



**AUGUST 2 to 4
RIO DE JANEIRO
BRAZIL**

**Windsor Convention
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Acute pulmonary embolism workflow: Patient Screening & Endovascular treatment indications

João Luiz Frighetto, M.D.

Assistant Chief of Cath Lab, Hospital de Força Aérea do Galeão

Chief of Cath Lab, Votcor / Hospital São Francisco

RIO DE JANEIRO - BR





Acute pulmonary embolism workflow: Patient Screening & Endovascular treatment indications

- 1) CLINICAL SUSPICION
- 2) DIAGNOSIS
- 3) RISK STRATIFICATION**
- 4) TREATMENT STRATEGIES FOR REPERFUSION**
- 5) PATIENT SELECTION FOR ENDOVASCULAR THERAPY**

➔ WORKFLOW TO SELECTION OF PATIENTS TO PERCUTANEOUS TREATMENT



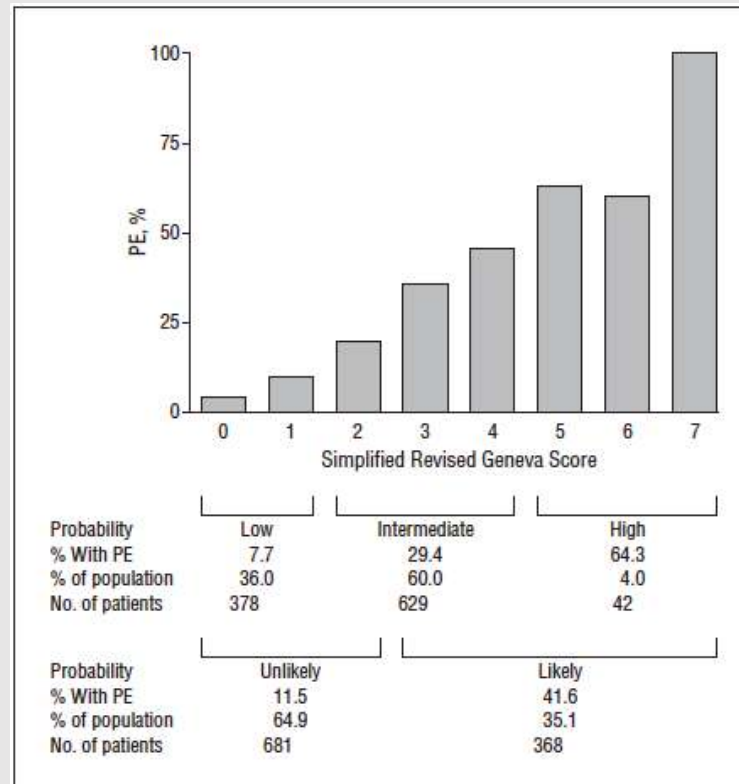
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1) CLINICAL SUSPICION

Prediction Score – Geneva Simplified Rule

Table 1. Scoring of the 8 Variables in the Original and Simplified Revised Geneva Score

Variable	Original	Simplified
Age >65 y	1	1
Previous DVT or PE	3	1
Surgery (under general anesthesia) or fracture (of lower limbs) within 1 mo	2	1
Active malignant condition (solid or hematologic, currently active or considered cured <1 y)	2	1
Unilateral lower-limb pain	3	1
Hemoptysis	2	1
Heart rate, beats/min		
75-94	3	1
≥95	2	1
Pain on lower-limb deep venous palpation and unilateral edema	4	1





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1) CLINICAL SUSPICION

Prediction Score – Wells Prediction Rule

Items	Clinical decision rule points	
	Original version ¹	Simplified version ²
Previous PE or DVT	1.5	1
Heart rate >100 b.p.m.	1.5	1
Surgery or immobilization within the past 4 weeks	1.5	1
Haemoptysis	1	1
Active cancer	1	1
Clinical signs of DVT	3	1
Alternative diagnosis less likely than PE	3	1
Clinical probability		
<i>Three-level score</i>		
Low	0–1	N/A
Intermediate	2–6	N/A
High	≥7	N/A
<i>Two-level score</i>		
PE unlikely	0–4	0–1
PE likely	≥5	≥2



