LIV Jornadas SOLACI
Ciudad de Panamá

EMBOLIA PULMONAR
FACTORES DE RIESGO Y DIAGNÓSTICO

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CLINICAL PRACTICE GUIDELINES

2026 AHA/ACC/ACCP/ACEP/CHEST/SCAI/SHM/SIR/SVM/SVN Guideline for the Evaluation and Management of Acute Pulmonary Embolism in Adults: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

Developed in Collaboration With and Endorsed by the American College of Clinical Pharmacy, American College of Emergency Physicians, American College of Chest Physicians, Society for Cardiovascular Angiography & Interventions, Society of Hospital Medicine, Society of Interventional Radiology, Society for Vascular Medicine, and the Society of Vascular Nursing

Table 1. AHA and ACC Associated Publications

Title	Organization	Publication Year (Reference)
Guidelines		
Evaluation and diagnosis of chest pain	AHA/ACC/ASE/ CHEST/SAEM/ SCCT/SCMR	2021[1]
Other Relevant Documents		
Management of massive and submassive PE	AHA	2011[2]
Interventional therapies for acute PE	AHA	2019[3]
Expert consensus statement on anticoagulant and antiplatelet therapy for Afib/VTE	ACC	2020[4]
Surgical therapy and MCS for acute PE	AHA	2023[5]
Balloon pulmonary angioplasty for CTEPH & CTEPD	AHA	2024[6]

ACC indicates American College of Cardiology; Afib, atrial fibrillation; AHA, American Heart Association; ASE, American Society of Echocardiography; CHEST, American College of Chest Physicians; CTEPD, chronic thromboembolic pulmonary disease; CTEPH, chronic thromboembolic pulmonary hypertension; MCS, mechanical circulatory support; PE, pulmonary embolism; SAEM, Society for Academic Emergency Medicine; SCCT, Society of Cardiovascular Computed Tomography; SCMR, Society for Cardiovascular Magnetic Resonance; and VTE, venous thromboembolism.

- El Objetivo de la guía:
  - Dirigida a la evaluación y manejo del TEP en adultos mayores de 18 años.
  - Se introduce un Sistema de Clasificación Clínica del TEP agudo.
  - El Sistema trata de clasificar la severidad, evaluar el pronóstico y permitir que las decisiones terapéuticas mas eficientes basadas en evidencia puedan ser tomadas por el médico tratante.

- "LAS GUÍAS ESTÁN DISEÑADAS PARA DEFINIR LAS PRÁCTICAS QUE RESPONDAN A LAS NECESIDADES DE LOS PACIENTES EN LA MAYORÍA DE LAS CIRCUNSTANCIAS, PERO NO EN TODAS, POR LO QUE NO DEBEN REEMPLAZAR EL JUICIO CLÍNICO"

EVALUACIÓN Y DIAGNÓSTICO

- El diagnóstico oportuno y temprano del TEP depende de que podamos reconocer los factores de riesgo predisponentes a TVP.
- La Hx clínica al igual que el Ex Físico nos dan la clave muchas veces del diagnóstico.
- Los laboratorios y las imágenes nos apoyan en el diagnóstico y permiten evaluar la severidad e intentar dilucidar el pronóstico.

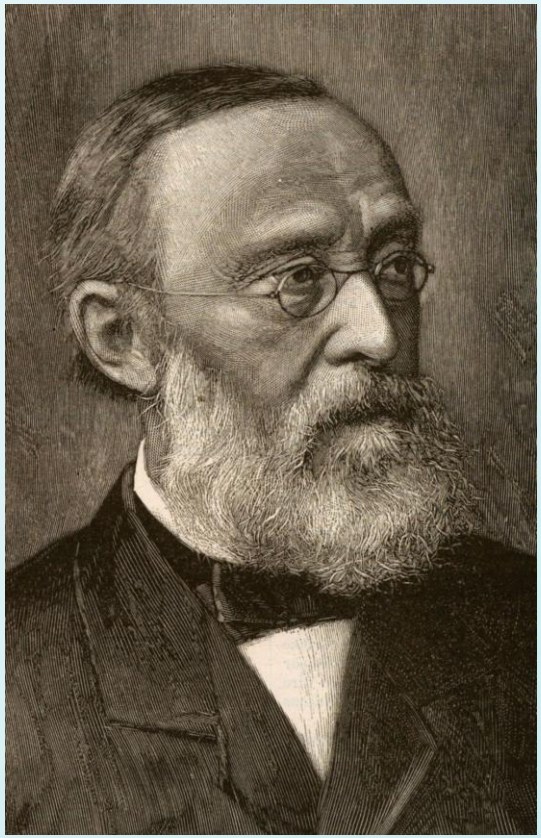
- Factores de Riesgo:
  - Cirugía reciente.
  - Hospitalización por tratamiento médico.
  - Inmovilidad.
  - Embarazo.
  - Uso de estrógenos.
  - Trauma.
  - Cáncer.
  - Trastornos inflamatorios.
  - Trombofilias congénitas o adquiridas.
  - Enfermedad aterosclerótica.
  - Enfermedad pulmonar.
  - Enfermedad venosa crónica.
  - Terapia hormonal.

