore S, Horowitz JM, Beam D, et al. Prealence and predictors of cardiogenic shock in intermediate-risk pulmonary embolism. Insights from the FLASH registry. *JACC Cardiovasc Interv* 2023; 16(8):958-972

Early PERT Process

- **CPES Score**
- Derivation Cohort (FLASH Registry)
  - CPES 6 with high probability of normotensive shock
- Validation Cohort
  - For risk of hemodynamic deterioration, cardiac arrest and in-hospital death
  - CPES 3 or greater discriminates outcomes across both Intermediate Risk strata



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Zhang RS, Yuriditski E, Zhang P, et al. Composite pulmonary embolism score and risk of adverse outcomes in patients with pulmonary embolism. *Circ Cardiovasc Interv* 2024; 17:690-699

Early PERT Process

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Treatment Candidacy:

Anticoagulation	Systemic Thrombolysis	Catheter Directed Therapy	Surgical Embolectomy
☐ IV Unfractionated Heparin ☐ Low Molecular Weight Heparin ☐ Unable to anticoagulate (consider IVC filter placement)	**{systemic thrombolysis:50640}**	{Catheter Directed Therapy:50636}	☐ Yes ☐ No ☐ N/A

Contraindications to Thrombolysis:

☐ Absolute: {Absolute Thrombolytic Contraindications:50637}
☐ Relative: {Relative Thrombolytic Contraindications:50639}

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Early PERT Process

Treatment Recommendations Summary:
Multidisciplinary Team Members in PERT discussion:

****Note to author- Please erase upon note completion*
For Low Risk PE, Pulmonary Hypertension consultation is not needed unless additional decision support for IVC filter requested
For Intermediate low risk PE- Please add to the PH consult list for surveillance of early hospital course
For Intermediate high risk PE- Please add to PH consult list and recommend formal PH consult, the case should be discussed with PERT 2 staff if CPES >3 or O2 needs >6L
For High Risk PE- Please add to PH consult list and recommend formal PH consult , the case should be discussed with PERT 2 staff

Most Intermediate Low Risk PE can be admitted to GPU unless other cardiac indications for telemetry
High intermediate risk patient May need ICU or telemetry at provider discretion based on O2 needs or CPES 5-6

Please notify on-call PERT staff with any changes in clinical findings or questions,

@ME@
@TD@ @NOW@