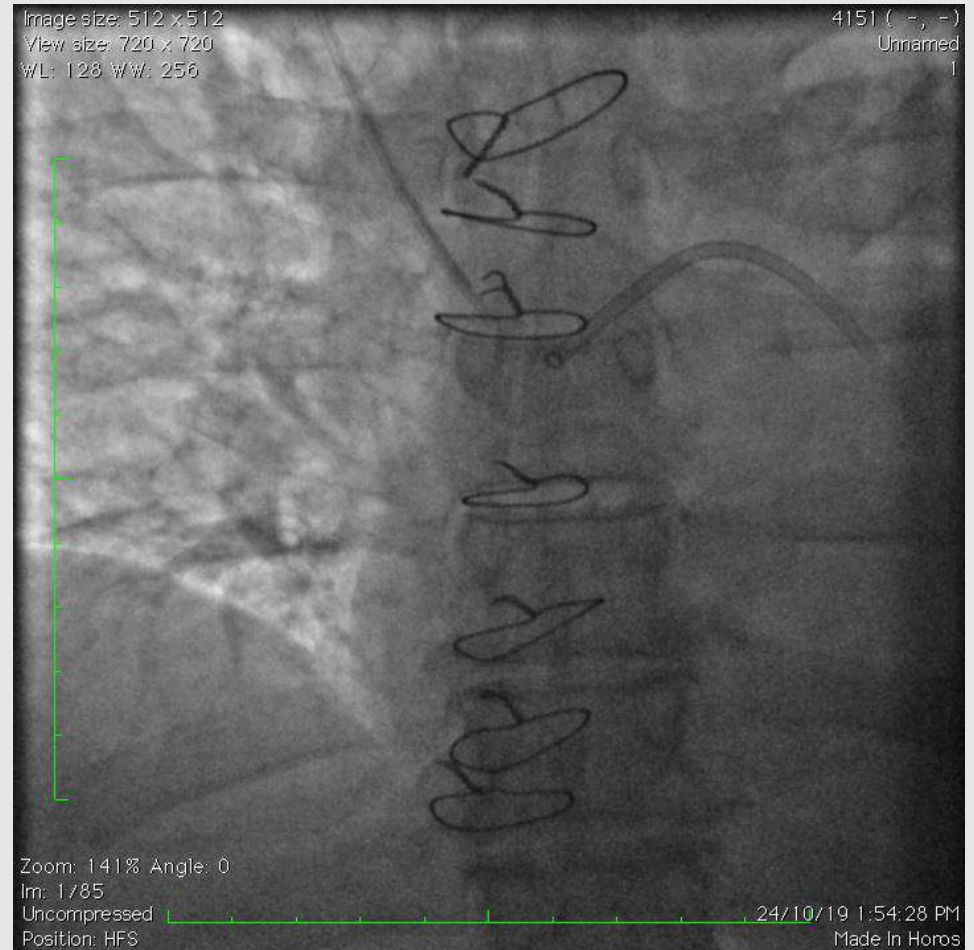
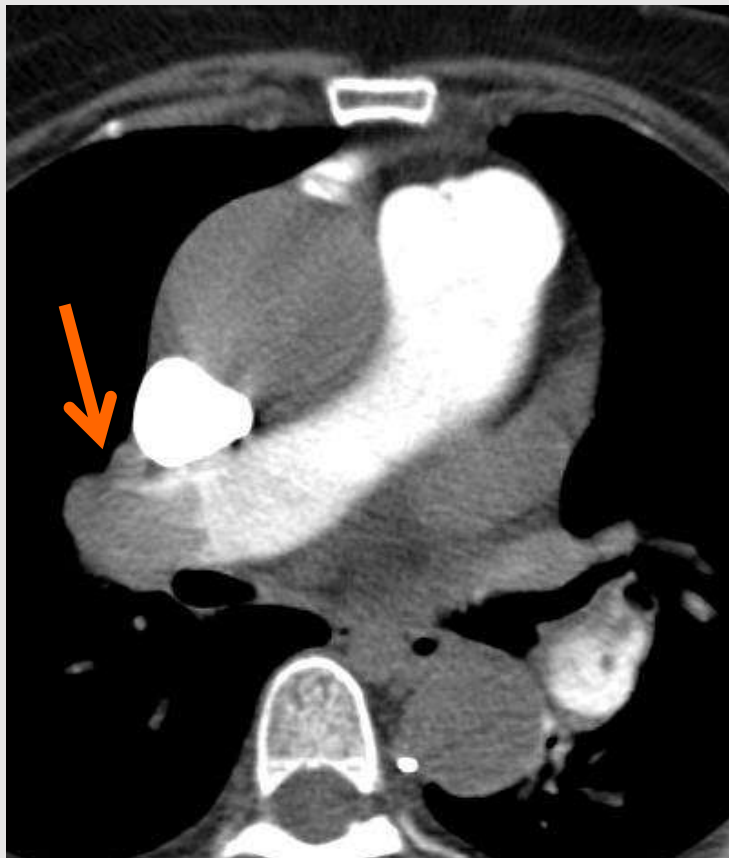
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2) DIAGNOSIS

- COMPUTED TOMOGRAPHY PULMONARY ANGIOGRAPHY (CTPA)
- LUNG SCINTIGRAPHY
- PULMONARY ANGIOGRAPHY
- ECHOCARDIOGRAM *
- COLOR ULTRASSOUND *