RECORDAR LA TRIADA DE VIRCHOW

COMPONENTES

- Lesión endotelial (daño en la pared del vaso)
- Estasis venosa (flujo sanguíneo anormal).
- Hipercoagulabilidad.

RUDOLF VIRCHOW



EVALUACIÓN Y DIAGNÓSTICO

- Síntomas más comunes:
  - Dolor pleurítico y disnea.
- Los signos pueden ser:
  - Hemoptisis.
  - Síncope.
  - Hipotensión y choque.
  - Taquicardia.
  - Taquipnea.
  - Hipoxemia.
  - Disminución de los ruidos pulmonares.
  - Frote pleural.
  - Ingurgitación yugular.
  - S2 aumentado.
  - Edema de miembros inferiores con dolor sugestivo de TVP.

- El curso de pensamiento debe ser:
  - Historia clínica.
  - Examen físico.
  - Utilizar algún Sistema de Puntaje (Score) que nos evalúe la probabilidad Pretest de TEP. Estos pueden ser:

Table 3. Clinical Decision Rules

Clinical Pretest Probability Score	Components	Points		Clinical Pretest Probability Grouping and Utilization
Wells Score for PE[28]	Clinical symptoms of DVT (leg swelling, pain with palpitation)	3		**Standard Wells Scoring:** Low: <2 Moderate: 2-6 High: >6 **Modified Wells Scoring:** PE likely: >4 PE unlikely: ≤4
	PE more likely than other diagnoses	3		
	Heart rate >100 bpm	1.5		
	Immobilization (≥3 days) or surgery in the previous 4 weeks	1.5		
	Previous DVT or PE	1.5		
	Hemoptysis	1		
	Cancer	1		
PE Rule Out Criteria[21]	Age <50 years			Assess if clinical pretest probability (gestalt) of PE is <15% (eg, Wells <2) When all criteria are met, the likelihood of PE is low and no further testing is required.
	Heart rate <100 bpm			
	Oxyhemoglobin saturation ≥95%			
	No hemoptysis			
	No estrogen use			
	No prior DVT or PE			
	No unilateral leg swelling			
	No surgery/trauma requiring hospitalization within the prior 4 weeks			
		Revised Geneva Score	Simplified Revised Geneva Score	
Revised Geneva Score[29,30]	Age >65	1	1	**Revised Geneva:** Low: 0-3 Intermediate: 4-10 High: ≥11 **Simplified Revised Geneva:** Low: 0-1 Intermediate: 2-4 High: 5-7 Unlikely: 0-2 Likely: 3-7
	Previous DVT or PE	3	1	
	Surgery under general anesthesia or fracture of the lower limbs within 1 months	2	1	
	Active cancers	2	1	
	Unilateral lower-limb pain	3	1	
	Hemoptysis	2	1	
	Heart rate 75-94 bpm	3	1	
	Heart rate ≥95 bpm	5	1	
	Pain on lower limb deep vein palpation and unilateral edema	4	1	

DVT indicates deep vein thrombosis; and PE, pulmonary embolism. Adapted with permission from Klok et al.[30] Copyright 2008 American Medical Association. All rights reserved, including those for text and data mining, AI training, and similar technologies. Additional material adapted with permission from Le Gal et al. and from *Annals of Internal Medicine*.[29] Copyright 2006 American College of Physicians. All Rights Reserved. Reprinted with the permission of American College of Physicians, Inc.