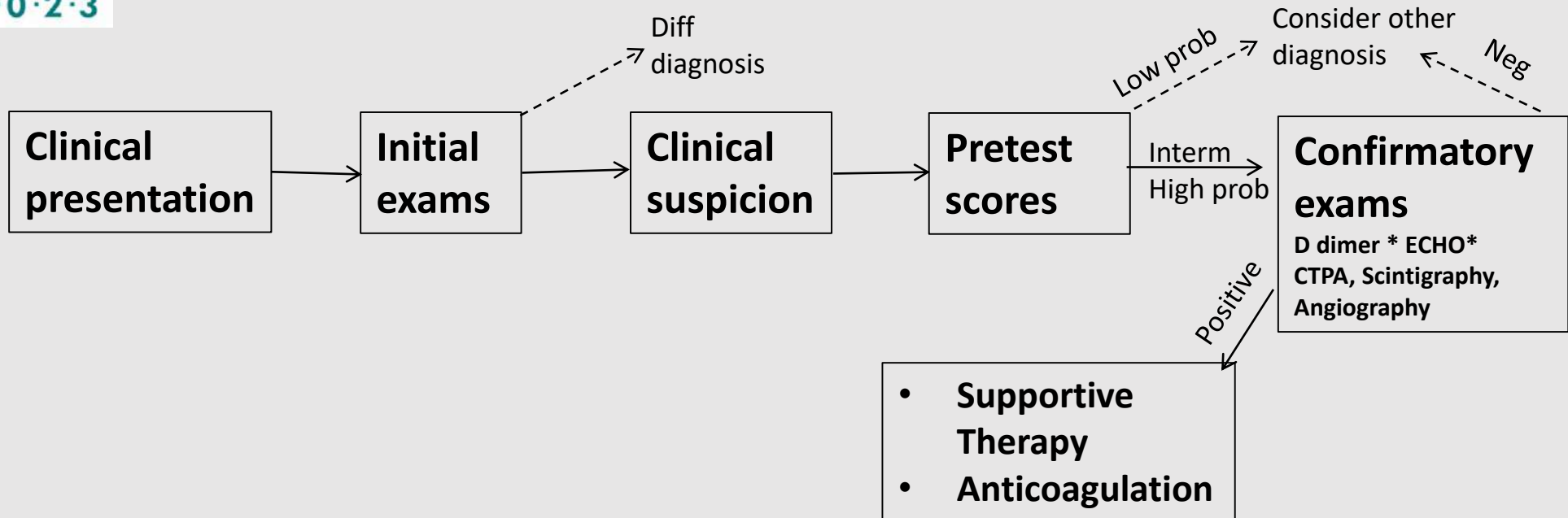


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- 3) RISK STRATIFICATION – PARAMETERS
 - a. HEMODYNAMIC STATE
 - a. PULMONARY EMBOLISM SEVERITY INDEX (PESI SCORE)
 - a. RIGHT VENTRICULAR DYSFUNCTION
 - b. MYOCARDIAL INJURY
 - c. ANATOMIC SCORE (MILLER)



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3) RISK STRATIFICATION – PARAMETERS

a. HEMODYNAMIC STATE - INSTABILITY

- Cardiac arrest ?
- Obstructive shock ?
- Persistent hypotension ?

- If yes: **HIGH RISK / MASSIVE PE**
- If no: Intermediate (Submassive) or Low Risk



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3) RISK STRATIFICATION – PARAMETERS

b. SIMPLIFIED PULMONARY EMBOLISM SEVERITY INDEX (sPESI)

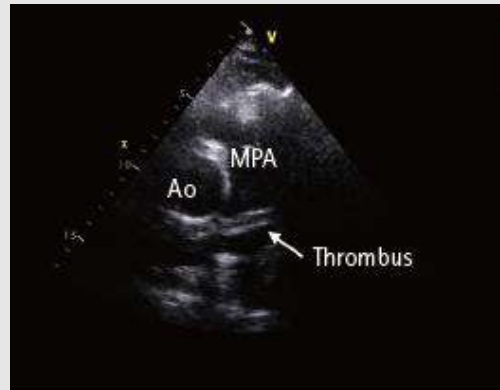
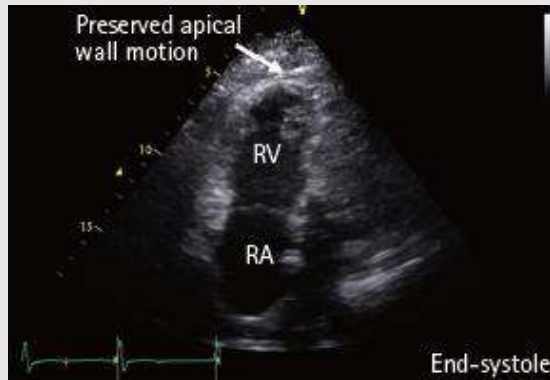
- Age > 80y
- Cancer
- Chronic heart failure or chronic pulmonary disease
- Pulse rate > 110 bpm
- Systolic BP < 100bpm
- Arterial oxyhemoglobin saturation < 90%

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3) RISK STRATIFICATION – PARAMETERS

c. RIGHT VENTRICULAR DYSFUNCTION / COMPROMISE

- ECHOCARDIOGRAM



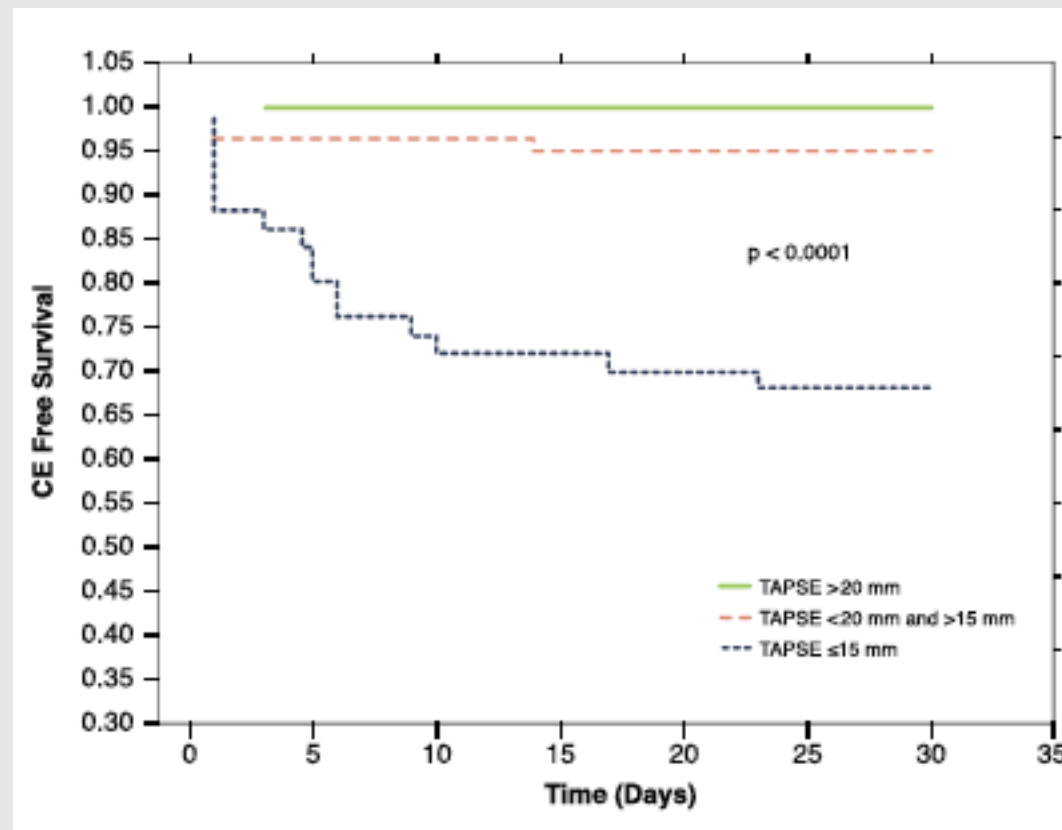
(From: Oh JK, Park JH. Korean J Intern Med 2023;Vol 38 N.4, 456-70)



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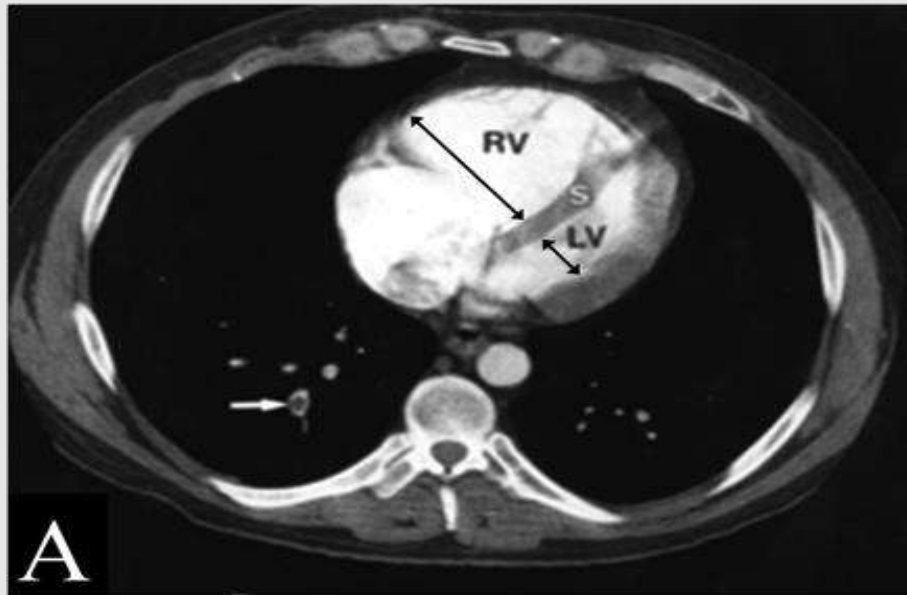
3) RISK STRATIFICATION – PARAMETERS