- La posibilidad de un TEP es baja si cumple todos estos 3 criterios:
  - Dímero D no excede los límites normales.
  - Probabilidad pretest baja a intermedia.
  - No estaba anticoagulado basalmente.

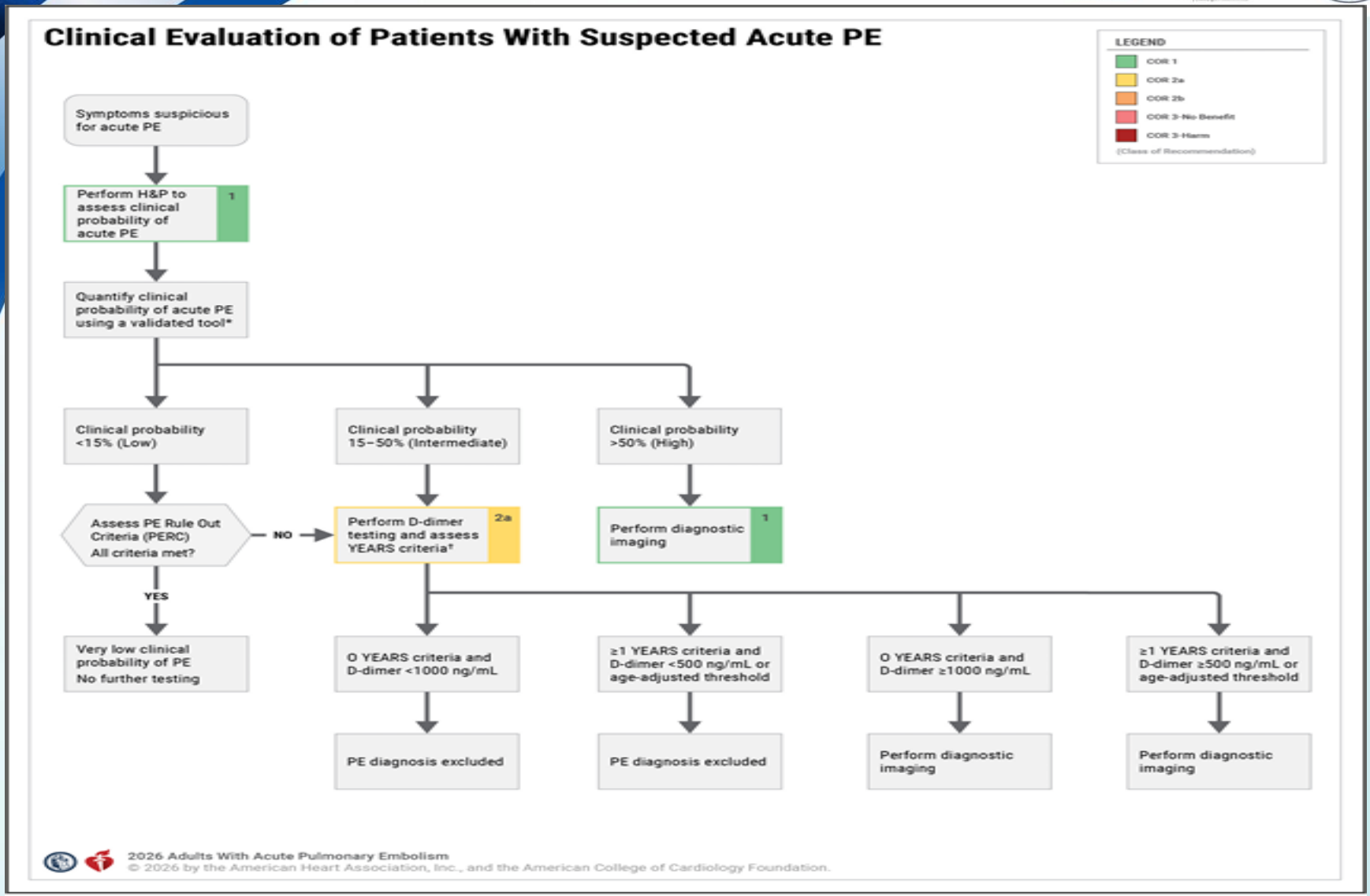


Figure 1. Clinical Evaluation of Patients With Suspected Acute PE.
*Indicates validated tools such as the Wells score, revised Geneva score, or clinical gestalt. †YEARS criteria include clinical signs of DVT, hemoptysis, or PE is the most likely diagnosis. Use of an age-adjusted D-dimer is an alternative to the use of the YEARS criteria. For pregnant patients, the pregnancy-adapted YEARS criteria should be used. DVT indicates deep vein thrombosis; and PE, pulmonary embolism.