c. ECHOCARDIOGRAM – **RV DYSFUNCTION**



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- 3) RISK STRATIFICATION – PARAMETERS
 - d. MYOCARDIAL INJURY (Troponin T, I)
 - e. CTPA
 - RV Strain



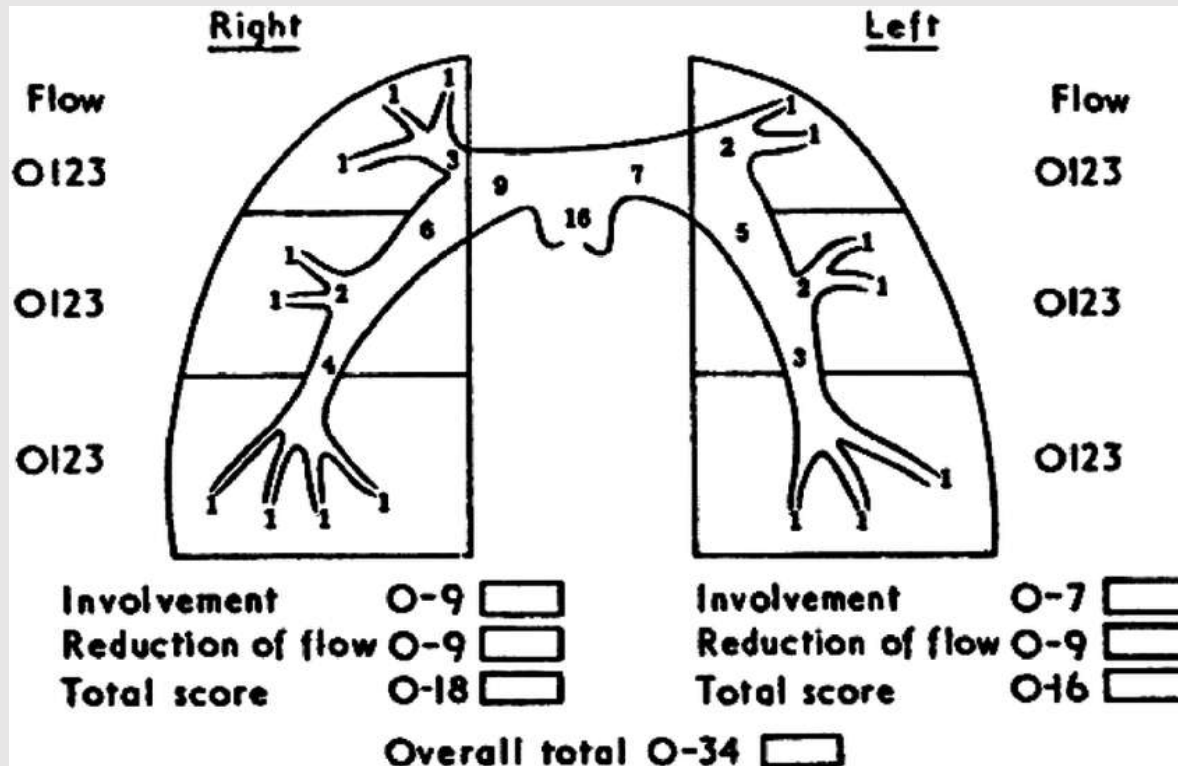


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3) RISK STRATIFICATION – PARAMETERS

e. CTPA

- Miller score



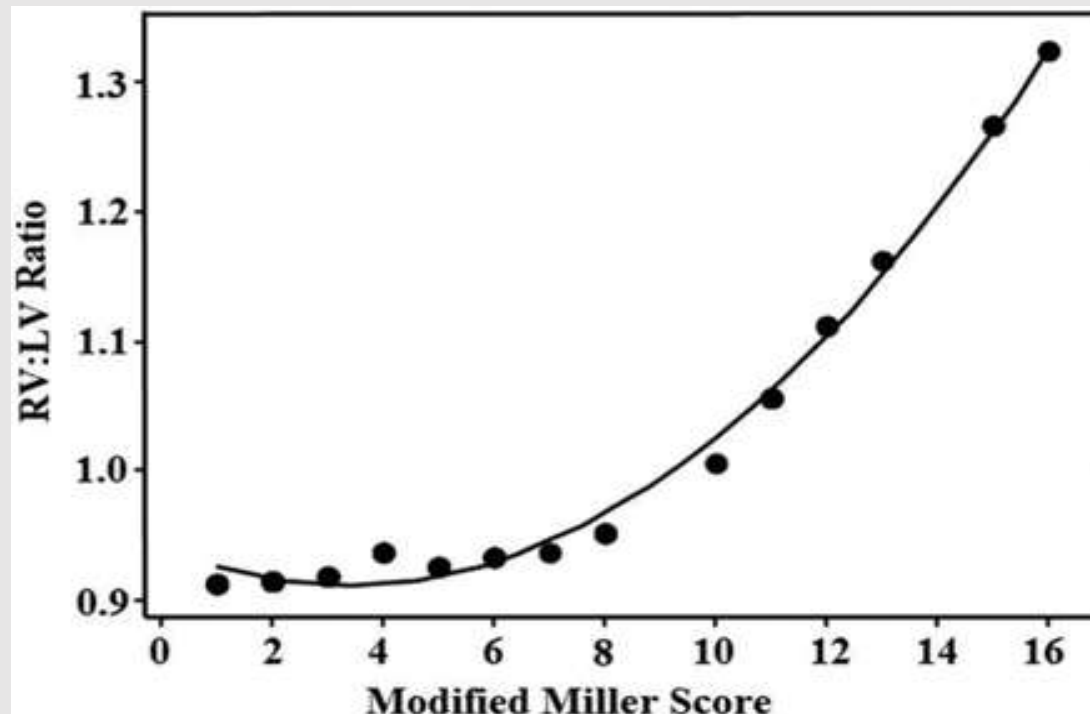


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3) RISK STRATIFICATION – PARAMETERS

e. CTPA

- Miller score



(Akram AR et al. Q J Med 2009; 102:407–414)



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- 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 \geq 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

(2019 ESC Guidelines)



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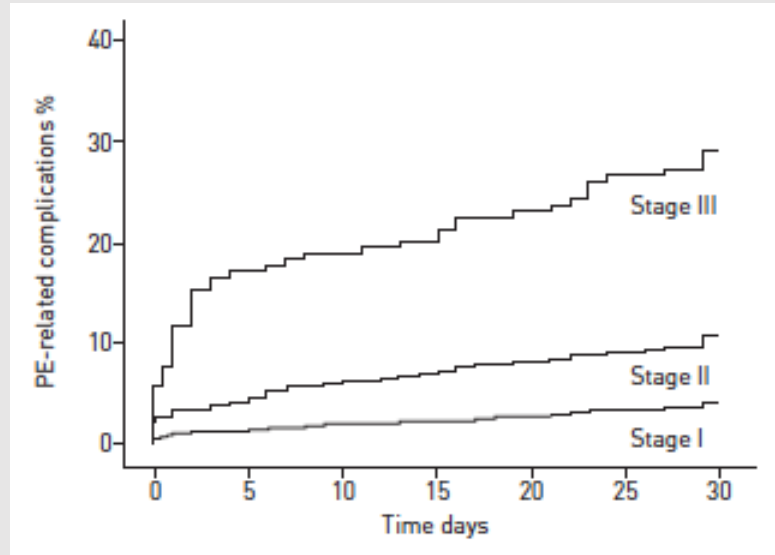
3) RISK STRATIFICATION – BOVA SCORE

- | Predictor | Points |
|---------------------------------|--------|
| • SBP 90-100 mmHg | 2 |
| • Elevated cardiac troponin | 2 |
| • RV dysfunction (echo or CTPA) | 2 |
| • Heart rate > 110 bpm | 1 |
- Stage 1 (0-2 points) / Stage 2 (3-4 points) / Stage 3 (>4 points)



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3) RISK STRATIFICATION – BOVA SCORE