CRITERIOS PERC

PE Rule Out Criteria[21]	Age <50 years			Assess if clinical pretest probability (gestalt) of PE is <15% (eg, Wells <2) When all criteria are met, the likelihood of PE is low and no further testing is required.
	Heart rate <100 bpm			
	Oxyhemoglobin saturation ≥95%			
	No hemoptysis			
	No estrogen use			
	No prior DVT or PE			
	No unilateral leg swelling			
	No surgery/trauma requiring hospitalization within the prior 4 weeks			

CRITERIOS YEARS

- Signos clínicos de TVP.
- Hemoptisis.
- TEP como el diagnóstico más posible.
  - Válido solo en no anticoagulados.
  - YEARS modificado para embarazo incluye un estudio de USG positivo para compresión de Minf.

- MODALIDADES DE IMÁGENES DIAGNÓSTICAS:
  - Angiotomografía del Tórax.
  - Centelleo de ventilación/perfusión con SPECT.
  - RMN.
  - Es de anotar que el ecocardiograma no debe ser usado para diagnóstico. Su valor está en la evaluación de la función del VD.
  - El USG Doppler venoso para diagnosticar TVP. (está presente entre el 44-71% de los casos de TEP diagnosticados y confirmados.

Table 4. Optimal Methods of RV Dysfunction Assessment on Echocardiogram[44]

	Recommended Technique for Assessment	Definition of Parameter
RV dimension	1) End-diastole from a right ventricle-focused apical 4-chamber view 2) Apical 4-chamber view	1) EDD >30 mm[21,37,42,51] 2) RV basal EDD >42 mm[44,51]
RV/LV	End-diastolic ratio (apical or subcostal view)	RV/LV >0.9[37,42,51]
TAPSE[42]	Measures the distance of systolic excursion of the RV annular segment in cm, on M-mode, along a longitudinal plane, from a standard apical 4-chamber view from end-diastole to end-systole	TAPSE <1.6 cm is abnormal[43,44,51]
Doppler evidence of pulmonary hypertension	Tissue Doppler imaging	Pulmonary acceleration time <90 ms, or the presence of an RV/atrial gradient >30 mm Hg[31,51]
Tricuspid systolic velocity	Apical or subcostal 4-chamber view	Tricuspid systolic velocity >2.6 m/sec[31,51]

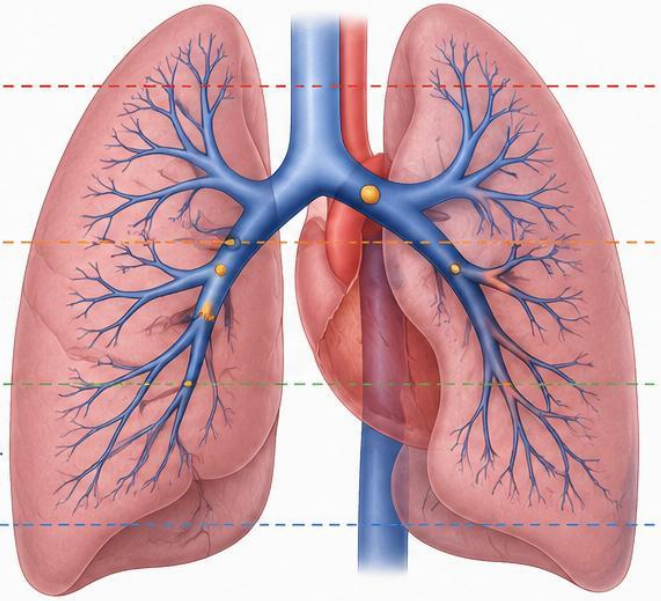
EDD indicates end-diastolic diameter; LV, left ventricle; RV, right ventricle; and TAPSE, tricuspid annular plane systolic excursion.