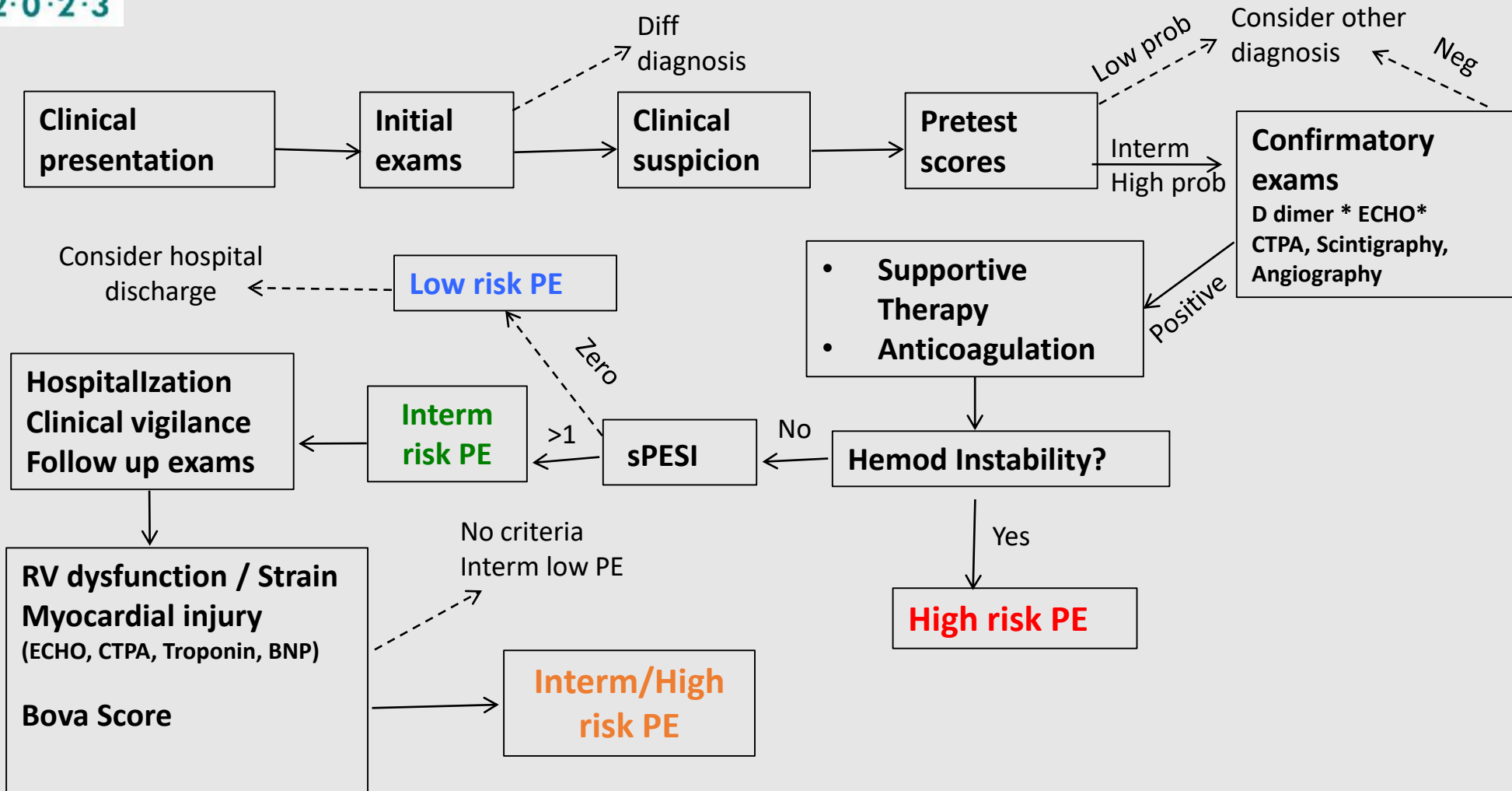


	Stage		
	I	II	III
Points	0-2	3-4	>4
Patients %	75.5	18.6	5.8
30-day PE-related complications %	4.2	10.8	29.2
In-hospital PE-related complications %	3.6	9.7	28.0
30-day PE-related mortality %	1.7	5.0	15.5

(Jimenez D, et al. Identification of intermediate-risk patients with acute symptomatic pulmonary embolism. Eur Respir J. 2014 Sep;44(3):694-703)



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4. PATIENT SELECTION FOR ENDOVASCULAR THERAPY

RISK STRATIFICATION AND INDICATION FOR REPERFUSION THERAPY:

(Esc Guidelines 2019, ACCP Guidelines 2016, AHA Scientific Statement)

- **HIGH RISK – Reperfusion indicated** (Class I for thrombolysis, IIa for endovascular)
- **LOW RISK – Reperfusion not indicated** (Class III)



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4) PATIENT SELECTION FOR REPERFUSION THERAPY

- INTERMEDIATE RISK / SUBMASSIVE PE
- - ESC Guidelines, 2019:

Routine use of primary systemic thrombolysis is not recommended in patients with intermediate- or low-risk PE.^{c,f 179}

III

B

- AHA Scientific Statement, 2019:
- *“In line with current guidelines, we discourage routine administration of thrombolytic therapy (either systemic or catheter directed) to patients with intermediate-risk PE.”*



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4) TREATMENT STRATEGIES FOR REPERFUSION - INTERMEDIATE RISK - PEITHO TRIAL