- CRITERIOS RADIOGRÁFICOS DE ENFERMEDAD PULMONAR TROMBOEMBÓLICA CRÓNICA:
  - Redes intravasculares.
  - Retracción o dilatación de la arteria pulmonar.
  - Dilatación de las arterias bronquiales.
  - Hipertrofia de VD.
  - Aplanamiento septal intraventricular.

¿Qué ubicación anatómica se usa cuando se informa una embolia pulmonar en la angiotomografía de tórax?

Sistema de ubicación: Árbol arterial pulmonar

La embolia pulmonar se localiza según el nivel del árbol arterial pulmonar en el que se encuentra el trombo.

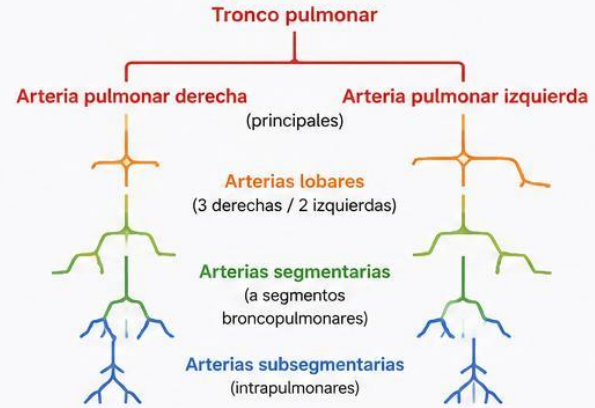


1. **Tronco pulmonar o arterias principales (interlobares)**
   Antes de la división derecha e izquierda.
2. **Arterias lobares**
   Ramas que irrigan cada lóbulo.
3. **Arterias segmentarias**
   Ramas que irrigan segmentos broncopulmonares.
4. **Arterias subsegmentarias**
   Ramas más distales dentro de cada segmento.

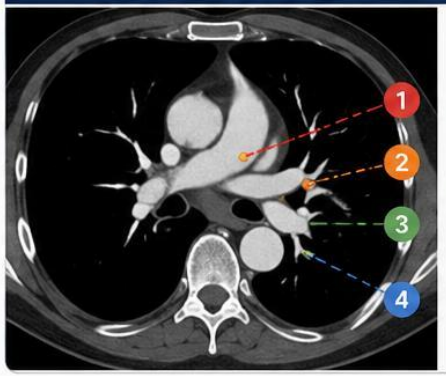
Para informar:

- Especifique el nivel más proximal del trombo (el más importante).
- Puede agregar extensión a ramas más distales si está presente.
- **Ejemplo:** *"Embolia pulmonar en arteria lobar inferior derecha y ramas segmentarias basales posteriores."*

Esquema del árbol arterial pulmonar



Ejemplo en angiotomografía (Corte axial)



Correspondencia en la TAC

1. Tronco pulmonar o arterias principales
2. Arterias lobares
3. Arterias segmentarias
4. Arterias subsegmentarias

Importante: Usar siempre la nomenclatura anatómica del árbol arterial pulmonar para una comunicación clara y estandarizada.

ESTRATIFICACIÓN DE RIESGO

Table 5. Progression of Acute PE Risk Categorization Schemas

Year	Organization	Risk Category	Clinical Criteria
2011	AHA Scientific Statement[1]	Low risk	Normotensive; no right ventricular dysfunction or myocardial necrosis (elevated troponin)
		Submassive	Systolic BP ≥90 mm Hg and either right ventricular dysfunction or myocardial necrosis
		Massive	Systolic blood pressure <90 mm Hg for >15 minutes or requiring inotropic support
2019	ESC Acute Pulmonary Embolism Risk Scheme[2]	Low risk	Nonelevated risk score (eg, PESI class I-II or sPESI=0) Normal right ventricle on imaging
		Intermediate-low risk	Elevated risk score (eg, PESI class III-IV or sPESI ≥1) None or 1 positive of either troponin or right ventricular dysfunction on imaging
		Intermediate-high risk	Elevated risk score (eg, PESI class III-IV or sPESI ≥1) Both positive troponin and right ventricular dysfunction on imaging
		High risk	Hemodynamic instability
2026	AHA/ACC Acute PE Clinical Categories	A	Subclinical – incidental and asymptomatic PE
		B	Symptomatic PE with low clinical severity score (eg, PESI class I-II, sPESI=0, Hestia=0)
		C	Symptomatic PE with elevated clinical severity score (eg, PESI class III-V, sPESI ≥1, Hestia ≥1)
		D	Incipient cardiopulmonary failure (eg, normotensive shock)
		E	Cardiopulmonary failure

ACC indicates American College of Cardiology; AHA, American Heart Association; BP, blood pressure; ESC, European Society of Cardiology; PESI, Pulmonary Embolism Severity Index; and sPESI, simplified Pulmonary Embolism Severity Index.

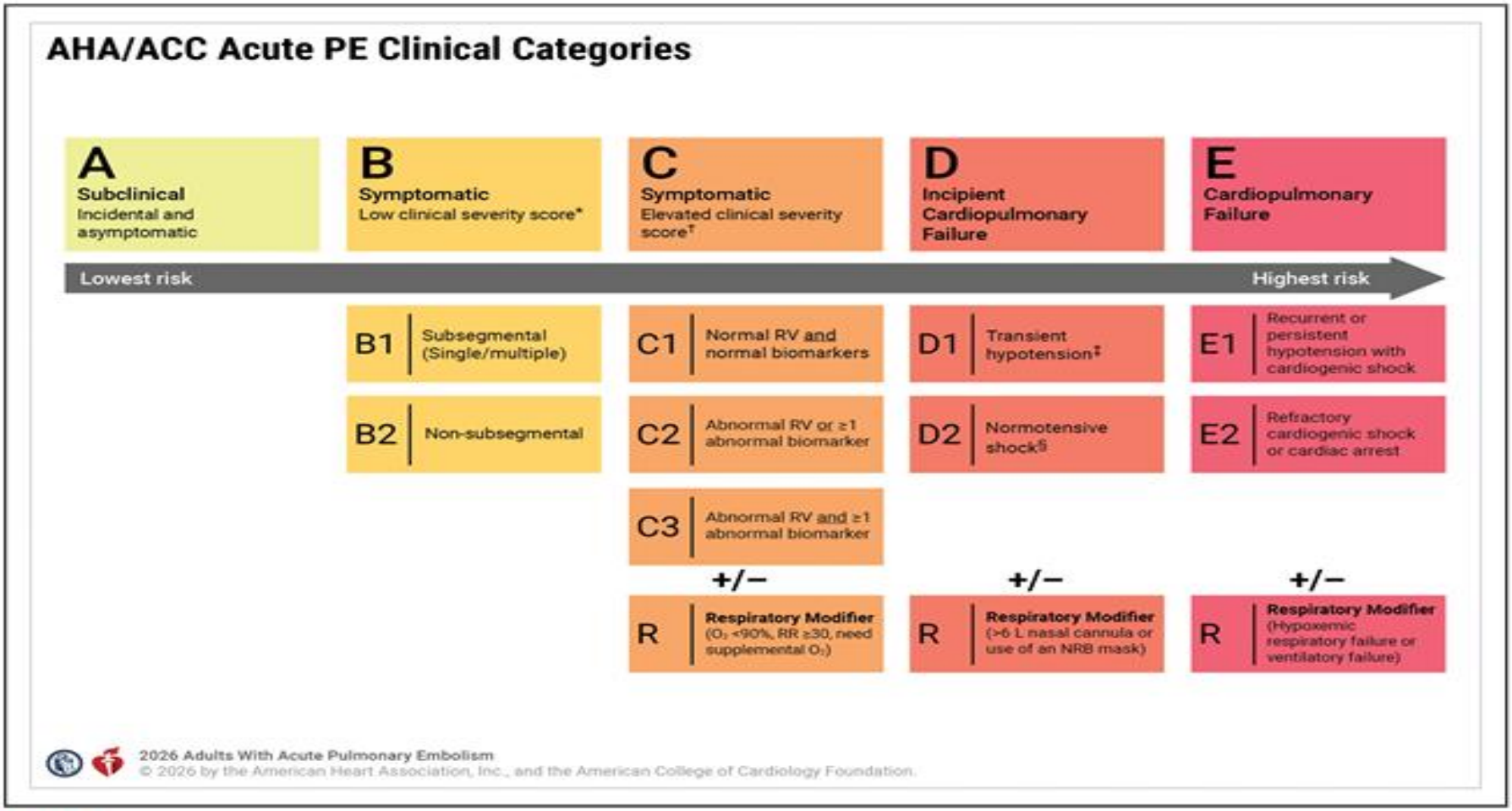


Figure 2. AHA/ACC Acute PE Clinical Categories.
When patients meet the respiratory modifier status criteria, then add "R" to the category description (eg, C3R, D2R). *Low Clinical Severity Score includes PESI ≤85 or sPESI =0 or Bova ≤ 4. †Elevated Clinical Severity Score includes PESI >85 or sPESI ≥1 or Bova > 4. ‡Systolic blood pressure <90 or decrease >40 mm Hg lasting <15 min or responding to IV fluids. §Any: Lactate >2 mmol/L, acute kidney injury, urine output <0.5 mL/kg/hr, mental status change, cardiac index <2.2 L/min/m^2, mean arterial pressure <60 mm Hg, increased shock score/stage (SCAI stage, CPES score). ACC indicates American College of Cardiology; AHA, American Heart Association; CPES, Composite Pulmonary Embolism Shock; IV, intravenous; NC, nasal cannula; NRB, nonrebreather; O_2, oxygen; PE, pulmonary embolism; PESI, Pulmonary Embolism Severity Index; RR, respiratory rate; RV, right ventricle; and sPESI, simplified PESI.

Table 6. Acute PE Clinical Risk Prediction Scores Used in the Acute Care Setting

Risk Score Name	Risk Score Components	Range of Risk Score	Risk Categories and Definitions
PESI	Age Male (10 pts) History of cancer (30 pts) History of heart failure (10 pts) Chronic lung disease, (10 pts) Heart rate ≥110 bpm (20 pts) Systolic blood pressure <100 mm Hg (30 pts) Respiratory rate ≥30 bpm (20 pts) Temperature <36°C (20 pts) Altered mental status (60 pts) Oxygen saturation <90% (20 pts) Calculate score by adding age (in years) and points by risk factor	Class I to V	Class I (lowest risk): ≤65 pts Class II: 66-85 pts Class III: 86-105 pts Class IV: 106-125 pts Class V: (highest risk) ≥126 pts
sPESI	Age >80 yrs History of cancer Chronic cardiopulmonary disease Systolic blood pressure <100 mm Hg Heart rate ≥110 bpm Arterial oxygen saturation <90% Calculate score by adding 1 pt for each of the risk factors	Low or High	0 points: Low risk of 30-day mortality ≥1 point: High risk of 30-day mortality