Table 3. Efficacy Outcomes.*

Outcome	Tenecteplase (N=506)	Placebo (N=499)	Odds Ratio (95% CI)	P Value
Primary outcome — no. (%)	13 (2.6)	28 (5.6)	0.44 (0.23–0.87)	0.02
Death from any cause	6 (1.2)	9 (1.8)	0.65 (0.23–1.85)	0.42
Hemodynamic decompensation	8 (1.6)	25 (5.0)	0.30 (0.14–0.68)	0.002
Time between randomization and primary efficacy outcome — days	15.4 (11.7)	17.5 (11.6)		
Recurrent pulmonary embolism between randomization and day 7 — no. (%)	1 (0.2)	5 (1.0)	0.20 (0.02–1.68)	0.12
Fatal	0	3 (0.6)		
Nonfatal	1 (0.2)	2 (0.4)		
Other in-hospital complications and procedures — no. (%)				
Mechanical ventilation	8 (1.6)	15 (3.0)		
Surgical embolectomy	1 (0.2)	2 (0.4)		
Catheter thrombus fragmentation	1 (0.2)	0 (0.0)		
Vena cava interruption	5 (1.0)	1 (0.2)		
Thrombolytic treatment other than study medication	4 (0.8)	23 (4.6)		
Death from any cause between randomization and day 30 — no. (%)	12 (2.4)	16 (3.2)	0.73 (0.34–1.57)	0.42
Patient still hospitalized at day 30 — no. (%)	59 (11.7)	50 (10.0)		
Rehospitalization between randomization and day 30 — no. (%)	22 (4.4)	15 (3.0)		

(NEJM, 370(15):1402-11, 2014)



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4) TREATMENT STRATEGIES FOR REPERFUSION - INTERMEDIATE RISK – CATHETER DIRECT

Trial	n	Randomized Treatment	Comparator	Major Bleeding Criteria	Follow-Up, d	Low-Risk PE, n (%)	Intermediate-Risk PE, n (%)	High-Risk PE, n (%)	Mean Age (Range or SD), y	Male, n (%)	Efficacy	Safety
ULTIMA, ²⁰ 2013	59	tPA-USAT (20 mg)	Heparin	ICH, spinal, joint, retroperitoneal, pericardial, hemoglobin drop >2 g/dL with transfusion	90	0 (0)	59 (100)	0 (0)	63.01 (13.51)	28 (47.46)	RV/LV ratio reduced from 1.28±0.19 to 0.99±0.17 at 24 h (P<0.001)	1 Death, 0 major bleeds, 3 minor bleeds, 0 recurrent VTE
SEATTLE II, ⁵⁴ 2015	150	tPA-USAT (24 mg)	Single arm	ICH, hemodynamic compromise, need for intervention	30	0 (0)	119 (79)	31 (21)	59 (16.1)	73 (48.7)	RV/LV ratio reduced from 1.55 to 1.13 at 48 h (P<0.0001), PASP 51.4 reduced to 36.9 mmHg (P<0.0001) at 48 h	1 GUSTO major bleed, 16 GUSTO moderate bleed, 0 ICH/death
PERFECT, ⁵⁶ 2015	101	tPA or urokinase, CDL (variable dosing; mean, 28 mg tPA)	Single arm	ICH, fatal bleed	30	0 (0)	73 (72)	28 (28)	60.3 (14.9)	53 (52.5)	PASP 51.17±14.06 to 37.23±15.81 mmHg (P<0.0001)	0 Major procedure-related complications, major hemorrhages, or hemorrhagic strokes

(Giri J et al. Circulation 2019;140:e774-801)



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4) TREATMENT STRATEGIES FOR REPERFUSION - **INTERMEDIATE RISK** - CONSIDERATIONS

- Intermediate-high risk patients / Bova score III
- Possible risk/benefit relation with endovascular therapy
- Clinical deterioration during follow-up
- Importance of PERT for decision making

➔ More evidence of the benefit of reperfusion therapy in intermediate-high risk patients is necessary to change its recommendation in guidelines



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5) PATIENT SELECTION FOR ENDOVASCULAR TREATMENT

REPERFUSION THERAPY OPTIONS

- SYSTEMIC THROMBOLYSIS
- ENDOVASCULAR TREATMENT (CDT OU THROMBECTOMY)
- SURGICAL EMBOLECTOMY



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5. PATIENT SELECTION FOR ENDOVASCULAR THERAPY

- CONTRAINDICATION FOR SYSTEMIC THROMBOLYSIS
- THROMBOLYTIC FAILURE
- CRITICALLY ILL PATIENT
- PERT DISCRETION / STAFF EXPERTISE

➔ More evidence of the efficacy and safety of endovascular therapy compared to systemic thrombolysis is necessary to change the level of recommendation of this therapeutic option in guidelines



Thank you!!!