Bova Score	Systolic blood pressure 90-100 mm Hg (2 pts) Cardiac troponin elevation (2 pts) Right ventricular dysfunction (2 pts) Heart rate ≥110 bpm (1 pt) Calculate score by adding pts for each of the risk factors	0 to 7	Stage I (lowest risk): 0-2 pts Stage II: 3-4 pts Stage III (highest risk): >4 pts
Hestia Criteria	Is the patient hemodynamically unstable? Is thrombolysis or embolectomy necessary? Does the patient have active bleeding or a high risk of bleeding? Does the patient require >24 hours of oxygen to maintain oxygen saturation >90%? Is pulmonary embolism diagnosed during anticoagulant treatment? Does the patient have severe pain requiring intravenous pain medication for >24 h? Are there medical or social reasons for hospitalization >24 hours (eg, infection, cancer, lack of support system)? Does the patient have a creatinine clearance of <30 mL/min? Does the patient have severe liver impairment? Is the patient pregnant? Does the patient have a documented history of heparin-induced thrombocytopenia?	Negative versus Positive	If answers to all criteria are "No," the Hestia rule is negative; consider outpatient management. If answer to ≥1 of the criterion is "Yes," the Hestia rule is positive; consider hospitalization.
CPES Score	Elevated cardiac troponin Elevated B-type natriuretic peptide Moderately or severely reduced RV function Central thrombus burden (saddle PE) Concomitant deep vein thrombosis Heart rate ≥100 bpm Calculate score by assigning 1 pt for each of the factors	0 to 6	0-5 pts: Lower risk for normotensive shock (cardiac index ≤2.2 L/min/m^2) 6 pts: Higher risk for normotensive shock
Shock Index	Heart rate divided by systolic blood pressure	Continuous	Lower scores associated with lower risk Lack of consensus on which cut-points to use for PE risk stratification
NEWS and NEWS2	Respiratory rate, oxygen saturation, temperature, systolic blood pressure, heart rate, level of consciousness, and need for supplemental oxygen Points are assigned based on individual measurements in each category	0 to 20	NEWS2 ≥9: High risk[12,21]

CPES indicates Composite Pulmonary Embolism Shock; NEWS, National Early Warning Score; PE, pulmonary embolism; PESI, Pulmonary Embolism Severity Index; RV, right ventricle; and sPESI, simplified PESI.

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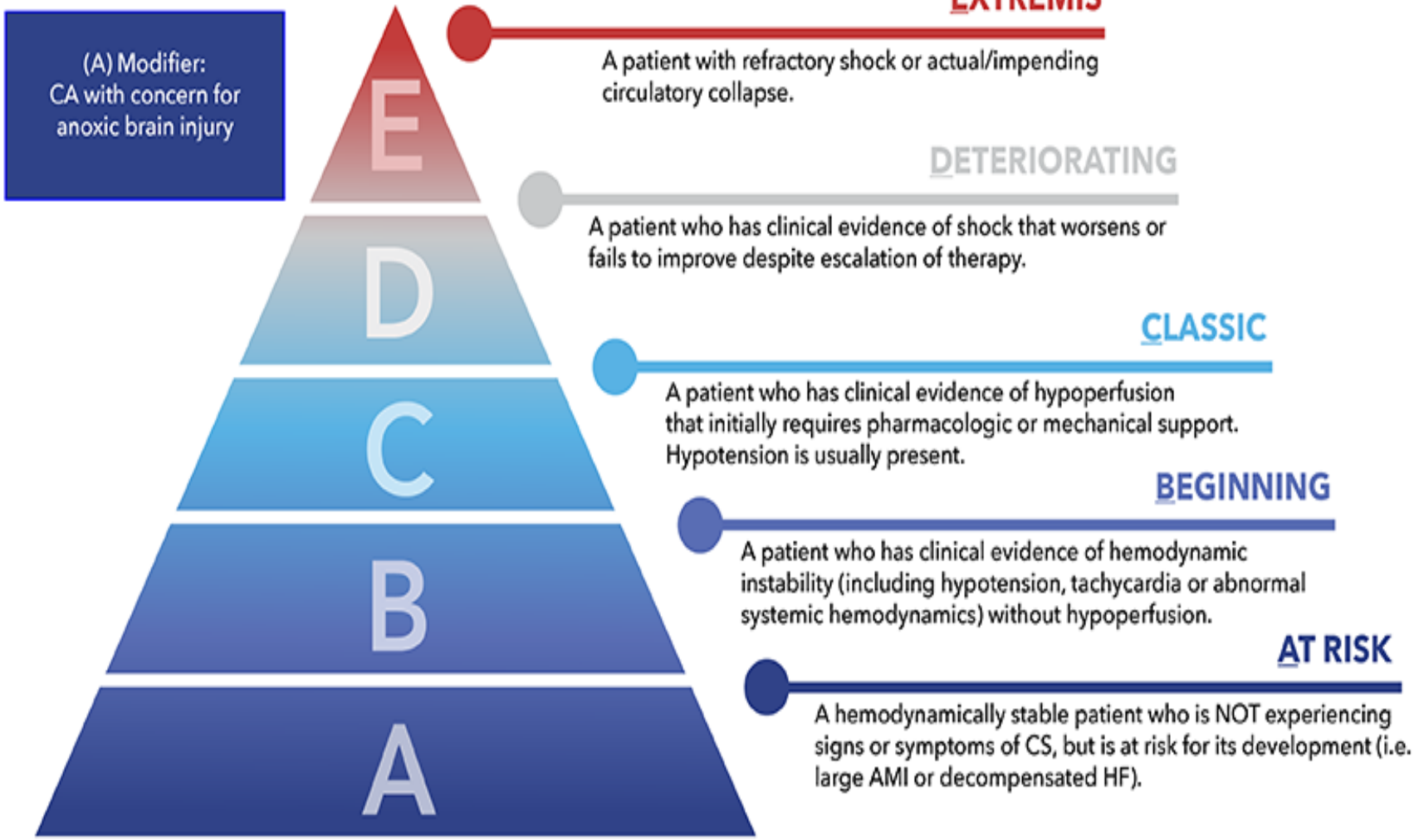

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